HILLCREST MIDDLE SCHOOL BUILDING COMMITTEE

MEETING AGENDA – JUNE 23, 2026, AT 7:00 PM

LOCATION: TRUMBULL TOWN HALL
5866 MAIN STREET
TRUMBULL, CT 06611
TOWN COUNCIL CHAMBERS

i. CALL TO ORDER
ii. PLEDGE OF ALLEGIANCE
iii. ROLL CALL
iv. APPROVAL OF MINUTES – JUNE 9, 2026
v. PUBLIC COMMENT
vi. REVIEW AND APPROVAL OF INVOICES
vii. NEW BUSINESS
    1. ARCHITECT'S PROJECT UPDATE – TSKP
    2. OPM'S PROJECT UPDATE – ARCADIS
    3. CONSTRUCTION MANAGER UPDATE – BISMARK
viii. ACTIONS / APPROVAL OF BUILDING COMMITTEE - IF REQUIRED
ix. DATE OF NEXT MEETING
x. ADJOURNMENT

Hillcrest Middle School
Building Committee

TOWN OF TRUMBULL
CONNECTICUT

Town Hall
5866 Main Street
Trumbull, Connecticut 06611

Hillcrest Middle School Building Committee
June 9, 2026
7:00 pm
Council Chambers, Trumbull Town Hall

Present: Joseph Costa, Jeff Alterman, Bill Mecca, Bob Gerbert, Fran Basbagill, J.C. Cinelli, John Morello and Ann Sather

Absent: Andrew Lubin

Also Present: Robert Tencza, Arcadis; John Butkus, Arcadis; Gregory Raucci, Bismark Construction; Ron Rossomondo, Bismark Project Manager; Michael Scott, TSKP; Town Attorney James Nugent; Kevin Dion, BOE, Director of Facilities

The meeting was called to order at 7:00 pm followed by the Pledge of Allegiance and Roll Call.

Past Minutes
Ms. Sather motioned to approve the minutes of May 12, 2026 as written; seconded by Ms. Basbagill. Approved with abstention from Mr. Morello.

Public Comment
No public comment.

Review and Approval of Invoices
Mr. Tencza presented two invoices for approval; one for record:

1. The first invoice was the $2,000 fee to CT DEEP for the Storm Water Permit. Due to the timing, the Town paid the invoice and it is presented here for record.
2. Arcadis Invoice #36131260 in the amount of $15,400 for the month of May.
3. TKSP Invoice #250501-12 for architectural services through May in the amount of $344,500 for 80% of Construction Documents. Documents are out being costed and 80% is appropriate at this time.

Ms. Basbagill motioned the Building Committee approve the invoice in the amount of $2,000 for CT DEEP for record only and invoices in the total amount of $359,900 for processing; seconded by Ms. Sather and approved unanimously.

New Business

Architect's Project Update – TSKP

Mr. Scott noted the following:

1. Attended meetings with Mr. Dion and his staff to verify a few items in the building.
2. Issued 100% Construction Documents that are being estimated by Bismark and the estimator.
3. Currently assembling the other PCR documents required for Phase 2 approval while awaiting the cost estimates and the other review comments to be received.

OPM's Project Update

Mr. Tencza noted the following:

1. Received the OGA approval letter for Phase 1 and going out to bid on June 11.
2. Material Testing Services RFP results have been received and looking for a selection at this meeting.
3. Working on Phase 2 documents.
4. Third party consultants - structural review submitted their initial report on June 8; expecting the third party code review June 10 and commissioning agent review is expected on June 12. This will coincide with the reconciliation period and over the next weeks the comments will be incorporated into the documents. The consultants will conduct an additional check to make sure they are satisfied with the responses. Structural review continues through the construction period; code reviewer services will be completed; commissioning agent will remain after completion of the building.

(Costa) – estimate due. (Tencza) – estimate due this week with reconciliation with Bismark on June 15.

5. 90 Day Look Ahead –
    a. June - going out to bid for Phase 1 this month; looking to approve at the next meeting Phase 2 documents to be presented at the OGA PCR; scheduled a special meeting of the BOE on June 29.
    b. July - approval to proceed with Bismark's contract increase; OGA PCR is scheduled for July 7, should receive approval within three weeks; OSTA and utility approvals were received so it will only be their own documents for submission. Going out for bid at the end of July for Phase 2.
    c. August – bidding and scope reviews; receiving permit.
    d. September – looking for Phase 2 approval for the GMP at the September 8 meeting.
6. Schedule was reviewed. (Costa) – ground breaking Phase 2 mid-September (Tencza) – should start approximately two weeks after Building Committee approval.
7. Financials were reviewed. Have not received the first reimbursement from OGA. Mr. Butkus noted they are only speaking with the Superintendent's office at this time. Dr. Semmel did follow up with them. It is now a three-step approval process that significantly delays the payment. Dr. Semmel continues to check on the process. (Mecca) – would it make any difference if the elected officials were included. (Butkus) – would prefer to receive the first payment and if they answer the questions presented to them. This might be considered in the future, if necessary. Owner Contingency is just over $8 million.
8. RFP for Materials Testing came back; almost all bids were below budget. Lowest bidder was Tri State Material Testing at $124,853; highest bid was almost $270,000. Discussion was held with

TSKP, Bismark and Special Inspection Coordinator and they have all worked with Tri State. They have qualified inspectors. Team will make sure they meet the requirements of the Statement of Special Inspections. The recommendation is Tri State as the lowest, responsible bidder. Mr. Butkus noted the numbers were based on assumed quantities of the various types of tests. The actual needs of the project will vary as it proceeds. Asking to approve an initial Purchase Order value that will get them started and as the project moves along, it will be reassessed as to where it needs to be supplemented.

9. Discussion was held regarding MultiVista for video recording services. It was deferred until the hiring of consultants was completed; the budget is doing well in the consultant line and could be entertained at this time. Services available are ala carte. Approximately $140,000-$150,000 with the web cam. Discussion held regarding the use of the BOE IT Department for these services; web cam is not State reimbursable. The construction progression gives multiple views throughout the building and is a facilities management tool. Mr. Tencza will provide pricing, excluding the web cam. (Alterman) – does the webcam benefit Arcadis and Bismark or just nice to have. (Tencza) – web cam gives the time lapse video that can be viewed by the community and nice to have at the end; is not necessarily of value to the Facilities Department.

<u>Construction Manager Update</u>

Mr. Rossomondo noted the following:

1. Working diligently on the Phase 1 package; going out to bid June 11; advertising from June 11 through June 14. Reached out to Purchase Department regarding their postings.
2. On schedule to place a trailer on site on June 15. Spoke with BOE and Facilities personnel for the placement; have issued for permit, should be approved by the end of the week. Some onsite work needs to be completed for temporary power, trailer location.
3. Continue to meet with the structural design team, Michael Horton, and third party consultant RAM for the steel drafting. Reviewing items and identifying any conflicts before bids.
4. Estimating team has been working with TSKP and Arcadis for Phase 1 and Phase 2.
5. Working on a Phase 1 schedule; once the sub-contractor partners are on board, they will work with them to make sure everyone is in agreement.
6. Approximately 25 packages being worked on for the Phase 2 bids; July 7 is the PCR meeting with bids going out shortly after that date. Bids going out July 11; July 18 is a non-mandatory walk through with potential bidders at the site. Everyone is welcome.
7. Phase 1 bids due July 2 with opening at 2 pm.

(Costa) – have there been meetings to discuss safety with first responders and BOE. (Rossomondo) – meetings have been held to discuss safety concerns with all parties including Town Departments; will continue to have meetings throughout the project. Once construction begins, the third party consultant site safety manager will be on site bi-weekly or more. They have a safety plan that is given to the sub-contractors; sub-contractors also have their own plans in place. There will be on-going safety meetings. Quality control is also covered. (Costa) – estimate for Phase 1 construction costs. (Rossomondo) – approximately $15 million for Phase 1, including site work and fencing. (Raucci) – will have background screening for all personnel on site.

Authorization to Execute Russell and Dawson Contract
Mr. Nugent noted the services were approved; Finance Director already signed the contract; needs Building Committee approval and signature. **Mr. Mecca motioned to approve the contract for Russell and Dawson; seconded by Mr. Cinelli and approved unanimously.**

Actions/Approval of Building Committee
Mr. Cinelli motioned to approve the contract for Tri State Material Testing for $124,853; seconded by Mr. Alterman. Mr. Costa reiterated this is a place holder amount, actual amount would change as they conduct testing. **Approved unanimously.**

Next Meeting
June 23, 2026. Meetings will be held as scheduled through the summer; once construction has started, the Committee will decide on frequency of meetings.

Adjournment
There being no further business, Ms. Basbagill motioned to adjourn the meeting at 7:35 pm; seconded by Ms. Sather and approved.

Respectfully submitted,

Barbara Crandall
Clerk



HILLCREST MIDDLE SCHOOL
TOWN OF TRUMBULL

Hillcrest Middle School Building Committee
Arcadis Report

June 23, 2026

AGENDA

A) Project Updates

B) 90 Day Look-Ahead

C) Phase 2 Cost Estimate and Project Document Approval


PROJECT UPDATES

PROJECT UPDATES

- 3rd Party Consultants Plan Review Status
- Material Testing Firm Update
- Builder's Risk Insurance Update
- Phase 2 100% Construction Documents Update


90 Day-Look Ahead

90 DAY LOOK AHEAD SCHEDULE

June 2026

- HMSBC & BOE Approval of Phase 2 Construction Documents (June 23 & June 29)

July 2026

- HMSBC Phase 1 Approval to Proceed
- Start of Phase 1 Construction
- Phase 2 OGA PCR (July 7)
- Phase 2 Advertise for Bid

August 2026

- Phase 2 Bidding & Scope Reviews
- Phase 2 Building Permit (Bismark)

Hillcrest Middle School

PHASE 1 & 2 GMP

PRECONSTUCTION MILESTONE SCHEDULE

6/18/2026

	Milestones	Schedule Plan	Current Target	Actual	Delta
☑	Phase 1 Advertise for Bid	~~May 1, 2026~~	June 11, 2026		
☑	Phase 2 3rd Party Reviews Reports Completed	~~May 21, 2026~~	June 12, 2026		
15	Phase 1 Building Permit Approval	~~June 4, 2026~~	June 17, 2026		
16	Phase 1 Bids Received	~~May 22, 2026~~	July 2, 2026		
17	Phase 1 Sitework & Temp Fencing Scope Reviews	~~May 29, 2026~~	July 6, 2026		
18	Phase 2 CD Estimate Reconciliation	~~May 21, 2026~~	June 12, 2026		
19	Phase 2 HMSBC Approval of CD's	~~May 24, 2026~~	**June 23, 2026***		
20	Phase 2 BOE Approval of CD's	~~May 24, 2026~~	June 29, 2026		
21	Phase 1 GMP Approval by HMSBC	~~June 9, 2026~~	**July 14, 2026***		
22	Selection of Material Testing	June 9, 2026			
23	Phase 1 Approved by Town of Trumbull	~~June 12, 2026~~	July 16, 2026		
24	Phase 1 Start of Construction	~~June 25, 2026~~	August 3, 2026		
25	Phase 2 OGA PCR Meeting	~~July 6,2026~~	July 7, 2026		
26	Phase 2 OGA PCR Approval	July 24, 2026			
27	Phase 2 Advertise for Bid	July 27, 2026			
28	Phase 2 Bids Received	August 21, 2026			
29	Phase 2 Scope Reviews	August 28, 2026			
30	Phase 2 Building Permit Approval	August 28, 2026			
31	Project GMP Recommendation to HMSBC	September 3, 2026			
32	Project GMP Approval by HMSBC	**September 8, 2026***			
33	Project GMP Approved by Town of Trumbull	September 9, 2026			
34	Phase 2 Start of Construction	September 14, 2026			
	***HMSBC Meeting Dates**				


FOR APPROVAL

ARCADIS

ARCADIS

For HMSBC Review June 23, 2026

NEW Hillcrest Middle School Project

100% CD Estimate Reconciliation Summary
*Note: Includes Phase 1 Costs

Bismark Estimate		$ 111,428,203
PM+C Estimate (Design Team Consultant)		$ 109,805,710
Variance		$ 1,622,493
Approved GMP Budget		$ 118,200,000
Variance as percent of GMP Budget		**1.4%**
Budget Summary	**Reconciled Avg.**	**$ 110,616,957**
Included Contingencies	Design	1.00%
	Cost Escalation	1.00%
Reconciled Cost		$ 110,616,959
Approved GMP Budget		$ 118,200,000
Variance Over (Under) Budget		**$ (7,583,041)**

TSKP STUDIO

Transmittal

146 Wyllys Street Building 1, Suite 203, Hartford, CT 06106

PROJECT:	Trumbull Hillcrest Middle School 250501	DATE:	5/19/2026
SUBJECT:	Trumbull Hillcrest CD100	TRANSMITTAL ID:	00019
PURPOSE:	For your use	VIA:	Info Exchange

FROM

NAME	COMPANY	EMAIL	PHONE
Jeffrey Brown 146 Wyllys Street Building 1, Suite 203 Hartford CT 06106 United States	TSKP Studio	jbrown@TSKP.com	860-547-1970 x7036

TO

NAME	COMPANY	EMAIL	PHONE
Greg M Raucci	Bismark	gmraucci@bismarkconstruction.com	
Robert Tencza	Arcadis U.S., Inc.	Robert.Tencza@arcadis.com	
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Amy Happ 20 Downer Avenue, Suite 5 Hingham MA 02043 United States	PM&C	amyhapp@pmc-ma.com	781-740 8007
gjraucci@bismarkconstruction.com		gjraucci@bismarkconstruction.com	
rrossomandojr@bismarkconstruction.com		rrossomandojr@bismarkconstruction.com	
TTarini@bismarkconstruction.com		TTarini@bismarkconstruction.com	

REMARKS:

All,
Please find attached volumes 1 & 2 of our 100% CD documents including plans and specifications for for pricing.
Best regards,
Jeff Brown

Transmittal

DATE: 5/19/2026
TRANSMITTAL ID: 00019

DESCRIPTION OF CONTENTS

QTY	DATED	TITLE	NOTES
1	5/19/2026	_CD100_Vol1_Set.pdf	
1	5/19/2026	_CD100_Vol2_Set.pdf	
1	5/19/2026	20260519 HILLCREST CD SPECIFICATIONS VOL1.pdf	
1	5/19/2026	20260519 HILLCREST CD SPECIFICATIONS VOL2.pdf	

COPIES:

Michael Scott (TSKP Studio)

TOWN OF TRUMBULL, CT

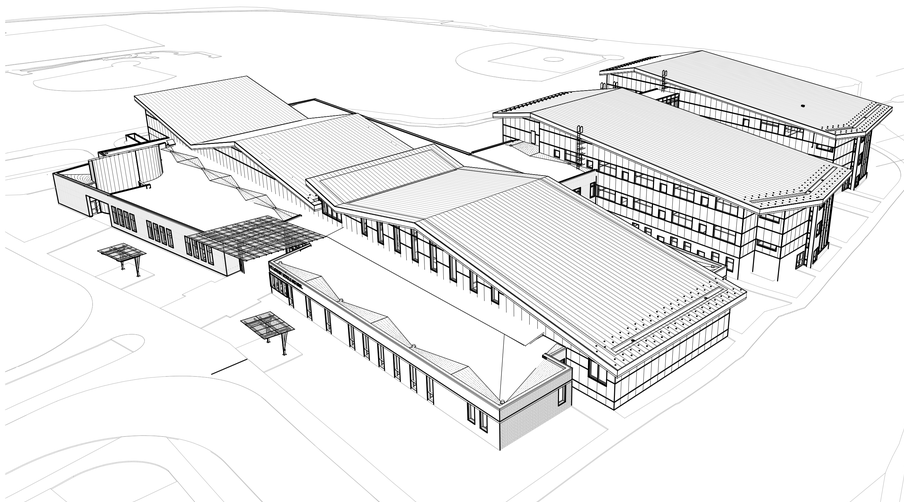
TRUMBULL HILLCREST MIDDLE SCHOOL

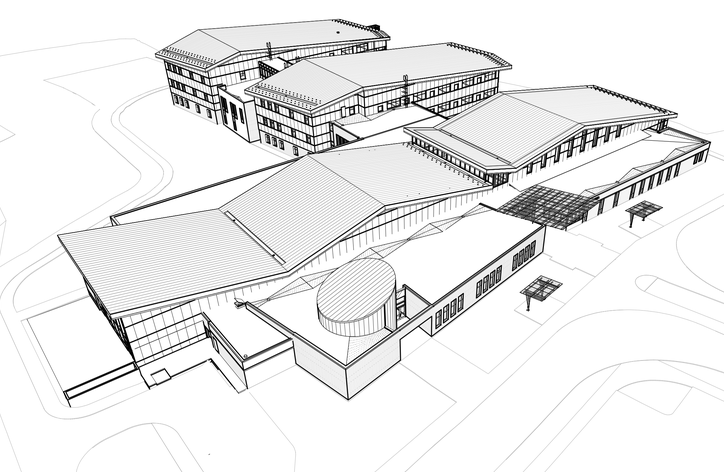
530 DANIELS FARM ROAD
TRUMBULL, CT 06611

STATE PROJECT # 144-0108N
05/19/2026

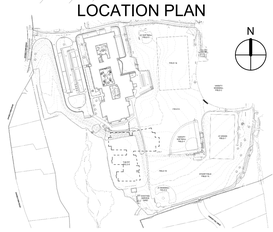
CONSTRUCTION DOCUMENTS 100%

VOLUME 1 OF 2





LOCATION PLAN



DRAWING LIST

GENERAL	
A0.01	GENERAL INFORMATION
A0.02	CODE PLAN
A0.02B	CODE PLAN
A0.03	WALL TYPES
A0.05	PHASING PLANS
SURVEY	
VB101	PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY
VB102	PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY
VB103	PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY
VB104	PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY
CIVIL	
CD101	PHASE I SITE DEMOLITION PLAN I
CD102	PHASE I SITE DEMOLITION PLAN II
CD201	PHASE II SITE DEMOLITION PLAN I
CD202	PHASE II SITE DEMOLITION PLAN II
CS100	OVERALL SITE PLAN
CS101	SITE PLAN I
CS102	SITE PLAN II
CS201	SITE PLAN I - ALTERNATES
CS501	SITE DETAILS I
CS502	SITE DETAILS II
CS503	SITE DETAILS III
CS504	SITE DETAILS IV
CS505	SITE DETAILS V
CG100	OVERALL GRADING AND DRAINAGE PLAN
CG101	GRADING AND DRAINAGE PLAN
CG102	GRADING AND DRAINAGE PLAN
CG201	GRADING AND DRAINAGE PLAN I - ALTERNATE
CG501	GRADING AND DRAINAGE DETAILS I
CG502	GRADING AND DRAINAGE DETAILS II
CU100	OVERALL SITE UTILITY PLAN
CU101	SITE UTILITY PLAN I
CU102	SITE UTILITY PLAN II
CU501	SITE UTILITY DETAILS
CE100	PHASE I OVERALL SOIL EROSION & SEDIMENT CTRL PLN
CE101	PHASE I SOIL EROSION & SEDIMENT CONTROL PLAN I
CE102	PHASE I SOIL EROSION & SEDIMENT CONTROL PLAN II
CE200	PHASE II OVERALL SOIL EROSION & SEDIMENT CTRL PLN
CE201	PHASE II SOIL EROSION & SEDIMENT CONTROL PLAN I
CE202	PHASE II SOIL EROSION & SEDIMENT CONTROL PLAN II
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CE502	SOIL EROSION & SEDIMENT CONTROL DETAILS II
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LP102	PLANTING PLAN II
LP201	PLANTING PLAN - ALTERNATES
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LL101	SITE LIGHTING PLAN I
LL102	SITE LIGHTING PLAN II
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LL501	SITE LIGHTING NOTES AND DETAILS
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A1.02B	MAIN LEVEL AREA B
A1.02C	MAIN LEVEL AREA C
A1.03	UPPER LEVEL
A1.31	ROOF PLAN
A1.41	ROOF DETAILS
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A2.02	MAIN LEVEL REFLECTED CEILING PLAN OVERALL
A2.02A	MAIN LEVEL REFLECTED CEILING PLAN AREA A
A2.02B	MAIN LEVEL REFLECTED CEILING PLAN AREA B
A2.02C	MAIN LEVEL REFLECTED CEILING PLAN AREA C
A2.03	UPPER LEVEL REFLECTED CEILING PLAN
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A3.03	EXTERIOR ELEVATIONS
A3.04	EXTERIOR ELEVATIONS
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A3.12	BUILDING SECTIONS
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A4.02	WALL SECTIONS
A4.03	WALL SECTIONS
A4.04	WALL SECTIONS
A4.05	WALL SECTIONS
A4.06	WALL SECTIONS
A4.07	WALL SECTIONS
A4.08	WALL SECTIONS
A4.09	WALL SECTIONS
A4.10	WALL SECTIONS
A4.21	SECTION DETAILS
A4.22	SECTION DETAILS
A4.23	SECTION DETAILS
A4.24	SECTION DETAILS
A4.25	SECTION DETAILS
A4.26	SECTION DETAILS
A4.27	MAIN ENTRY CANOPY
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A4.29	SECTION DETAILS
A4.31	PLAN DETAILS - AREA A
A4.32	PLAN DETAILS - AREA B
A4.33	PLAN DETAILS - AREA B
A4.34	PLAN DETAILS - AREA C
A4.35	PLAN DETAILS - AREA C
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A5.02	STOREFRONT SCHEDULE AND DETAILS
A6.01	STAIR PLANS AND SECTIONS

DRAWING LIST

A6.02	STAIR PLANS AND SECTIONS
A6.03	STAIR PLANS AND SECTIONS
A6.04	STAIR PLANS AND SECTIONS
A6.05	STAIR PLANS AND SECTIONS
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A6.07	STAIR DETAILS
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A8.03	INTERIOR ELEVATIONS - CORRIDOR
A8.04	INTERIOR ELEVATIONS - CORRIDOR
A8.05	INTERIOR ELEVATIONS - CORRIDOR
A8.06	INTERIOR ELEVATIONS - CORRIDOR
A8.07	INTERIOR ELEVATIONS - LIBRARY MEDIA CENTER
A8.08	INTERIOR ELEVATIONS - BLACK BOX
A8.09	INTERIOR ELEVATIONS - GYM
A8.10	INTERIOR ELEVATIONS - AUX GYM & ADMIN
A8.11	INTERIOR ELEVATIONS - CAFETERIA & FACULTY RMS
A8.12	INTERIOR ELEVATIONS - PLANETARIUM
A8.13	INTERIOR ELEVATIONS - CLASSROOMS
A8.14	INTERIOR ELEVATIONS - CLASSROOMS
A8.15	INTERIOR ELEVATIONS - CLASSROOM
A8.16	INTERIOR ELEVATIONS - CLASSROOM
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F1.02C	MAIN LEVEL FFE PLAN - AREA C
F1.03	UPPER LEVEL FFE PLAN
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S1.00B	LOADING PLANS C, MAIN LEVEL, UPPER & ROOF
S1.01	OVERALL FOUNDATION PLAN
S1.01A	FOUNDATION PLAN - AREA A
S1.01B	FOUNDATION PLAN - AREA B
S1.01C	LOWER LEVEL FOUNDATION PLAN - AREA C
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S1.02C	MAIN LEVEL FRAMING PLAN - AREA C
S1.03	OVERALL UPPER LEVEL FRAMING PLAN
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S1.03B	LOW ROOF FRAMING PLAN - AREA B
S1.03C	UPPER LEVEL FRAMING PLAN - AREA C
S1.03D	AREA B HIGH ROOF
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S1.03F	CANOPY FRAMING PLAN
S1.04	ROOF FRAMING PLAN - OVERALL
S1.04A	ROOF FRAMING PLAN - AREA A
S1.04B	ROOF FRAMING PLAN - AREA B
S1.04C	ROOF FRAMING PLAN - AREA C
S2.00	COLUMN SCHEDULE AND DETAILS
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S2.02	COLUMN SCHEDULE AREAS C
S2.03	TRUSS ELEVATIONS AND DETAILS
S2.04	TRUSS ELEVATIONS & DTLS
S2.05	ELEVATIONS
S2.10	BRACE FRAME ELEVATIONS AND DETAILS
S2.11	BRACE FRAME ELEVATIONS
S2.20	MASONRY SHEAR WALL ELEVATIONS
S2.21	MASONRY SHEAR WALL ELEVATIONS
S2.22	MASONRY SHEAR WALL ELEVATIONS
S2.23	MASONRY SHEAR WALL ELEVATIONS
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S3.01	FOUNDATION SECTIONS
S3.02	FOUNDATION SECTIONS
S3.03	FOUNDATION SECTIONS
S4.00	FLOOR SECTIONS
S4.01	FLOOR SECTIONS
S4.02	FLOOR SECTIONS
S4.03	FLOOR SECTIONS
S5.00	ROOF SECTIONS
S5.01	ROOF SECTIONS
S5.02	ROOF SECTIONS
S5.03	ROOF SECTIONS
S5.04	ROOF SECTIONS
S5.05	ROOF SECTIONS
S5.06	ROOF SECTIONS
S6.00	TYPICAL DETAILS
S6.01	TYPICAL DETAILS
S6.02	TYPICAL DETAILS

APPROVALS

PUBLIC WORKS DATE

AGENCY DATE

ARCHITECT

TSKP STUDIO, LLC
ONE HARTFORD SQUARE WEST
146 WYLLYS STREET, BLDG 1-203
HARTFORD, CT 06106
860.547.1970

SITE & CIVIL ENGINEER
ENVIRONMENTAL ENGINEER

LANGAN ENGINEERING
555 LONG WHARF DRIVE
NEW HAVEN, CT 06511
203.784.5771

MECHANICAL
ELECTRICAL / PLUMBING

CMTA
161 WORCESTER ROAD
FRAMINGHAM, MA 01701
508.647.9200

STRUCTURAL
ENGINEER

MICHAEL HORTON ASSOCIATES, INC.
780 E. MAIN STREET, STE 1
BRANFORD, CT 06405
203.481.8600

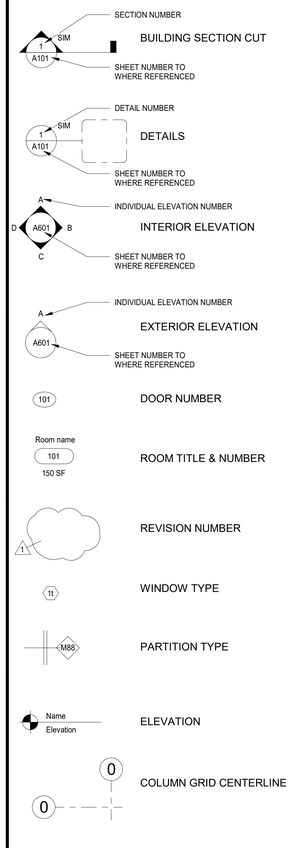
TECHNOLOGY/SECURITY
ACOUSTICS

NEWCOMB & BOYD
303 Peachtree Center Ave NE
Suite 525,
Atlanta, GA 30303
843.574.8741

KITCHEN
CONSULTANT

CRABTREE McGRATH ASSOCIATES, INC.
161 West Main Street
Georgetown, Mass 01833
978.352.8500

ANNOTATION LEGEND



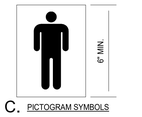
TYPICAL SIGNALS



A. TYPICAL IDENTIFICATION SIGN



B. INTERNATIONAL SYMBOL



C. PICTOGRAM SYMBOLS

NOTE:
ACCESSIBLE FACILITIES AND EXITS SHALL BE IDENTIFIED USING THE INTERNATIONAL SYMBOL OF ACCESSIBILITY.

NOTES:

1. THE SIGN DWG. ABOVE IS GENERIC IN NATURE. FOR DESCRIPTION PURPOSES ONLY. SIZES AND NUMBERING SYSTEM WILL BE ESTABLISHED BY THE OWNER AND / OR THE ARCHITECT. THE ROOM NAMES ARE INDICATED ON DOOR SCHEDULE DWGS. SIGNS SHALL BE SURFACE MOUNTED AND SHALL BE MOUNTED SUCH THAT THE BOTTOM OF SIGN IS 48" A.F.F.

2. LETTERS AND NUMBERS ON SIGNS SHALL HAVE A WIDTH TO HEIGHT RATIO BETWEEN 3:5 AND 1:1 AND A STROKE WIDTH TO HEIGHT RATIO BETWEEN 1:5 AND 1:10.

3. RAISED CHARACTERS OR SYMBOLS SHALL BE AT LEAST 5/8" HIGH BUT NO GREATER THAN 2".

4. FONT STYLE SHALL BE HELVETICA MEDIUM AND ALL UPPER CASE AND SHALL BE ACCOMPANIED WITH GRADE 2 BRAILLE.

5. SIGNS SHALL BE INSTALLED ADJACENT TO THE LATCH SIDE OF THE DOOR OR TO THE RIGHT OF DOUBLE DOORS. WHERE THERE IS NO SPACE AT THE LATCH SIDE OF THE DOOR OR TO THE THE RIGHT OF DOUBLE DOORS, SIGNS SHALL BE PLACED ON THE NEAREST ADJACENT WALL.

6. THERE MUST BE A CLEAR FLOOR SPACE OF 18" x 18" MINIMUM, CENTERED ON THE SIGN. THIS SPACE SHOULD NOT INTERSECT BY THE ARC OF ANY DOOR SWING BETWEEN THE CLOSED POSITION AND 45 DEGREE OPEN POSITION.

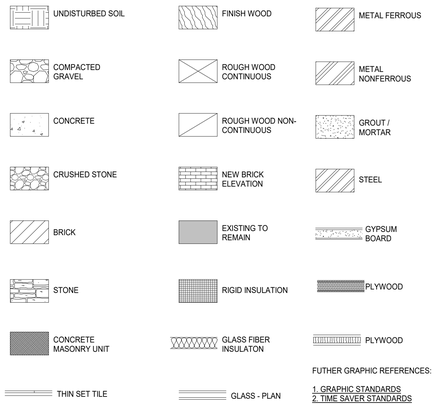
7. CHARACTERS AND THEIR BACKGROUNDS SHALL HAVE A NON-GLARE FINISH AND SHALL CONTRAST WITH EACH OTHER. LIGHTING ON DARK OR DARK ON LIGHTING.

8. PROVIDE BACKER PLATE FOR ROOM SIGNAGE @ GLASS MOUNTED LOCATION.

9. SEE DOOR SCHEDULE FOR NUMBERING AND NAME IDENTIFICATION OF SIGN.

10. COORDINATE ROOM NUMBER WITH OWNER AS PART OF SIGNAGE SUBMITTAL PROCESS.

MATERIAL LEGEND



FUTHER GRAPHIC REFERENCES:

1. GRAPHIC STANDARDS
2. TIME SAVER STANDARDS

ABBREVIATIONS

@	- AT	F.A.	- FIRE ALARM	N	- NORTH	T&B	- TOP AND BOTTOM
&	- AND	F.A.I	- FRESH AIR INTAKE	N.A	- NOT APPLICABLE	T&G	- TONGUE AND GROOVE
AC.	- ACOUSTIC, ACOUSTICAL	F.D.	- FLOOR DRAIN	N.I.C	- NOT IN CONTRACT	T	- TREAD
ACT	- ACOUSTIC TILE	FND.	- FOUNDATION	NO., #	- NUMBER	TAN.	- TANGENT
A.D.	- ACCESS DOOR, AREA DRAIN	F.E.	- FIRE EXTINGUISHER	NOM	- NOMINAL	T.B	- TACK BOARD
ADD	- ADDENDUM	FEC	- FIRE EXTINGUISHER CABINET	NRC	- NOISE REDUCTION COEFFICIENT	TEC.	- TECTUM
ADH	- ADHASIVE	FEC-R	- FIRE EXTINGUISHER CABINET - RECESSED	N.T.S.	- NOT TO SCALE	TEL	- TELEPHONE OR TELECOM
ADJ	- ADJUSTABLE	FEC-SR	- FIRE EXTINGUISHER CABINET - SEMI RECESSED			TEMP.	- TEMPORARY
AFF	- ABOVE FINISHED FLOOR	FEC-S	- FIRE EXTINGUISHER CABINET - SURFACE MOUNTED	O.A	- OVERALL	TER.	- TERRAZZO
ALT	- ALTERNATE			O.C	- ON CENTER	THK	- THICKNESS
ALUM	- ALUMINUM	FF	- FINISH FLOOR	O.D	- OUTSIDE DIAMETER / DIMENSION	THRES	- THRESHOLD
APPROX	- APPROXIMATE	FF&E	- FURNITURE, FINISHES & EQUIPMENT	OHD	- OVER HEAD	THRU	- THROUGH
ARCH	- ARCHITECTURAL	FHC	- FIRE HOSE CABINET	O.H.	- OPPOSITE HAND	TMPD	- TEMPERED
AWP	- ACOUSTICAL WALL PANEL	FIN.	- FINISH(ED)	OPNG	- OPENING	T.O.	- TOP OF (SEE OTHER WORD)
AUTO	- AUTOMATIC	FIXT.	- FIXTURE	OPP	- OPPOSITE	TV	- TELEVISION
AV	- AUDIO VISUAL	FL	- FLOOR	O.R.D.	- OVERFLOW ROOF DRAIN	TYP.	- TYPICAL
AVB	- AIR AND VAPOR BARRIER	FLG	- FLASHING	ORIG.	- ORIGINAL		
		FLUOR.	- FLUORESCENT	OVHD	- OVERHEAD	UNFIN.	- UNFINISHED
BD	- BOARD	FRTW	- FIRE RETARDANT TREATED WOOD			U.O.N	- UNLESS OTHERWISE NOTED
BLDG	- BUILDING	F.S.P	- FIRE STAND PIPE	PART.	- PARTIAL	UR	- URINAL
BLK(G)	- BLOCK(ING)	FT	- FEET, FOOT	PERP	- PERPENDICULAR	U.P.T	- UNGLAZED PORCELAIN TILE
BM	- BEAM	FTG	- FOOTING	PL. LAM.	- PLASTIC LAMINATE	UTIL.	- UTILITY
BOT.	- BOTTOM	FURN	- FURNITURE	PLYWD.	- PLYWOOD		
B.O	- BOTTOM OF	FURR.	- FURRED, FURRING	PRF	- POURED RESILIENT FLOORING	VAR.	- VARIES
BRK.	- BRICK	FUT	- FUTURE	PRL.	- PARALLEL	VAC	- VENTILATION AND AIR CONDITIONING
BSMT	- BASEMENT	F.V.C	- FIRE VALVE CABINET			VCT	- VINYL COMPOSITION TILE
BTWN.	- BETWEEN			PREFAB	- PREFABRICATED	VERT.	- VERTICAL
		GA	- GAUGE / GAGE	PROJ.	- PROJECT	VEST.	- VESTIBULE
C	- CHANNEL, COURSE	GALV.	- GALVANIZED	P.T	- PRESSURE TREATED	V.I.F	- VERIFY IN FIELD
CAB.	- CABINET	G.B.	- GLAZED BLOCK	PTD	- PAINTED	VT	- VINYL TILE
CB	- CATCH BASIN	G.C.	- GENERAL CONTRACT(OR)	PVG.	- PAVING	VWC	- VINYL WALL COVERING
CCTV	- CLOSED CIRCUIT TV	GEN	- GENERATOR	PVMT.	- PAVEMENT		
CER	- CERAMIC	G.F.C	- GROUND FACE CONC. BLOCK			W	- WEST
C.G.	- CORNER GUARD	GL.	- GLASS, GLAZING	Q.T	- QUARRY TILE	W/	- WITH
CHAM.	- CHAMFER	GL.BLK.	- GLASS BLOCK	QTY	- QUANTITY	W.C	- WATER CLOSET
CHCK	- CHECK	GRD	- GROUND			WD.	- WOOD
CIRC.	- CIRCUMFERENCE	GWB	- GYPSUM WALL BOARD	R	- RADIUS OR RISER	WDW	- WINDOW
CJ	- CONTROL JOINT	GYP. BD.	- GYPSUM BOARD	R.A.	- RETURN AIR	W/O	- WITHOUT
CL	- CENTER LINE			RAD.	- RADIUS	WTPFG	- WATERPROOFING
CLO	- CLOSET	H.C.	- HANDICAP(PED)	RCP	- REFLECTED CEILING PLAN	WWF	- WELD WIRE FABRIC
CLG.	- CEILING	HDWR.	- HARDWARE	R.D.	- ROOF DRAIN	WT	- WEIGHT
CLK(G)	- CAULK(ING)	HEX	- HEXAGON	RECOM	- RECOMMENDED		
CLR	- CLEAR	H.M.	- HOLLOW METAL	RECPT	- RECEPTACLE		
C.M.U	- CONCRETE MASONRY UNIT	HORZ.	- HORIZONTAL	REC.	- RECESSED		
COL	- COLUMN	HR	- HOUR	REF.	- REFERENCE		
COMP.	- COMPRESSIBLE	HT	- HEIGHT	REFL.	- REFLECTED / REFLECTIVE / REFLECT		
CONC.	- CONCRETE	HTG.	- HEATING	REFR.	- REFRIGERATOR		
CONF.	- CONFERENCE	H.V.A.C.	- HEATING, VENTILATION & AIR CON.	REG.	- REGISTER		
CONST.	- CONSTRUCTION			REINF.	- REINFORCED / REINFORCING		
CONT	- CONTINUATION,CONTINUOUS	I.D.	- INSIDE DIAMETER	REQ.	- REQUIRE / REQUIRED		
COORD	- COORDINATE	IN	- INCH(ES)	RESIL	- RESILIENT		
CORR	- CORRIDOR	INCL.	- INCLUDED, INCLUDING	REV.	- REVISION, REVISED		
CPT.	- CARPET	INFO	- INFORMATION	RET.	- RETURN		
C.S.	- CAST STONE	INSUL	- INSULATION	R.H.	- RIGHT HAND		
CT	- CERAMIC TILE	INTR.	- INTERIOR	RM.	- ROOM		
CUH	- CABINET UNIT HEATER	INTERM	- INTERMEDIATE	R.O.	- ROUGH OPENING		
CUH-S	- CABINET UNIT HEATER - SURFACE MOUNTED	INVERT	- INVERT	RTD	- RATED		
		ISO	- ISOLATION	RTG	- RATING		
CUH-R	- CABINET UNIT HEATER - RECESSED			R.W.L	- RAIN WATER LEADER		
CUH-SR	- CABINET UNIT HEATER - SEMI-RECESSED	JAN	- JANITOR	S	- SOUTH		
		J.C.	- JANITOR'S CLOSET	SAN.	- SANITARY		
DEMO	- DEMOLISH, DEMOLITION	JT.	- JOINT	SBB	- SANDBLASTED BLOCK		
DET.	- DETAIL	KD	- KNOCK DOWN	S.C.	- SOLID CORE		
DF	- DRINKING FOUNTAIN	KG	- KILOGRAM	SCHE.	- SCHEDULE		
DIA	- DIAMETER	KITC.	- KITCHEN	S.D.	- STORM DRAIN		
DIAG.	- DIAGONAL			SECT.	- SECTION		
DIFF	- DIFFUSER	LAM.	- LAMINATE(D)	SEW.	- SEWER		
DIM.	- DIMENSION	LAV.	- LAVATORY	SF	- SQUARE FEET/FOOT		
DISP	- DISPOSAL	LCC	- LEAD COATED COPPER	SHT.	- SHEET		
DIV.	- DIVISION	LOC	- LOCATION	SHWR	- SHOWER		
DMPR	- DAMPER	L.F.	- LINEAR FOOT	SIM.	- SIMILAR		
DN	- DOWN	LG	- LONG	S.O.G	- SLAB ON GRADE		
D.O.	- DOOR OPENING	LGTH.	- LENGTH	SPEC.	- SPECIFICATION		
DPFG	- DAMPPROOFING	LH	- LEFT HAND	SPKLR	- SPRINKLER		
DPTN	- DEMOUNTABLE PARTITION	LIN	- LINEAR	SPKR	- SPEAKER		
DR	- DOOR	LL	- LIVE LOAD	SQ.	- SQUARE		
DRN	- DRAIN	LLH	- LONG LEG HORIZONTAL	S/S	- SANITARY SINK		
DW	- DISHWASHER	LLV	- LONG LEG VERTICAL	S.S	- STAINLESS STEEL		
DWG(S)	- DRAWING(S)	LN	- LINE	S.STL	- STAINLESS STELLA		
DWR	- DRAWER	LT	- LIGHTING	ST	- STREET		
		LTG	- LIGHTINGING	STA.	- STATION		
E	- EAST	LT. WT.	- LIGHTING WEIGHT	STC	- SOUND TRANSMISSION CLASS		
EA.	- EACH			STD	- STANDARD		
E.F.	- EXHAUST FAN	MACH	- MACHINE	STL	- STEEL		
E.J.	- EXPANSION JOINT	MAN	- MANUAL	STOR.	- STORAGE		
EL.	- ELEVATION	M.A.T	- MINERAL ACOUSTIC TILE	STRG	- STRINGER		
ELEC.	- ELECTRICAL	MAX	- MAXIMUM	STRL	- STRUCTURAL		
ELEV	- ELEVATOR	M.B.	- MARKER BOARD	STRUCT.	- STRUCTURAL		
EMERG.	- EMERGENCY	MECH	- MECHANICAL	SUBCTG	- SUBCATEGORY		
ENCL.	- ENCLOSURE	MED.	- MEDIUM	SUSP.	- SUSPENDED		
EQ	- EQUAL	MEMB	- MEMBRANE	SYS	- SYSTEM		
EQUIP	- EQUIPMENT	MEZZ	- MEZZANINE				
ESCAL	- ESCALATOR	MFR	- MANUFACTURER				
EST	- ESTIMATED	MH	- MANHOLE				
E.W.C.	- ELECTRICAL WATER COOLER	MIN	- MINIMUM				
EXH.	- EXHAUST	MISC	- MISCELLANEOUS				
EXP.	- EXPANSION	M.O.	- MASONRY OPENING				
EXIST.	- EXISTING	MTD	- MOUNTED				
EXTR.	- EXTERIOR	MTG	- MOUNTING				
		MTL.	- METAL				
		MULL	- MULLION				

GENERAL NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO COMMENCING WORK AND BRING ANY DISCREPANCIES TO THE ATTENTION OF THE ARCHITECT.

2. CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY OF DISCREPANCIES IN THE DRAWINGS.

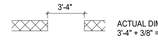
3. DO NOT SCALE DRAWINGS, USE WRITTEN DIMENSIONS ONLY.

4. ALL DIMENSIONS ARE ROUGH FRAMING DIMENSIONS. DIMENSIONS ARE FROM FACE OF METAL STUD WALL, TO FACE OF CONCRETE BLOCK, TO CENTER LINE OF STRUCTURAL GRID. SEE WALL TYPES FOR ADDITIONAL INFORMATION.

5. GENERAL REQUIREMENTS FOR MASONRY WALLS WHERE NOT SPECIFICALLY DETAILED OTHERWISE.

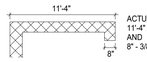
A. ALL MASONRY DIMENSIONS ARE SHOWN AS MODULAR DIMENSIONS UNLESS OTHERWISE NOTED.
B. MASONRY DIMENSIONS:
UNLESS OTHERWISE INDICATED ALL MASONRY PLAN DIMENSIONS ARE NOMINAL, WITH 'NOMINAL' DEFINED TO MEAN ACTUAL DIMENSION SHOWN OR DIMENSION SHOWN ± 3/8".

MASONRY DIMENSIONS ARE DEFINED TO BE 3/8" LARGER THAN DIMENSIONS SHOWN EXAMPLE:



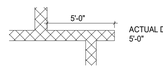
ACTUAL DIMENSION IS 3'-4" + 3/8" = 3'-4 3/8"

OVERALL DIMENSIONS OF MASONRY WALL LENGTH OR THICKNESS ARE DEFINED TO BE 3/8" SMALLER THAN DIMENSIONS SHOWN EXAMPLE:



ACTUAL DIMENSIONS ARE 11'-4" - 3/8" = 11'-3 5/8" AND 8" - 3/8" = 7 5/8"

DIMENSIONS FROM INSIDE TO OUTSIDE CORNERS ARE ACTUAL EXAMPLE:



ACTUAL DIMENSION IS 5'-0"

INSIDE DIMENSIONS OF MASONRY WALL ARE DEFINED TO BE 3/8" LARGER THAN DIMENSIONS SHOWN EXAMPLE:



ACTUAL DIMENSION IS 10'-0" + 3/8" = 10'-0 3/8"

6. THE TERM "TYPICAL" IS USED TO DEFINE A GENERAL CONDITION THAT WILL APPLY TO ALL SUCH CONDITIONS EXCEPT AS OTHERWISE NOTED.

7. ALL INTERIOR WALL SHALL TERMINATE AT BOTTOM OF METAL DECK OR BOTTOM OF STRUCTURAL STEEL.

8. ALL SMOKE WALLS OR FIRE RATED PARTITIONS WHICH TERMINATE AT UNDERSIDE OF METAL DECK SHALL HAVE FLUTES AT METAL DECK FILLED SOLID WITH FIRE SAFING INSULATION.

9. STAIR ENCLOSURES SHALL HAVE NO PENETRATIONS OR OPENINGS FOR WIRING, PIPING, DUCTS, ETC.. EXCEPT FOR THOSE REQUIRED TO SERVE THE STAIR.

10. ALL PIPES, CONDUITS, CABLES, WIRES, DUCTS, ETC.. THAT PASS THROUGH FLOOR, SMOKE BARRIERS, FIRE RATED PARTITIONS AND FIRE WALLS SHALL HAVE THE SPACE BETWEEN THE PENETRATING ITEM AND THE WALL FILLED WITH EITHER FIRE RESISTANT JOINT SEALER OR FIRE SAFING INSULATION.

11. FIRESTOPPING SHALL BE PROVIDED IN CONNECTIONS BETWEEN HORIZONTAL AND VERTICAL SPACES SUCH AS SOFFITS, DROPPED CEILINGS AND COVE CEILINGS. FIRESTOPPING SHALL CONSIST OF APPROVED NON-COMBUSTIBLE MATERIALS, SECURELY FASTENED IN PLACE AND SHALL BE CONTINUOUSLY MAINTAINED. FIRESTOPPING SHALL NOT BE CONCEALED FROM VIEW UNTIL INSPECTED AND APPROVED.

12. INTERIOR WALL AND CEILING FINISHES SHALL BE CLASS A OR B. INTERIOR FINISHES IN STAIRS, CORRIDORS, LOBBIES AND EXITS SHALL BE CLASS A. FLOOR COVERINGS WITHIN STAIRS, CORRIDORS OR EXITS SHALL BE CLASS I OR II.

13. COORDINATE LOCATION OF ELECTRICAL DEVICES; I.E.: LIGHTINGS, SWITCHES, OUTLETS, FIRE ALARM DEVICES, SPEAKERS, ETC.., WITH ELECTRICAL DRAWINGS AND LOCATIONS INDICATED ON ARCHITECTURAL REFLECTED CEILING PLANS AND INTERIOR ELEVATIONS. IF CONFLICT ARISES BETWEEN ELECTRICAL DRAWINGS AND ARCHITECTURAL DRAWINGS CONTRACTOR SHALL NOTIFY ARCHITECT PRIOR TO INSTALLATION OF DEVICE.

14. PATCH ALL OPENINGS IN WALLS, CEILINGS AND FLOORS TO MATCH CONSTRUCTION ASSEMBLIES WHERE ELECTRICAL, PLUMBING AND MECHANICAL CONDUITS, PIPES, ETC. HAVE BEEN REMOVED.

15. PATCH AND REPAIR ANY EXISTING CEILING, FLOORING AND/OR WALL FINISHES DAMAGED DURING THE INSULATION OF NEW WALL, PIPING, DUCTWORK, OR UNDER THIS PROJECT.

15. IF A WALL OR SURFACE HAS BEEN WORKED ON, THAT WALL OR SURFACE SHALL BE PATCHED & REPAIRED WITH A COMPLETE FINISH, TO THE NEAREST CORNER, CHANGE OF PLANE OR OTHER JUNCTURE WHICH ALLOWS FOR SMOOTH & CLEAN TRANSITION FROM NEWLY FINISHED SURFACE TO THE SURROUNDING EXISTING SURFACE; i.e., THE INTENT IS TO ELIMINATE THE APPERANCE OF A PATCHED CONDITION.

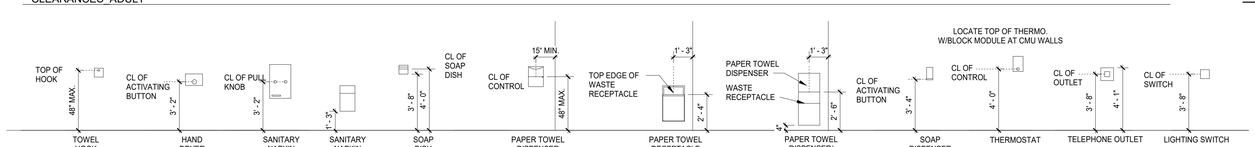
16. HARDWARE NOTES;

A. ALL RATED DOORS SHALL HAVE CLOSERS AND POSITIVE LATCHING LOCKSETS OR LATCHSETS.
B. ALL DOORS EXITING 50 OR MORE PEOPLE SHALL HAVE PANIC EXIT DEVICES.
C. ALL DOORS LEADING TO HAZARDOUS SPACES SHALL HAVE TACTILE WARNING. HAZARDOUS AREAS INCLUDE: CUSTODIAL SPACES, BOILER ROOM, MECHANICAL ROOMS AND ELCTRICAL CLOSETS.
D. ACCESSIBLE DOOR HARDWARE FOR PEOPLE WITH DISABILITIES SHALL BE PROVIDED TO COMPLY WITH UNIFORM FEDERAL ACCESSIBILITY STANDARDS.

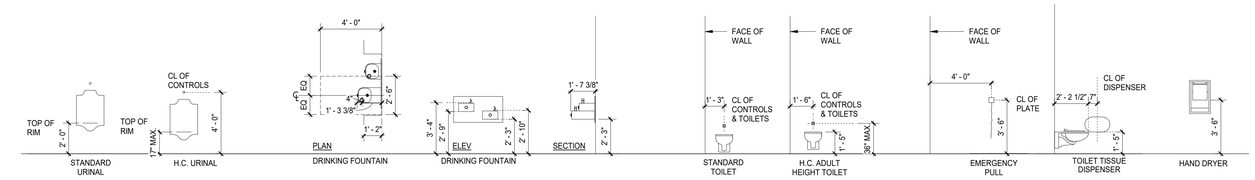
17. ACCESSIBILITY NOTES:

A. ALL PROGRAMS ARE ACCESSIBLE TO PERSONS WITH DISABILITIES.
B. ALL ROOMS USED BY PERSONS WITH DISABILITIES HAVE ACCESSIBLE WORK STATIONS.
C. ALL ACCESSIBLE ELEMENTS ARE MARKED WITH THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AND THE ACCESSIBLE ROUTE HAS 36 INCH MINIMUM CLEARANCE THROUGHOUT (32 INCH CLEARANCE FOR DOORWAYS).
D. ALL ITEMS SHALL COMPLY WITH SECTION 504, REHABILITATION ACT 1973.
E. ALL LABS & SHOPS USED BY PERSON W/ DISABILITIES HAVE ACCESSIBLE EMERGENCY EYEWASH & BODY WASH STATION

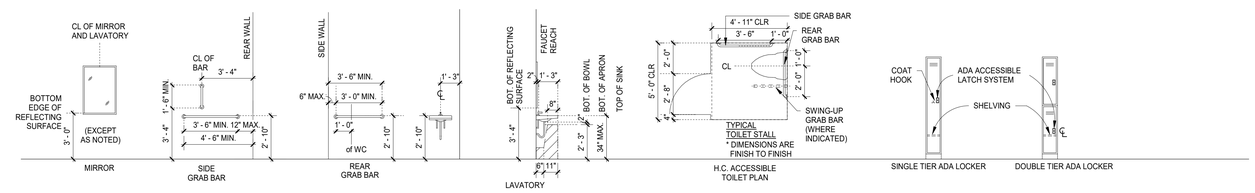
TYPICAL FIXTURE HEIGHTS AND CLEARANCES ADULT

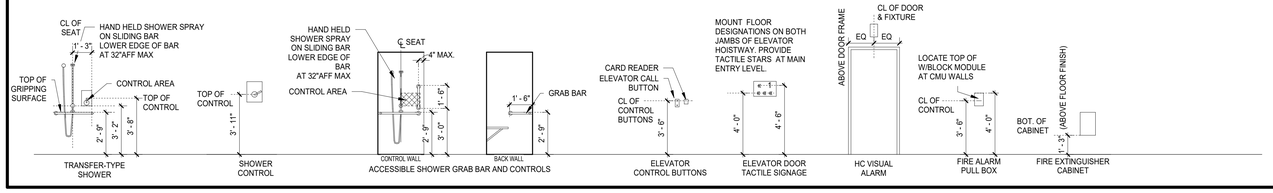


NOTE: ALL MOUNTING HEIGHTS SHOWN ON INTERIOR ELEVATIONS SHOULD SUPERSEDE HEIGHTS SHOWN ON THESE DRAWINGS AND ANY DISCREPANCY SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO INSTALLATION.

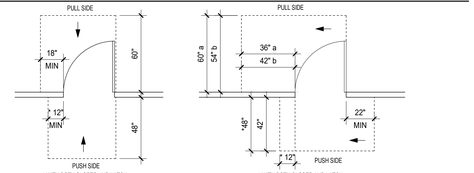


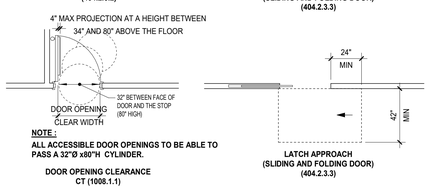
▫ COORDINATE HEIGHT OF FLUSH VALVE WITH GRAB BARS





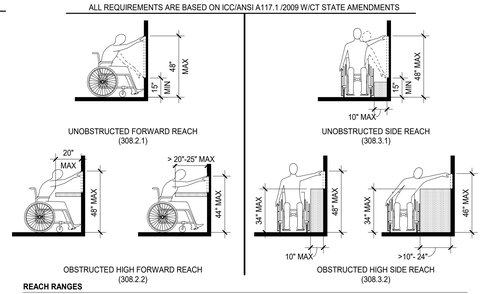
MANEUVERING CLEARANCES FOR ALL ACCESSIBLE DOORS



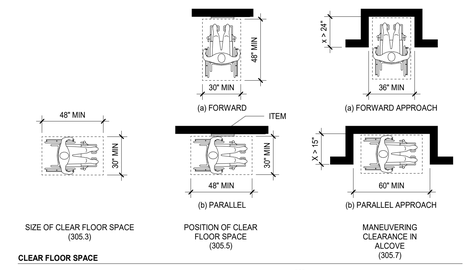


REACH RANGES AND CLEAR FLOOR SPACE

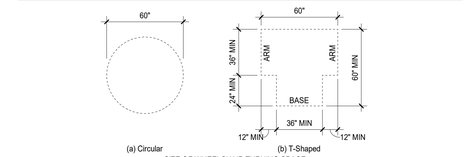
ALL REQUIREMENTS ARE BASED ON ICC/ANSI A117.1 /2009 W/CT STATE AMENDMENTS



REACH RANGES



CLEAR FLOOR SPACE



WHEELCHAIR TURNING SPACE

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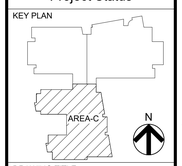
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

GENERAL INFORMATION

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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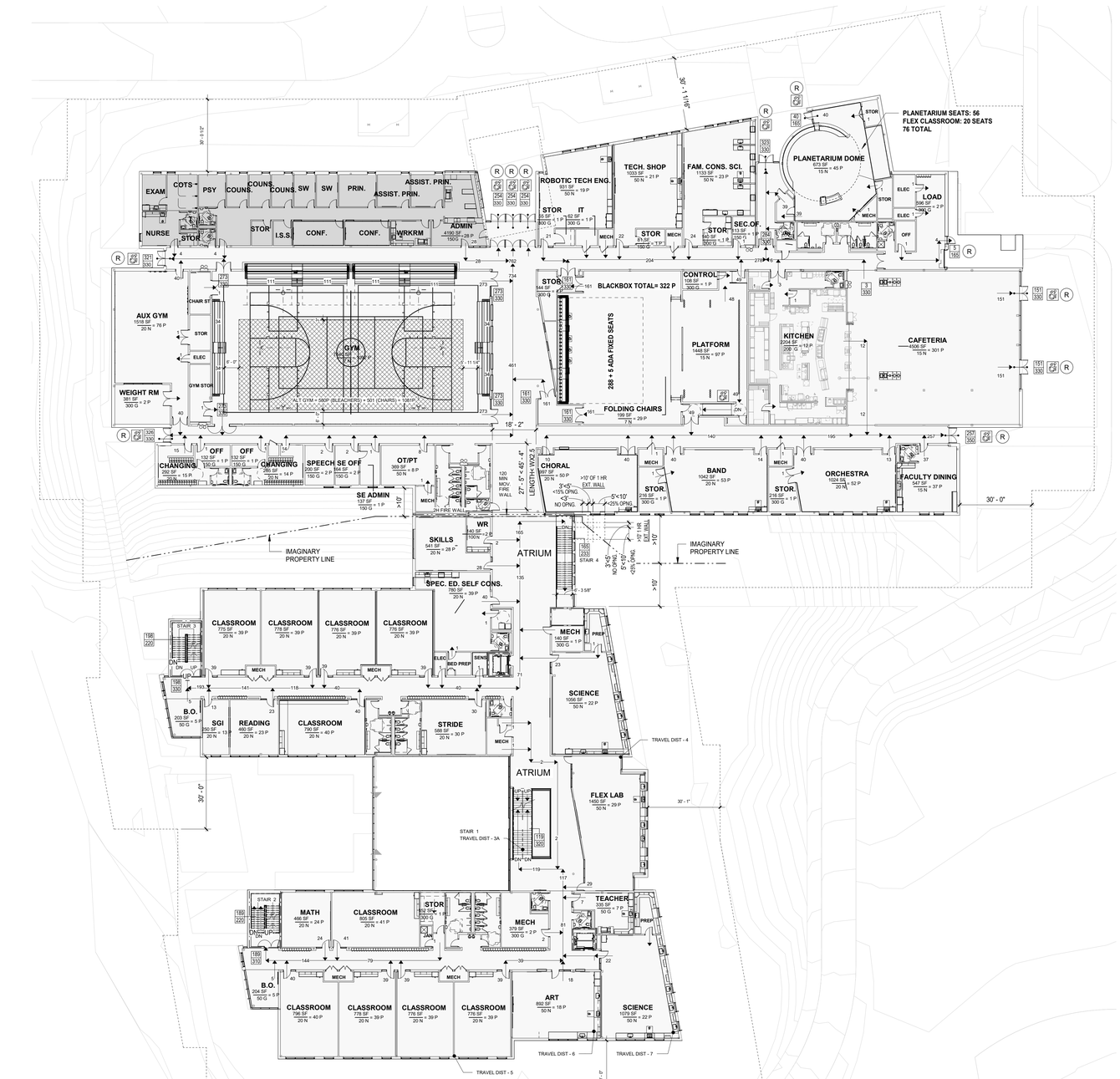
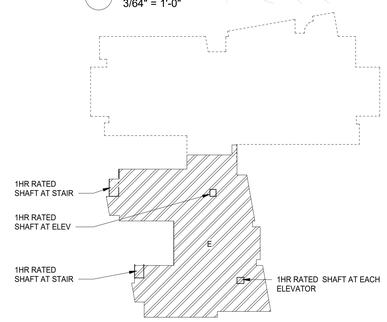
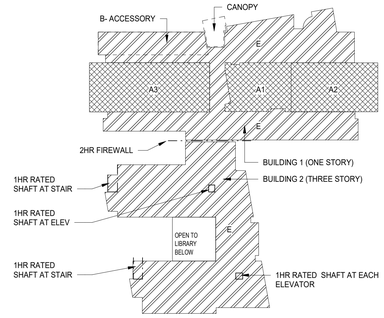


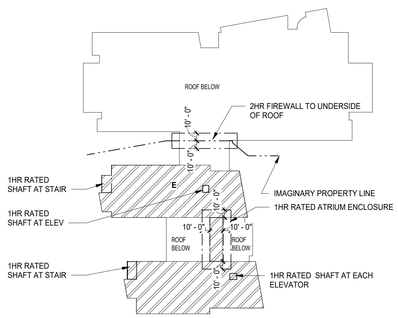
H11 MAIN LEVEL PLAN
3/64" = 1'-0"



LOWER LVL: (IBC-5) AREA



MAIN LVL: (IBC-5) AREA



UPPER LVL: (IBC-5) AREA

1. USE GROUP CLASSIFICATION (IBC CHAPTER 3) - SEE PLANS ON THIS SHEET

PRIMARY.....E (EDUCATIONAL)

ACCESSORY.....B (BUSINESS)
SEPARATED (NO RATING REQ).....A1 (ASSEMBLY- BLACK-BOX THEATER)
SEPARATED (NO RATING REQ).....A2 (ASSEMBLY-CAFETERIA)
SEPARATED (NO RATING REQ).....A3 (ASSEMBLY- GYM)

2. CONSTRUCTION TYPE (IBC CHAPTER 6)

MINIMUM TYPE REQUIRED — TYPE IIB (FULLY SPRINKLERED)

ACTUAL TYPE PROVIDED — TYPE IIB (FULLY SPRINKLERED)

3. BUILDING HEIGHT (IBC CHAPTER 5)

(E) ALLOWABLE HEIGHT (STORY/FEET) — 3 STORIES / 75 FEET (FULLY SPRINKLERED)

ACTUAL HEIGHT (STORY/FEET) — 3 STORIES / 54' - 3"

STORIES ABOVE GRADE — 1 & 3 STORIES

4. BUILDING AREA (IBC CHAPTER 5) - SEE PLANS ON THIS AND NEXT SHEETS

BUILDING GFA (EACH FLOOR INSIDE FACE OF WALL & OVERHANGS)

MAIN LEVEL:	**78,719 SF**
LOWER LEVEL:	**30,790 SF**
UPPER LEVEL:	**24,124 SF**
CANOPY:	**930 SF**
TOTAL:	**134,563 SF**

5. AREA MODIFICATIONS TO TABLE 506

	NORTH	EAST	WEST	SOUTH
TOTAL PERIMETER =	586 LF	403 LF	378 LF	591 LF
OPEN PERIMETER (min. 30') =	586 LF	403 LF	378 LF	591 LF

TOTAL PERIMETER (P) = 1958 LF

TOTAL OPEN PERIMETER ≥ 30' = 1958 LF

Weighted Average (W) = 30

(BUILDING PERIMETER WHICH FRONTS ON A PUBLIC WAY OR OPEN SPACE HAVING MIN. 30' OPEN MIN. WIDTH)

Lf = [(F/P) - 0.25] * (W/30)

FRONTAGE INCREASE (Lf) = [(1,958 / 1,958) - 0.25] * (30/30) = **0.75**

6. **CASE 1 - SINGLE OCCUPANCY OR NONSEPARATED USES - IBC 506.2 (ALLOWABLE AREA 506.2.3)**

Aa = [At + (NS x Lf)]
Allowable Area per Floor = [Tabular Area (Sprinklered) + (Tabular area for nonsprinklered building x Frontage Increase Factor]

Aa = [At + (NS x Lf)]

Aa = [43,500 + (14,500 x0.75)] = 54,375 sf.
Aa = 54,375 sf < 78,719 SF ; NOT OK - Main Floor Area requires a 2 hour fire rated separation.

7. **CASE 2 - MIXED OCCUPANCY SEPARATED USES (508.4.2) (ALLOWABLE AREA 506.2.4)**

ALLOWABLE AREA IS CALCULATED INDIVIDUALLY FOR BUILDING 1 (SINGLE STORY) AND BUILDING 2 (THREE STORY), SEPARATED BY A 2 HOUR FIREWALL.

Building1: designed as separated occupancies (A1,A2,A3 & E). Per 508.4 A&E have no separation requirement.
B is accessory to E, B= 8.38% of total floor area < 10%
Building 2: designed as single occupancy (E) with allowable area calculated per floor.

Aa = [At + (NS x Lf)]
Allowable Area (Aa) = [Tabular Area (Sprinklered) + (Tabular Area for Nonsprinklered Building x Frontage Increase Factor)]

Table 506.2:	E(EDUCATION)	A3,A2(ASSEMBLY)	A1 (ASSEMBLY)
TABULAR AREA (NS), NS (TYPE IIB) =	14,500 sf	9,500 sf	8,500 sf
TABULAR AREA (At), SM (TYPE IIB) =	43,500 sf	NOT USED	NOT USED
TABULAR AREA (At), SI (TYPE IIB) =	106,000 sf	38,000 sf	34,000 sf

a) ALLOWABLE AREA — [43,500+(14,500 x 0.75)] = **54,375 sf** | [38,000+(9,500 x 0.75)] = **45,125 sf** | [34,000+(8,500x 0.75)] = **40,375 sf**
106,000+(14,500 x 0.75) = **116,875 sf**

b) **BUILDING 1 (508.4.2)**
ACTUAL / ALLOWABLE AREA ≤ 1

EDUCATION (E) = 26,990 sf /116,875 sf = 0.23
ASSEMBLY (A1) = 5,493 sf / 40,375 sf = 0.13
ASSEMBLY (A2/A3) = 17,657 sf / 45,125 sf = 0.38

BUILDING 1: 0.23 + 0.13 + 0.38 = **0.757 < 1.00**

BUILDING 2 (506.2.1)
ALLOWABLE AREA PER FLOOR

LOWER LEVEL: 30,974 sf < 54,375 sf **OK**
MAIN LEVEL: 32,300 sf < 54,375 sf **OK**
UPPER LEVEL: 24,305 sf < 54,375 sf **OK**

c) PER TABLE 508.4, NO SEPERATION IS REQUIRED BETWEEN ASSEMBLY AND EDUCATION OCCUPANCY.

d) ACCESORY USE (508.2): BUSINESS OCCUPANCY
CHECK 10% OF TOTAL FLOOR AREA= 4,190 sf (BUSINESS) / 50,000 sf (BUILDING 1 total area):
= 0.838 = **8.38% < 10% OK**

CHECK BUSINESS TABULAR AREA (NS) vs ACCESSORY AREA= **23,000 sf > 4,190 sf OK**

8. FIRE RESISTANT RATINGS OF STRUCTURAL ELEMENTS (IBC TABLE 601)

	REQUIRED	PROVIDED
STRUCTURAL FRAME: INCLUDING COLUMNS, GIRDERS, TRUSSES	0	0
BEARING WALLS - EXTERIOR	NA	NA
BEARING WALLS - INTERIOR	NA	NA
NONBEARING WALLS AND PARTITIONS (EXT.) SEPARATION <5'	1	1
NONBEARING WALLS AND PARTITIONS (EXT.) SEPARATION ≥5' < TO 10'	1	1
NONBEARING WALLS AND PARTITIONS (EXT.) SEPARATION ≥10' <TO 30'	N/A	N/A
NONBEARING WALLS AND PARTITIONS (INTERIOR)	0	0
FLOOR CONSTRUCTION (INCLUDING SUPPORTING BEAMS AND JOISTS)	0	0
ROOF CONSTRUCTION (INCLUDING SUPPORTING BEAMS AND JOISTS)	0	0
FIRE WALLS	2	2
EXIT ENCLOSURES (LESS THAN 4 STORIES)	1	1
SHAFT ENCLOSURES (LESS THAN 4 STORIES)	NA	NA
MIXED USE SEPARATION (NOT REQUIRED FOR E&A PER TABLE 508.4)	NA	NA
FIRE SEPARATIONS, SMOKE BARRIERS	1	1
FIRE SEPARATION FOR ATRIUM AT UPPER LEVEL	1	1

*FIRE PROTECTION OF STRUCTURAL MEMBERS SHALL NOT BE REQUIRED, INCLUDING PROTECTION OF ROOF FRAMING AND DECKING WHERE EVERY PART OF THE ROOF CONSTRUCTION IS 20 FEET OR MORE ABOVE ANY FLOOR IMMEDIATELY BELOW.

9. OCCUPANCY LOAD (SECTION 1004)

DESIGN LOAD FOR EACH FLOOR:

LOWER LEVEL	715
MAIN LEVEL	2,971
UPPER LEVEL	602
DESIGN TOTAL FOR BUILDING:	**4,288**

DESIGN LOAD FOR EACH FLOOR, BUILDING 1:

LOWER LEVEL	0
MAIN LEVEL	2,299
UPPER LEVEL	0
DESIGN TOTAL FOR BUILDING 1:	**2,299**

TOTAL EXIT CAPACITY FOR EACH FLOOR:

LOWER LEVEL	1,365
MAIN LEVEL	4,350
UPPER LEVEL	840
TOTAL EXIT CAPACITY FOR BUILDING:	**6,555**

DESIGN LOAD FOR EACH FLOOR, BUILDING 2:

LOWER LEVEL	715
MAIN LEVEL	672
UPPER LEVEL	602
DESIGN TOTAL FOR BUILDING 2:	**1,989**

10. BUILDING CODE MODIFICATIONS
1. MUSIC ROOM SINK ACCESSIBILITY

11. ACCESSIBLE BUILDING
DESIGNATED

12. MINIMUM PLUMBING FIXTURE COUNT -

	EDUCATION (E)	BUSINESS (B)	(A2) CAFETERIA	(A1/A3) BB/GYM	TOTAL REQUIRED	TOTAL PROVIDED
WC FEMALE	: 1178/50 = 23.57	14/25 = 0.56	152.5/75 = 2.03	799/65 = 12.29	= 38.45 (**39**)	**43**
WC MALE	: 1178/50 = 23.57	14/25 = 0.56	152.5/75 = 2.03	799/125 = 6.39	= 32.55 (**33**)	**42**
LAVS	: 2,357/50 = 47.14	28/40 = 0.7	305/200 = 1.52	1598/200 = 7.99	= 57.35 (**58**)	**64**
DRINKING F.	: 2,357/100 = 23.57	28/100 = 0.28	305/500 = 0.61	1598/500 = 3.19	= 27.65 (**28**)	**28**
SERVICE SINK	: 1	0	1	1	**3**	**5**

PLUMBING FIXTURE SUBSTITUTION RULE, CT PC 410.4: PERMANENTLY INSTALLED BOTTLE-FILLING STATIONS CAN COUNT AS DRINKING FOUNTAINS UP TO TWO-THIRDS OF THE REQUIRED NUMBER , 50% OF FOUNTAINS TO BE ADA ACCESSIBLE

DESIGN TOTAL BUILDING OCCUPANCY: 4,288

EDUCATION (E) : TOTAL OCCUPANCY = **2,357**

BUSINESS (B): TOTAL OCCUPANCY = **28**

ASSEMBLY (A2) (CAFETERIA AND OTHER ASSEMBLY): TOTAL OCCUPANCY = **305**

ASSEMBLY (A1) (BLACK-BOX) & **(A3)** (GYM) : TOTAL OCCUPANCY = **1,598**

13. SPRINKLER PROTECTION

FULLY SPRINKLERED

14. CODES TO WHICH THIS PROJECT WAS DESIGNED

A. 2022 CONNECTICUT STATE BUILDING CODE [CSBC]
B. 2022 CONNECTICUT FIRE SAFETY CODE [CFSC]
C. 2022 CONNECTICUT FIRE PREVENTION CODE [CSFPC]
D. 2021 INTERNATIONAL PLUMBING CODE [IEBC]
E. 2021 INTERNATIONAL MECHANICAL CODE[IMC]
F. 2021 INTERNATIONAL ENERGY CONSERVATION CODE [IECC]
G. 2020 NATIONAL ELECTRICAL CODE [NEC]
H. 2017 ACCESSIBLE AND USABLE BUILDING FACILITIES [ICC A117.1]
I. 2010 ADA STANDARDS FOR ACCESSIBLE DESIGN [ADA]
J. CT-DCP GUIDELINES FOR PUBLIC PLAYGROUND EQUIPMENTS
K. 2010 CPSC PUBLIC PLAYGROUND SAFETY BOOK [PPSH]

15. THRESHOLD BUILDING CONDITION *(greater than four stories or 60 feet in height, or has a clear span of 150 ft or more in width or which has an total 150.000 sf gross floor area and an occupant content of greater than 1000 persons.)*

NO

16. BUILDING AREAS FOR GRANT CALCULATION (ENTIRE FACILITY) (INSIDE FACE OF EXTERIOR WALLS)

EXISTING CONSTRUCTION PRIOR TO THIS PROJECT :	117,000 SF
EXISTING BEING DEMOLISHED AND REMOVED:	117,000 SF
TOTAL NEW CONSTRUCTION FOR THIS PROJECT	134,563 SF
TOTAL CONSTRUCTION FOR THIS PROJECT (including overhangs and openings):	**134,563 SF**
OVERHANGS :	**930 SF**
OPENINGS:	**392 SF**
TOTAL NET AREA OF CONSTRUCTION:	**134,055 SF**

PROJECTED STUDENT ENROLLMENT **826** ALLOWABLE AREA OF CONSTRUCTION **135, 706 SF**

17. BUILDING AREAS FOR CONSTRUCTION COST CALCULATION:
TOTAL CONSTRUCTION BUILDING AREA - EXTERIOR FACE OF EXTERIOR WALLS (EXCLUDING OVERHANGS AND OPENINGS)

MAIN LEVEL:	80,686 SF
LOWER LEVEL:	25,068 SF
UPPER FLOOR:	31,990 SF
TOTAL GFA:	**137,744 SF**

DRAWING LEGEND

- Room name / 101 — ROOM NUMBER AND NAME
- 875 / 20 — ROOM OCCUPANCY LOAD: AREA IN SQUARE FEET ÷ 43P = ROOM OCCUPANCY LOAD; OCCUPANCY LOAD FACTOR
- 191 — MAX.. ALLOWABLE EGRESS OCCUPANCY OF STAIR
- 440 — MAX.. ALLOWABLE OCCUPANCY OF CORRIDOR
- X / 165 — EXIT CAPACITY: ACTUAL EGRESS OCCUPANCY OF DOOR OR STAIR; MAX. ALLOWABLE EGRESS OCCUPANCY OF DOOR OR STAIR
- ACCESSIBLE AREA OR EXIT (CT)
- ACCESSIBLE AT GRADE (FLUSH CONDITION)
- R — REQUIRED EXTERIOR EXIT
- PATH OF TRAVEL
- 2 HOUR FIRE RATED WALL (TIGHT TO DECK ABOVE)
- 1 HOUR FIRE RATED WALL (TIGHT TO DECK ABOVE)

CLEAR EGRESS WIDTH AND ALLOWABLE EGRESS OCCUPANCY

0.2 FACTOR FOR DOORS AND HORIZONTAL EGRESS WAYS

X / 155	2'-10" DOOR (31" CLR.)
X / 165	3'-0" DOOR (33" CLR.)
X / 175	3'-2" DOOR (35" CLR.)
X / 190	3'-5" DOOR (38" CLR.)
X / 225	4'-0" DOOR (45" CLR.)
X / 290	5'-4" DOOR (58" CLR.)
X / 300	5'-6" DOOR (60" CLR.)
X / 310	5'-8" DOOR (62" CLR.)
X / 330	6'-0" DOOR (66" CLR.)
X / 350	6'-4" DOOR (70" CLR.)
X / 355	6'-5" DOOR (71" CLR.)
X / 360	6'-6" DOOR (72" CLR.)
X / 370	6'-8" DOOR (74" CLR.)
X / 390	7'-0" DOOR (78" CLR.)
X / 395	7'-1" DOOR (79" CLR.)
X / 400	7'-2" DOOR (80" CLR.)
X / 405	7'-3" DOOR (81" CLR.)

0.3 FACTOR FOR STAIRS

X / 200	5'-0" STAIR CLR
X / 220	5'-6" STAIR CLR
X / 240	6'-0" STAIR CLR
X / 300	7'-6" STAIR CLR
X / 320	8'-0" STAIR CLR

TABLE 1004.1.2
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

ASSEMBLY CONCENTRATED (chairs only - GYM)	=	7 NET
ASSEMBLY UNCONCENTRATED (tables & chairs - CAFETERIA & PLATFORMS)	=	15 NET
CLASSROOM	=	20 NET
SHOPS AND OTHER VOCATIONAL AREAS	=	50 NET
LOCKER ROOMS	=	50 GROSS
EXERCISE ROOMS	=	50 GROSS
LIBRARY READING AREAS	=	50 GROSS
BOOK STACK AREAS	=	100 GROSS
OFFICE	=	100 GROSS
BUSINESS AREAS	=	150 GROSS
ACCESSORY STORAGE AREAS AND MECH... EQUIP, RM...	=	300 GROSS

CODE LEGEND

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

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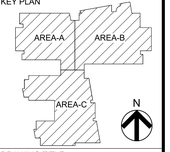

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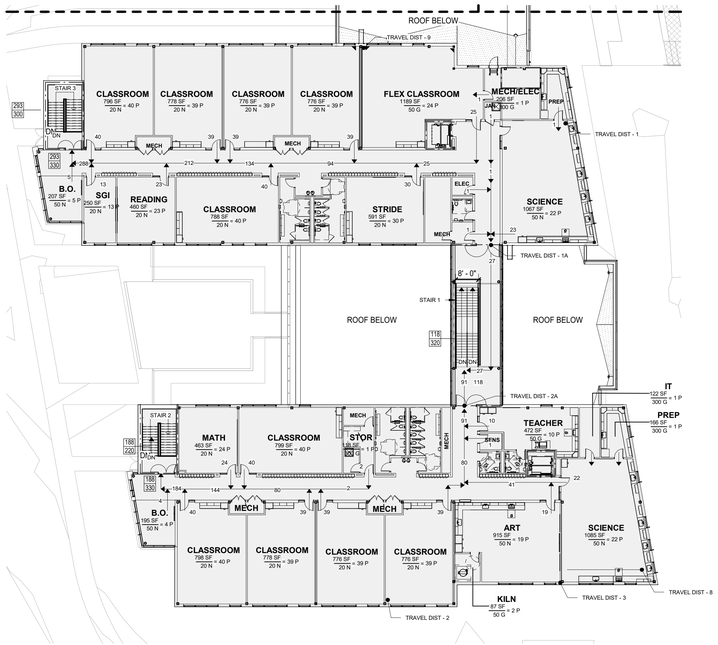
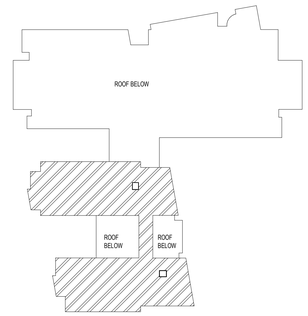
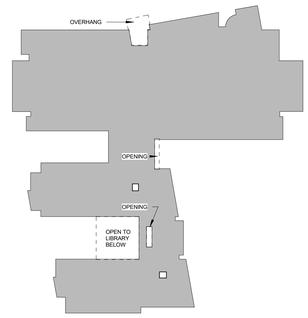


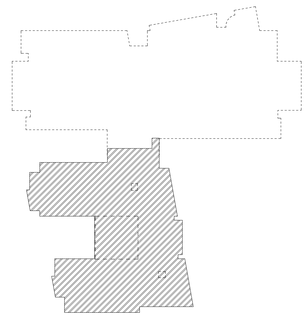
E10 UPPER LEVEL CODE
3/64" = 1'-0"



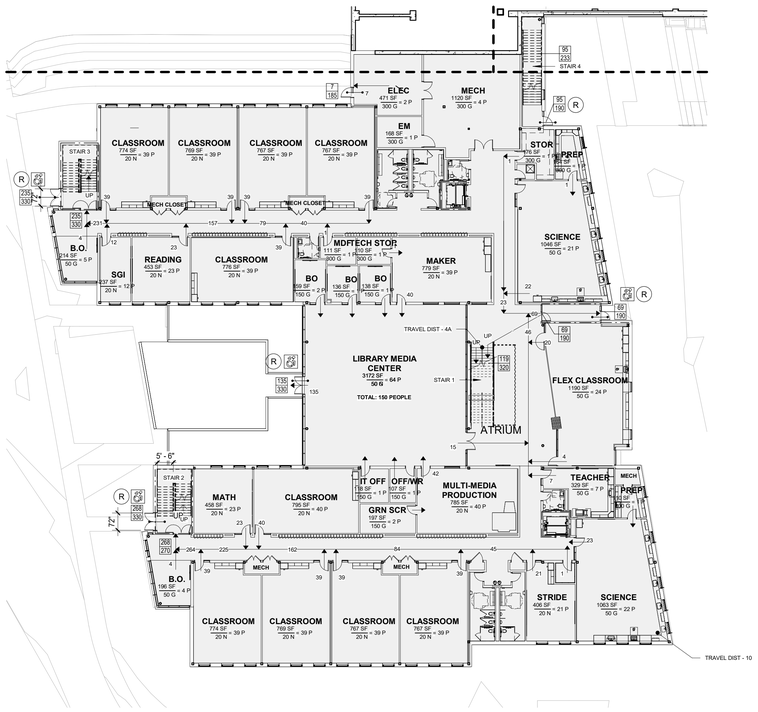
C4 UPPER LVL: AREA GRANT CALCULATION
1" = 80'-0"



E4 MAIN LVL: AREA GRANT CALCULATION
1" = 80'-0"



H4 LOWER LVL: AREA GRANT CALCULATION
1" = 80'-0"



J10 LOWER LEVEL PLAN
3/64" = 1'-0"

ATRIUM TRAVEL DISTANCES:

1A. FROM UPPER LEVEL NORTH DOOR: 191 FT

2A. FROM UPPER LEVEL SOUTH DOOR: 157 FT

3A. FROM STAIR 2 MAIN LEVEL : 52.5 FT

4A. FROM STAIR 2 LOWER LEVEL: 23.5 FT

*ATRIUM DISTANCE INCLUDES HORIZONTAL AND VERTICAL DISTANCES AT STAIR 2

MAXIMUM TRAVEL DISTANCE INSIDE ATRIUM: **200 FT**

TRAVEL DISTANCES FOR EGRESS THROUGH ATRIUM :

1. B201 SCIENCE: 242' -0"
2. B227 CLASSRM: 233' 9"
3. B228 ART: 233'0"
4. B138 FLEX: 135' 0"
5. B133 CLASSRM: 171' 0"
6. B134 ART: 159' 0"
7. B135 SCIENCE: 164' 0"

*ATRIUM DISTANCE INCLUDES HORIZONTAL AND VERTICAL DISTANCES AT STAIR 2

MAXIMUM TRAVEL DISTANCE TOTAL : **250 FT**

OTHER TRAVEL DISTANCES:

8. B229 SCIENCE: 191' 0"
9. B203 FLEX: 179' 0"
10. B038 SCIENCE: 186' 0"

MAXIMUM TRAVEL DISTANCE TOTAL : **250 FT**

DRAWING LEGEND

- Room name / 101 — ROOM NUMBER AND NAME
- ROOM OCCUPANCY LOAD
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- ≠43P — ROOM OCCUPANCY LOAD
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- X / 165 — ACTUAL EGRESS OCCUPANCY OF DOOR OR STAIR / MAX.. ALLOWABLE EGRESS OCCUPANCY OF DOOR OR STAIR
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CLEAR EGRESS WIDTH AND ALLOWABLE EGRESS OCCUPANCY

0.2 FACTOR FOR DOORS AND HORIZONTAL EGRESS WAYS		0.3 FACTOR FOR STAIRS	
X 155	2'-10" DOOR (31" CLR.)	X 200	5'-0" STAIR CLR
X 165	3'-0" DOOR (33" CLR.)	X 220	5'-6" STAIR CLR
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EXERCISE ROOMS	=	50 GROSS
LIBRARY READING AREAS	=	50 GROSS
BOOK STACK AREAS	=	100 GROSS
OFFICE	=	100 GROSS
BUSINESS AREAS	=	150 GROSS
ACCESSORY STORAGE AREAS AND MECH... EQUIP. RM...	=	300 GROSS

CODE LEGEND

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ARCHITECTURE | PLANNING | INTERIORS

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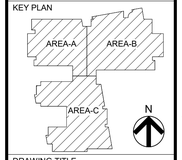

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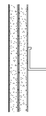
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A0.02B

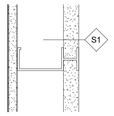
5/19/2026 3:10:28 PM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



2 HOUR RATING SHAFT WALL
UL DES U415

STC 43

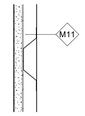
2 LAYER 5/8" GYP BD
4" CH STUDS @ 24" OC
1" GYPSIUM LINER PANEL



1 HOUR RATING SHAFT WALL
UL DES U415

STC 39

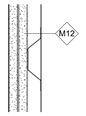
1 LAYER 5/8" GYP BD
4" CH STUDS @ 24" OC
1" GYPSIUM LINER PANEL



1/3 HOUR FINISH RATING
IBC TABLE 721.2.1.4(2)

STC NA

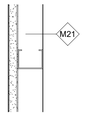
1 LAYER 5/8" GYP BD
7/8" MET FURRING
@ 16" OC



1 HOUR FINISH RATING
IBC TABLE 721.2.1.4(2)

STC NA

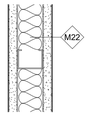
2 LAYERS 5/8" GYP BD
7/8" MET FURRING
@ 16" OC



1/3 HOUR FINISH RATING
IBC TABLE 721.2.1.4(2)

STC NA

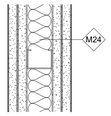
1 LAYER 5/8" GYP BD
1-5/8" MET STUD
@ 16" OC



1 HOUR RATING
OSU T-3296

STC 38

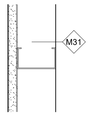
2 LAYER 5/8" GYP BD
1-5/8" MET STUD
@ 16" OC
1-1/2" MINERAL FIBER
INSULATION



2 HOUR RATING
UL DESIGN U412

STC 46

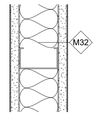
2 LAYERS 5/8" GYP BD
BOTH SIDES ON 1-5/8"
MET STUD @ 16" OC
1-1/2" MINERAL FIBER
INSULATION



1/3 HOUR FINISH RATING
IBC TABLE 721.2.1.4(2)

STC NA

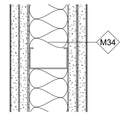
1 LAYER 5/8" GYP BD
2-1/2" MET STUD
@ 16" OC



1 HOUR RATING
UL DES U419

STC 45

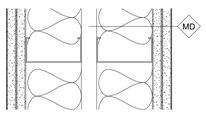
2 LAYERS 5/8" GYP BD
2-1/2" MET STUD
@ 16" OC
2-1/2" SOUND
ATTENUATION BATTS



2 HOUR RATING
UL DES U419

STC 53

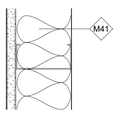
2 LAYERS 5/8" GYP BD
BOTH SIDES ON 2-1/2"
MET STUD @ 16" OC
2-1/2" SOUND
ATTENUATION BATTS



2 HOUR RATING
UL DES U493

STC 60 (EST)

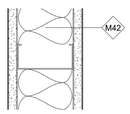
2 LAYER 5/8" GYP BD
3-5/8" MET STUD @ 16" OC W/ 3 1/2"
SOUND ATTENUATION BATTS
AIR SPACE
3-5/8" MET STUD @ 16" OC W/ 3 1/2"
SOUND ATTENUATION BATTS
2 LAYER 5/8" GYP BD



1/3 HOUR RATING
IBC TABLE 721.2.1.4(2)

STC 34

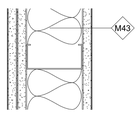
1 LAYER 5/8" GYP BD
3-5/8" MET STUD
@ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 45

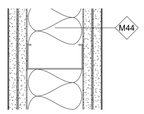
2 LAYERS 5/8" GYP BD
3-5/8" MET STUD
@ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 50

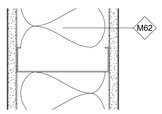
3 LAYERS 5/8" GYP BD
3-5/8" MET STUD
@ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



2 HOUR RATING
UL DES U419

STC 53

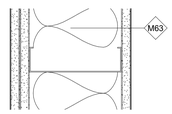
2 LAYERS 5/8" GYP BD
BOTH SIDES ON 3-5/8"
MET STUD @ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 51 (EST)

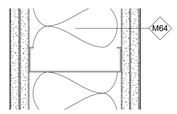
2 LAYERS 5/8" GYP BD
6" MET STUD
@ 16" OC
5-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 54 (EST)

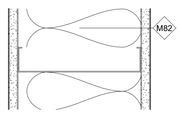
3 LAYERS 5/8" GYP BD
6" MET STUD
@ 16" OC
5-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 58 (EST)

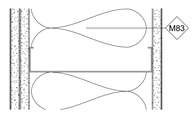
4 LAYERS 5/8" GYP BD
6" MET STUD
@ 16" OC
5-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 51 (EST)

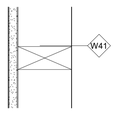
2 LAYERS 5/8" GYP BD
8" MET STUD
@ 16" OC
5-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U419

STC 54 (EST)

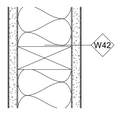
3 LAYERS 5/8" GYP BD
8" MET STUD
@ 16" OC
5-1/2" SOUND
ATTENUATION BATTS



1/3 HOUR RATING
IBC TABLE 721.2.1.4(2)

STC NA

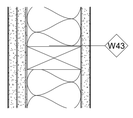
1 LAYER 5/8" GYP BD
2 x 4 WD STUD
@ 16" OC



1 HOUR RATING
UL DES U305

STC 36 (EST)

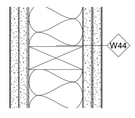
2 LAYERS 5/8" GYP BD
2 x 4 WD STUD
@ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



1 HOUR RATING
UL DES U305

STC 42 (EST)

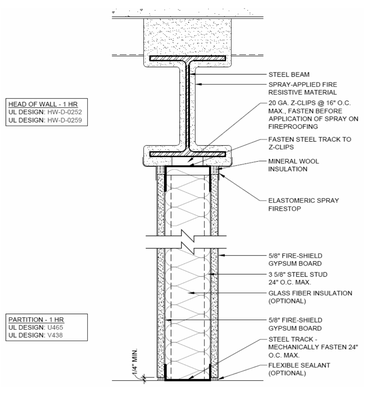
3 LAYERS 5/8" GYP BD
2 x 4 WD STUD
@ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



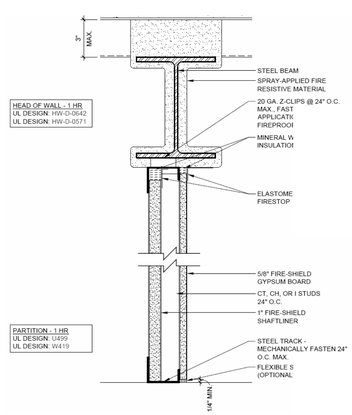
2 HOUR RATING
UL DES 301

STC 44 (EST)

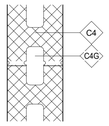
2 LAYERS 5/8" GYP BD
BOTH SIDES ON 2 x 4
WD STUD @ 16" OC
3-1/2" SOUND
ATTENUATION BATTS



NOTE: DETAIL IS PORVIDED FOR REFERENCE. SIMILAR DETAIL CAN BE APPLIED TO WALL ATTACHMENT TO SPRAYED DECK. (VIF)



NOTE: DETAIL IS PORVIDED FOR REFERENCE. SIMILAR DETAIL CAN BE APPLIED TO WALL ATTACHMENT TO SPRAYED DECK. (VIF)

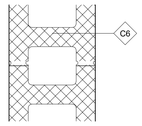


1 TO 2 HR RATING
IBC TABLE 721.3.2

STC 44

4" CONC MASONRY

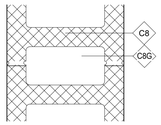
G - GROUND FACE / SIDE



1 TO 2 HR RATING
UL DES U906

STC 46

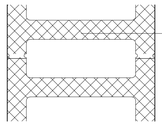
6" CONC MASONRY



1 TO 4 HR RATING
UL DES U905 FOR 2 HRS
UL DES U904 FOR 3 HRS
UL DES U901 FOR 4 HRS

STC 48

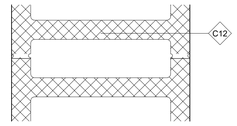
8" CONC MASONRY
G - GROUND FACE / SIDE



1 TO 4 HR RATING
UL DES U905 FOR 2 HRS
UL DES U904 FOR 3 HRS
UL DES U901 FOR 4 HRS

STC 50

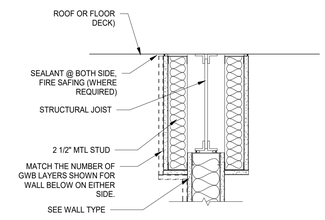
10" CONC MASONRY



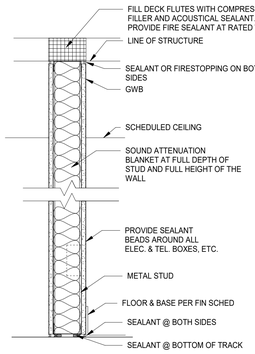
1 TO 4 HR RATING
UL DES U905 FOR 2 HRS
UL DES U904 FOR 3 HRS
UL DES U901 FOR 4 HRS

STC 52

12" CONC MASONRY

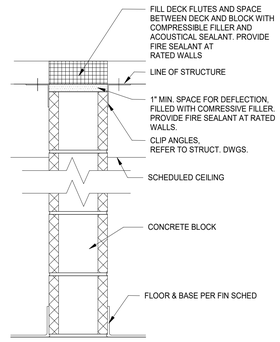


TYPICAL TOP OF WALL SECTION AT JOIST



NOTE
SEE CODE PLANS FOR LOCATIONS OF SMOKE RESISTANT AND FIRE RATES PARTITIONS
FOR 1 OR 2 HR RATED PARTITIONS
COMPLY WITH UL# U419

TYPICAL STUD WALL SECTION



NOTE
SEE CODE PLANS FOR LOCATIONS OF SMOKE RESISTANT AND FIRE RATED PARTITIONS
FOR 1 OR 2 HR RATED PARTITIONS
COMPLY WITH UL# U906

TYPICAL CMU WALL SECTION

GENERAL WALL SECTIONS

GENERAL PARTITION NOTES:

1. ALL PARTITIONS SHALL BE PARTITION TYPE M42 UNLESS OTHERWISE NOTED.

2. ALL PARTITIONS SHALL RUN TO THE UNDERSIDE OF DECK OR BEAM ABOVE.
   A. WHERE THERE IS AN OBSTRUCTION, SUCH AS BEAM RUNNING PERPENDICULAR TO THE PARTITION, BOX AROUND THE OBSTRUCTION,COMPLETELY FILL ALL VOIDS WITH CONSTRUCTION EQUAL TO THAT OF THE PARTITION.
   B. WHERE A NON- FIRE RATED PARTITION RUNS PARALLEL TO AND TERMINATES AT AN OPEN WEB JOIST OR TRUSS, PROVIDE METAL FRAMING AND ONE LAYER OF GWB, WITH SOUND BATTS, FROM THE BOTTOM OF THE JOIST OR TRUSS TO THE UNDERSIDE OF DECK, FOR A CONTINUOUS ACOUSTICAL SEPARATION.
   C. WHERE A FIRE RATED PARTITION RUNS PARALLEL TO AND TERMINATES AT AN OPEN WEB JOIST OR TRUSS,PROVIDE FIRE RATED CONSTRUCTION TO THE UNDERSIDE OF DECK, WITH RATING EQUAL TO THAT OF THE WALL.

3. PROVIDE MINERAL WOOL BATTS WITH 60% OVERCUT AROUND ALL PENETRATIONS, PIPING, CONDUITS, DUCTS, CABLES, WIRES AND ALL STAIR AND HAZARDOUS AREA WALLS TO ALLOW FOR COMPLETE SMOKE TIGHT CONSTRUCTION IN ACCORDANCE WITH THE CT. STATE FIRE SAFETY CODE.

4. TOILET ROOM PARTITIONS:
   ALL GWB PARTITIONS AT TOILET ROOMS ARE REUIRED TO HAVE MOISTURE RESISTANT GWB ON TOILET ROOM SIDE OF PARTITION. CERAMIC TILE WHERE INDICATED BY ROOM FINISH SCHEDULE.

5. CMU PARTITION TYPES:
   REFER TO SPECIFICATIONS FOR TYPE OF CMU. REFER TO STRUCTURAL DRAWINGS FOR SPECIFICATIONS FOR REINFORCEMENT.

6. FIRE AND SOMKE RATED PARTITION TYPES:
   FIRE STOP PERIMETER AND ALL PENETRATIONS WITH FIRESAFING AND FIRESTOP SEALANT IN ACCORDANCE WITH A SPECIFIED UL APPROVED SYSTEM.

7. STAIR ENCLOSURES:
   FIRE STOP PERIMETER AND ALL PENETRATIONS WITH FIRESAFING AND FIRESTOP SEALANT IN ACCORDANCE WITH A SPECIFIED UL APPROVED SYSTEM. PENETRATIONS INTO AND OPENINGS THROUGH AN EXIT ENCLOSURE ASSEMBLY ARE PROHIBITED EXCEPT FOR REQUIRED EXIT DOORS, SPRINKLER PIPING, STANDPIPES AND ELECTRICAL CONDUIT SERVING THE STAIRWAY AND TERMINATING AT A STEEL BOX NOT TO EXCEED 16 SQ. INCHES IN TOTAL AREA.

8. GYPSUM WALL BOARD TYPES:
   REFER TO SPECS FOR ABUSE RESISTANT TYPE LOCATIONS.

9. PROVIDE BLOCKING WITHIN PARTITIONS FOR INSTALLATION OF WAINSCOTS, BUMPERS, CORNER GUARDS, SHELVING, MILWORK, EQUIPMENT AND FIXTURES.

10. REFERENCE PLAN DETAILS AND WALL SECTIONS FOR ADDITIONAL INFORMATION INVOLVING PARTITION CONFIGURATION.

11. REFER TO CODE SHEETS FOR LOCATION OF FIRE RATED WALL ASSEMBLIES INDICATED ON THIS DRAWING.

12. WALL TYPES M11 TO M83 ARE ACOUSTICAL PARTITIONS (TYPICAL) PROVIDE 1 OR 2 HOURS RATING ONLY WHERE INDICATED IN CODE SHEET.

ACOUSTIC NOTES

1. THE SOLE PLATE FOR THE PARTITION SHALL LIE FLUSH WITH SUB-FLOOR, WITH BOTTOM OF PLATE CAULKED WITH TWO BEADS OF NON-HARDENING RESILIENT ACOUSTIC SEALANT (CAULK) PER ASTM C919.

2. PARTITIONS WITH DOUBLE STUD CONSTRUCTION SHOULD HAVE NO RIGID CONTACT WITH EACH OTHER. IF BRACING IS REQUIRED FOR STABILITY, STUDS SHOULD BE BRACED LATERALLY, AS PER UL DESIGN #493

3. JOINTS OF GYPSUM BOARD LAYERS FOR DOUBLE LAYER PARTITIONS SHALL BE STAGGERED, OR ALTERNATIVELY, JOINTS OF ONE LAYER SHALL RUN VERTICALLY WITH THE OTHER LAYER JOINT RUNNING HORIZONTALLY TO MINIMIZE GAPS.

4. WALL GYPSUM BOARD PANELS SHALL EXTEND FROM THE FLOOR TO WITHIN ½ INCH OF THE DECK ABOVE. THE GYPSUM SHALL NOT CONTACT THE DECK ABOVE. THE GAP BETWEEN THE WALL GYPSUM BOARD AND THE DECK SHALL BE FILLED WITH A BEAD OF NON-HARDENING RESILIENT ACOUSTIC SEALANT PER ASTM C919. WALL GYPSUM BOARD LAYERS SHALL NOT CONTACT THE FLOOR BELOW, OR THE OTHER WALLS IN THE ROOM. TEMPORARY ¼ INCH FLOOR AND WALL SPACERS MAY BE USED TO SET THE WALL BOARD. THE FLOOR/WALL, CEILING/WALL AND WALL/WALL GAPS FOR EACH GYPSUM BOARD LAYER IN EACH PARTITION SHALL BE COMPLETELY SEALED AIR TIGHT USING SAME SEALANT.

5. ANY PENETRATIONS FOR ELECTRICAL AND LOW-VOLTAGE (TELEPHONE/CABLE) SERVICE BOXES SHALL BE STAGGERED SO THAT NO PENETRATION PASSES THROUGH THE TWO WALL PARTITIONS IN THE SAME LOCATION. SERVICE BOX PENETRATIONS SHALL BE STAGGERED AND SHALL NOT BE DIRECTLY ACROSS FROM EACH OTHER, BACK TO BACK.

6. ALL ELECTRICAL CONNECTIONS TO LIGHTING FIXTURES INSTALLED ON THE WALL SHALL BE VIBRATION ISOLATED, BY USING COILED WIRE WITH ADEQUATE SLACK OR OTHER MEANS TO AVOID RIGID CONDUIT ATTACHMENTS.

7. ALL LIGHTING FIXTURES, ELECTRICAL SWITCH BOXES, AND ELECTRICAL AND LOW-VOLTAGE (TELEPHONE/CABLE) OUTLET BOXES SHALL BE COMPLETELY BACK-PLASTERED WITH NON-HARDENING FIRESTOP PUTTY TO PREVENT SOUND TRANSMISSION THROUGH THE PENETRATION.

8. ALL MECHANICAL SERVICE PENETRATIONS IN THE WALLS SHALL HAVE ½ INCH OF CLEAR SPACE BETWEEN THE DUCT OR PIPE AND THE WALL STRUCTURE. THAT SPACE SHALL BE SEALED BY PACKING WITH A LAYER OF GLASS FIBER INSULATION FOR THE FULL DEPTH OF THE PENETRATION. BOTH SIDES OF THE PENETRATION SHALL BE SEALED AIR TIGHT USING NON-HARDENING RESILIENT ACOUSTIC SEALANT PER ASTM C919. AN ANNULAR METAL SLEEVE, ATTACHED USING NON-HARDENING RESILIENT SEALANT, SHALL BE USED FOR PENETRATION GAPS OVER 1 INCH.

9. PROVIDE SOUND ATTENUATION BATTS & ACOUSTIC SEALANT AT BOTH SIDES OF STRUCTURAL BRACING LOCATIONS AND VERTICAL RETRACTING PARTITIONS (STC 53).

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ARCHITECTURE | PLANNING | INTERIORS

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

WALL TYPES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A0.03

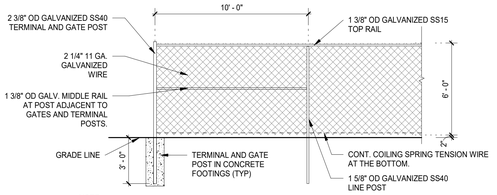
5/17/2026 1:09:48 PM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt

NOTE: PHASING

THE PHASING BELOW IS PROVIDED AS A CONVENIENCE AND A SUGGESTION TO SUPPORT THE PROJECT TO MAINTAIN SERVICES TO THE EXISTING SCHOOL BUILDING. ALTERNATIVE APPROACHES BY THE CONTRACTOR ARE ENCOURAGED AS NOT TO DISRUPT SAID SERVICES UNTIL THE NEW SYSTEMS ARE PUT INTO OPERATION.

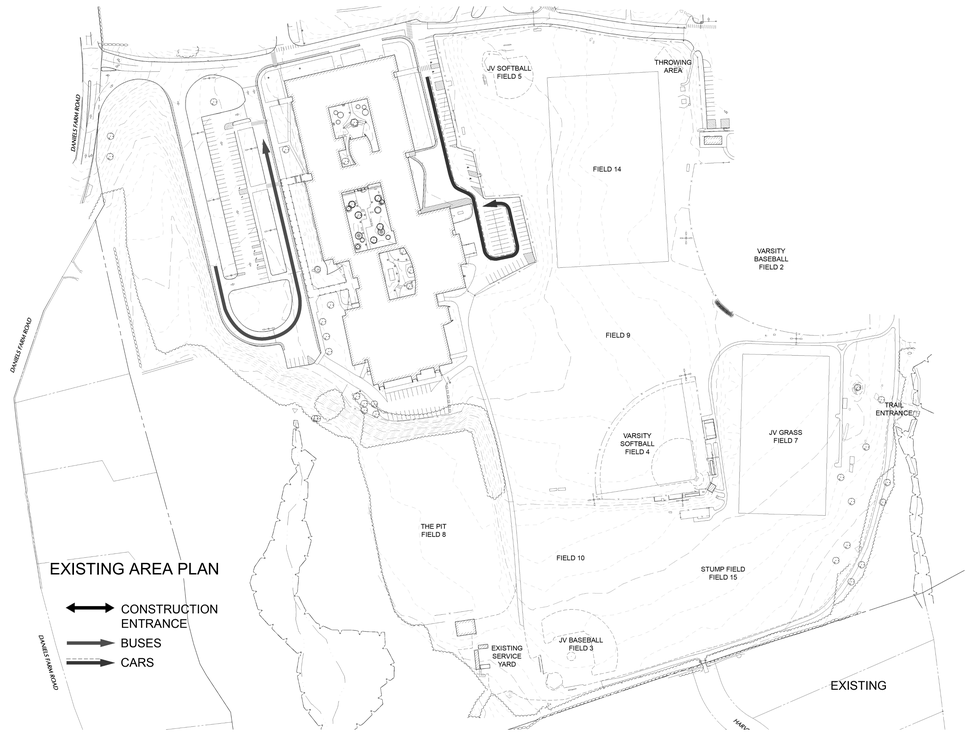
PROPOSED PHASING:

- EXISTING SCHOOL TO BE MAINTAINED AND TO MAINTAIN POWER AND DOMESTIC WATER FEED UNTIL TEMPORARY CONDITIONS SERVICES PROVIDED.
- BUILD NEW SCHOOL.
- PROVIDE TEMPORARY POWER. RELOCATE/RECONFIGURE AS NEEDED TO SUPPORT THE TEMPORARY POWER CONDITIONS.
- PROVIDE FINAL SERVICES TO THE NEW SCHOOL BUILDING AFTER NEW BUILDING SERVICES ARE AVAILABLE WITHOUT DISRUPTION TO THE EXISTING SCHOOL.
- REMOVE ALL TEMPORARY INSTALLATIONS.
- DEMOLISH EXISTING SCHOOL BUILDING.



2 SITE FENCE
1/4" = 1'-0"

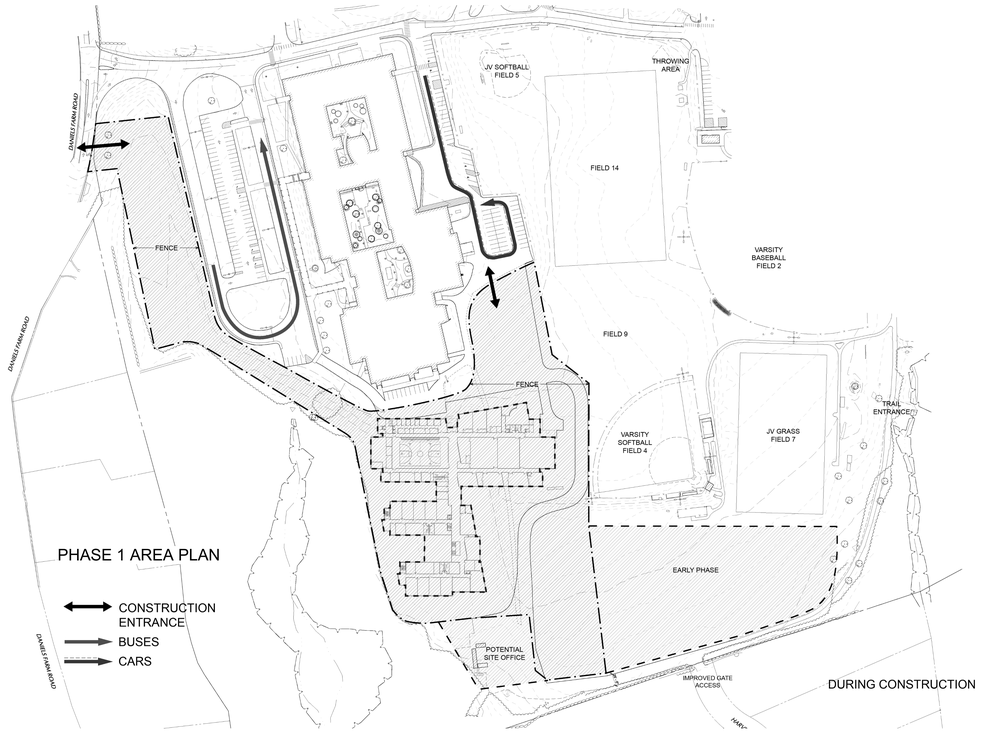
NOTE:
1. PROVIDE FULL HEIGHT GREEN SCREEN ON FENCES FACING ROADS, BALLFIELDS AND EXISTING SCHOOL. BASIS OF DESIGN: CI FABRICS, STANDARD ENVIROTEXT OR EQUAL PRODUCT FROM A DIFFERENT MANUFACTURER. SECURE SCREEN TO FENCE AS RECOMMENDED BY THE MANUFACTURER.
2. TIE WIRE SPACING IS TO BE AT EVERY 24" ON RAILS AND BRACING.
3. PROVIDE ADDITIONAL MIDDLE BRACING AS REQUIRED TO STABILIZE THE FENCE CONSTRUCTION.
4. PROVIDE FENCED GATES AT CONSTRUCTION ENTRANCES.



EXISTING AREA PLAN

- CONSTRUCTION ENTRANCE
- BUSES
- CARS

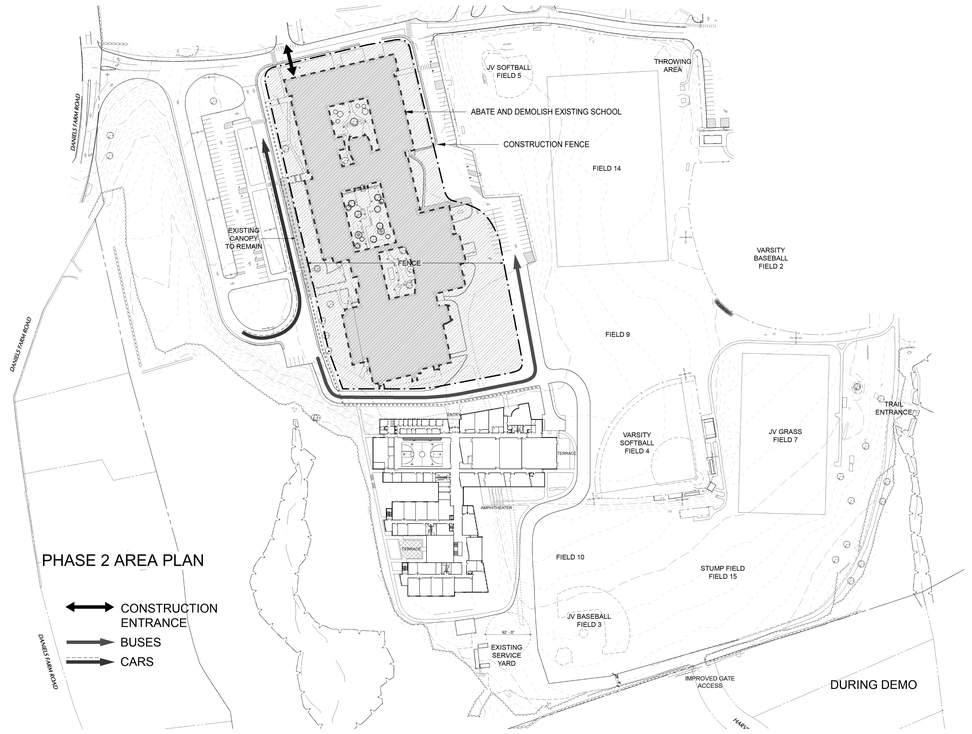
EXISTING



PHASE 1 AREA PLAN

- CONSTRUCTION ENTRANCE
- BUSES
- CARS

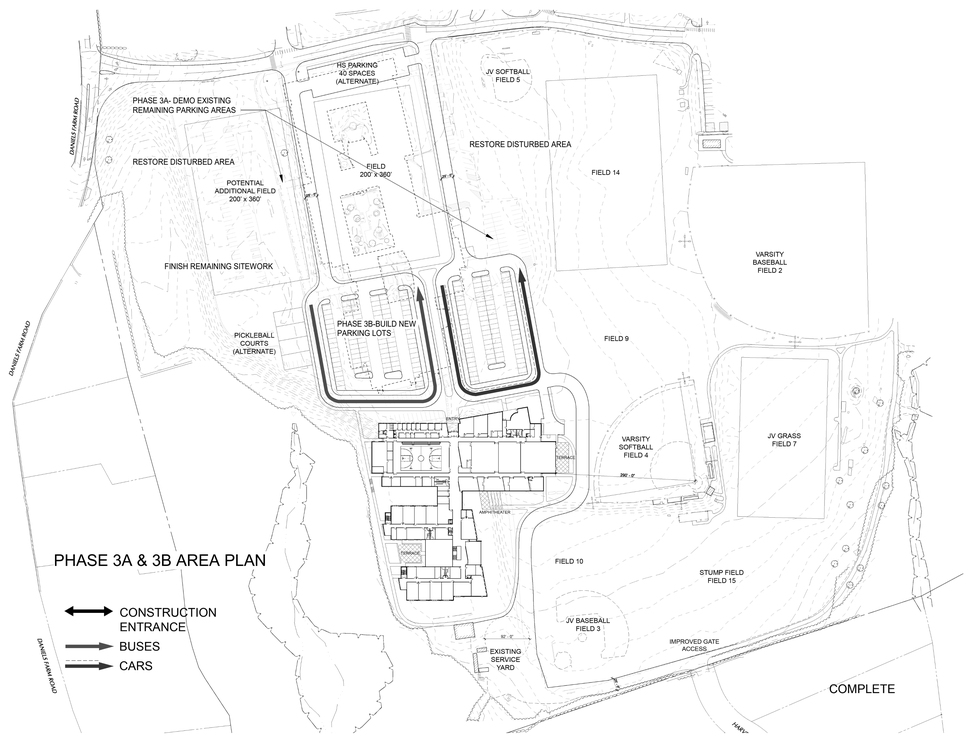
DURING CONSTRUCTION



PHASE 2 AREA PLAN

- CONSTRUCTION ENTRANCE
- BUSES
- CARS

DURING DEMO



PHASE 3A & 3B AREA PLAN

- CONSTRUCTION ENTRANCE
- BUSES
- CARS

COMPLETE

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ARCHITECTURE | PLANNING | INTERIORS

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

PHASING PLANS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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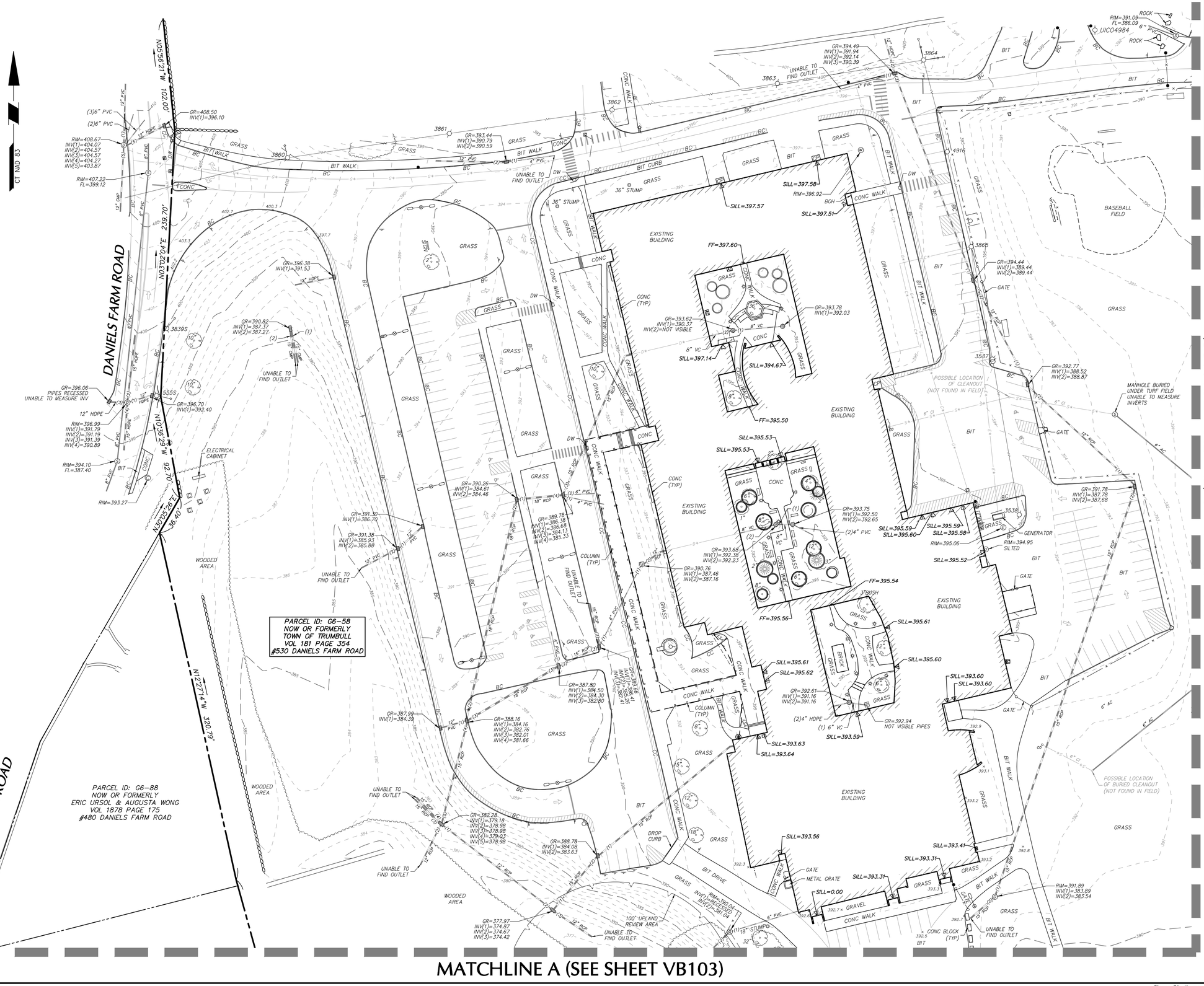

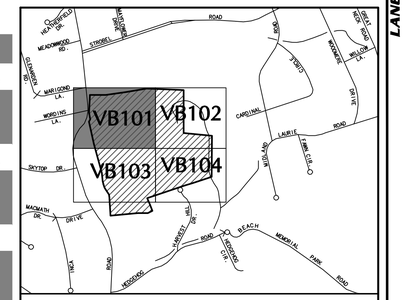

PROJECT LOCATION MAP
SCALE: 1"=1000'
SOURCE: CONNECTICUT DEPARTMENT OF TRANSPORTATION

SCALE: 1 INCH = 40 FEET

STATE OF CONNECTICUT
ANDREW G. IVES
NO. 70286
LICENSED LAND SURVEYOR

Date	Description	No.
REVISIONS		

"TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON."

ANDREW G. IVES DATE SIGNED
PROFESSIONAL LAND SURVEYOR
CT STATE LIC. NO. 70286

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Project
HILLCREST MIDDLE SCHOOL
#530 DANIELS FARM ROAD
TRUMBULL CONNECTICUT

Drawing Title
PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY

Project No.	Drawing No.
140325901	VB101
Date: JULY 11, 2025	
Drawn By: JJS	
Checked By: AGI	Sheet 1 of 4

PROJECT NO. 140325901

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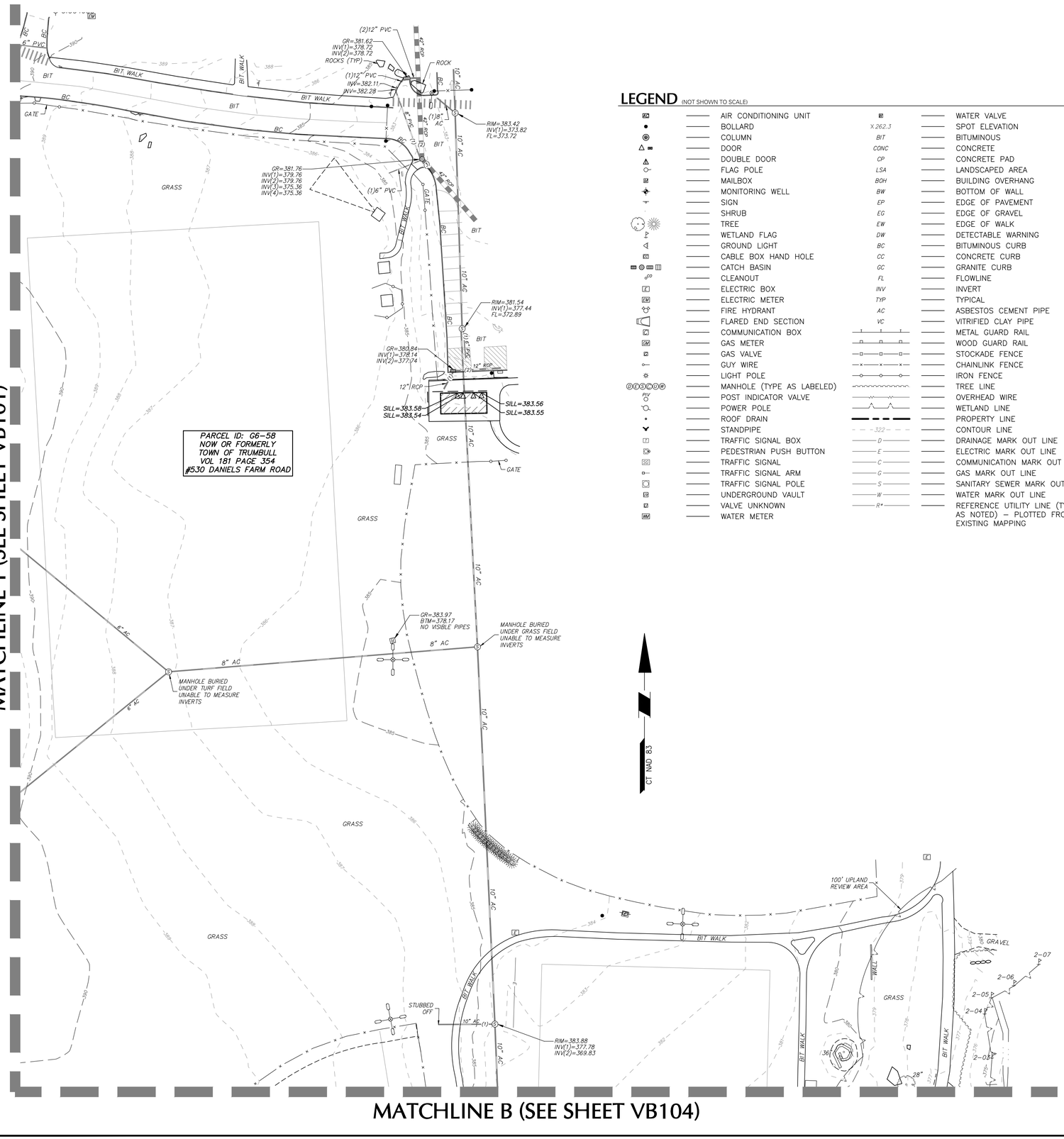
Filename: C:\bms\langan-pw-01\d07746741\40325901-V-EX0101.dwg Date: 7/14/2025 Time: 12:15 User: jstublic Style Table: Langan.stb Layout: VB101

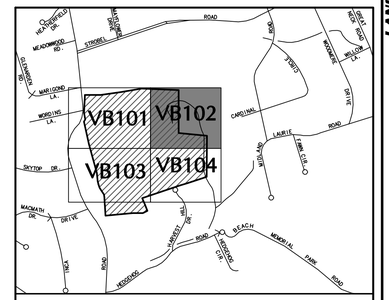


LEGEND (NOT SHOWN TO SCALE)

AIR CONDITIONING UNIT		WATER VALVE	
BOLLARD	X 262.3	SPOT ELEVATION	
COLUMN	BIT	BITUMINOUS	
DOOR	CONC	CONCRETE	
DOUBLE DOOR	CP	CONCRETE PAD	
FLAG POLE	LSA	LANDSCAPED AREA	
MAILBOX	BOH	BUILDING OVERHANG	
MONITORING WELL	BW	BOTTOM OF WALL	
SIGN	EP	EDGE OF PAVEMENT	
SHRUB	EG	EDGE OF GRAVEL	
TREE	EW	EDGE OF WALK	
WETLAND FLAG	DW	DETECTABLE WARNING	
GROUND LIGHT	BC	BITUMINOUS CURB	
CABLE BOX HAND HOLE	CC	CONCRETE CURB	
CATCH BASIN	GC	GRANITE CURB	
CLEANOUT	FL	FLOWLINE	
ELECTRIC BOX	INV	INVERT	
ELECTRIC METER	TYP	TYPICAL	
FIRE HYDRANT	AC	ASBESTOS CEMENT PIPE	
FLARED END SECTION	VC	VITRIFIED CLAY PIPE	
COMMUNICATION BOX		METAL GUARD RAIL	
GAS METER		WOOD GUARD RAIL	
GAS VALVE		STOCKADE FENCE	
GUY WIRE		CHAINLINK FENCE	
LIGHT POLE		IRON FENCE	
MANHOLE (TYPE AS LABELED)		TREE LINE	
POST INDICATOR VALVE		OVERHEAD WIRE	
POWER POLE		WETLAND LINE	
ROOF DRAIN		PROPERTY LINE	
STANDPIPE	322	CONTOUR LINE	
TRAFFIC SIGNAL BOX	D	DRAINAGE MARK OUT LINE	
PEDESTRIAN PUSH BUTTON	E	ELECTRIC MARK OUT LINE	
TRAFFIC SIGNAL	C	COMMUNICATION MARK OUT LINE	
TRAFFIC SIGNAL ARM	G	GAS MARK OUT LINE	
TRAFFIC SIGNAL POLE	S	SANITARY SEWER MARK OUT LINE	
UNDERGROUND VAULT	W	WATER MARK OUT LINE	
VALVE UNKNOWN	R*	REFERENCE UTILITY LINE (TYPE AS NOTED) – PLOTTED FROM EXISTING MAPPING	
WATER METER			

NOTES

1. THIS SURVEY HAS BEEN PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTIONS 20-300b-1 THROUGH 20-300b-20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF LAND SURVEYORS, INC. ON SEPTEMBER 26, 1996.
   a. THIS SURVEY IS A PROPERTY SURVEY CONFORMING TO A HORIZONTAL ACCURACY OF A-2 AND A TOPOGRAPHIC SURVEY CONFORMING TO A T-2 ACCURACY. THE BOUNDARY DETERMINATION IS A RESURVEY. THE PURPOSE OF THIS SURVEY IS TO PROVIDE A BOUNDARY OPINION AND DEPICT SITE FEATURES FOR FUTURE SITE DEVELOPMENT.
2. THIS SURVEY IS BASED UPON EXISTING PHYSICAL CONDITIONS FOUND AT THE SUBJECT SITE, DEED INFORMATION AND THE FOLLOWING REFERENCES:
   A. MAP TITLED "MAP OF PROPERTIES IN TRUMBULL, CONN. OF HELEN J. MARSILIUS, NEWMAN M., JR. & MARIE K. MARSILIUS AND MARJORIE MARSILIUS POWERS.", SCALE: 1"=40', DATED: DEC. 19, 1953, LAST REVISED: MAR. 28, 1949, MAP #553
   B. MAP TITLED "MAP OF LOTS IN TRUMBULL, CONN. FOR EUGENE & EMMA KOTTSIEPER, SCALE: 1"=50', DATED: JUNE 30, 1958, MAP #920
   C. MAP TITLED "MAP OF PROPERTY FOR THE ESTATE OF STEPHEN TOMEK SR. ET. AL. TRUMBULL, CONN.", SCALE: 1"=100', SEPT 5, 1962, SHEET 1 & 2 OF 2, BY: RICHARD J. DREW, MAP #1137 & 1138
   D. MAP TITLED "MAP OF SUBDIVISION OF PROPERTY IN TRUMBULL, CONN. PREPARED FOR: ROBERT SIMNA", SCALE: 1"=40', DATED: JAN. 4, 1972, BY: FULLER & CO., MAP #1672
   E. MAP TITLED "PROPOSED RESUBDIVISION OF LAN IN TRUMBULL, CONN FOR NEWMAN M. MARSILIUS & MARIE K. MARSILIUS, SCALE: 1"=40', DATED: DEC. 4, 1972, BY: CHARLES J. HEIMANN II, MAP #1726
   F. MAP TITLED "SUBDIVISION OF PARCEL "C" PREPARED FOR HELEN J. MARSILIUS AND MARJORIE MARSILIUS POWERS TRUMBULL, CONN.", SCALE: 1"=40', DATED: FEB. 4, 1974, LAST REVISED: FEB. 27, 1975, BY: MONTEL ASSOCIATES, MAP #1829
   G. MAP TITLED "PROPOSED RESUBDIVISION OF LAND PREPARED FOR JENNIE ANDRUSCHKEVICH 358 & 336 DANIELS FARM ROAD TRUMBULL, CONNECTICUT", SCALE: 1"=40', DATED: SEPT. 2, 1988, LAST REVISED: 2-9-89, BY: MICHAEL BUTURLA, MAP #2539
3. THE MERIDIAN OF THIS SURVEY IS REFERENCED TO CONNECTICUT STATE PLANE COORDINATE SYSTEM NAD 83 (EPOCH 2011). POSITION WAS DETERMINED BY GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) AS PROVIDED BY HXGN SMARTNET CONTINUOUSLY OPERATED REFERENCE STATIONS (CORS).
4. ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) (GEOID 12B) AS DETERMINED BY GNSS
5. PLANIMETRIC AND TOPOGRAPHIC INFORMATION SHOWN HEREON HAS BEEN OBTAINED FROM GROUND SURVEYS BY LANGAN CT, INC. FIELD WORK COMPLETED DURING THE MONTH OF JUNE 2025.
6. AS PER THE NATIONAL FLOOD INSURANCE PROGRAM FIRM MAP ENTITLED "FAIRFIELD COUNTY, CONNECTICUT PANEL 289 OF 626, MAP NUMBER 09001C0289F, EFFECTIVE DATE: JUNE 18, 2010" THE PROJECT AREA IS IN ZONE X (UNSHADED).
7. UNLESS SPECIFICALLY NOTED HEREON, STORM AND SANITARY SEWER INFORMATION (INCLUDING PIPE INVERT, PIPE MATERIAL, AND PIPE SIZE) WAS OBSERVED AND MEASURED AT FIELD LOCATED STRUCTURES (MANHOLES/CATCH BASINS, ETC). CONDITIONS CAN VARY FROM THOSE ENCOUNTERED AT THE TIMES WHEN AND LOCATIONS WHERE DATA IS OBTAINED. DESPITE MEETING THE REQUIRED STANDARD OF CARE, THE SURVEYOR CANNOT, AND DOES NOT WARRANT THAT PIPE MATERIAL AND/OR PIPE SIZE THROUGHOUT THE PIPE RUN ARE THE SAME AS THOSE OBSERVED AT EACH STRUCTURE, OR THAT THE PIPE RUN IS STRAIGHT BETWEEN THE LOCATED STRUCTURES.
8. ADDITIONAL UTILITY (WATER, GAS, ELECTRIC ETC.) DATA MAY BE SHOWN FROM FIELD LOCATED SURFACE MARKINGS (BY OTHERS), EXISTING STRUCTURES, AND/OR FROM EXISTING DRAWINGS.
9. UNLESS SPECIFICALLY NOTED HEREON, THE SURVEYOR HAS NOT EXCAVATED TO PHYSICALLY LOCATE THE UNDERGROUND UTILITIES. THE SURVEYOR MAKES NO GUARANTEES THAT THE SHOWN UNDERGROUND UTILITIES ARE EITHER IN SERVICE, ABANDONED OR SUITABLE FOR USE, NOR ARE IN THE EXACT LOCATION OR CONFIGURATION INDICATED HEREON.
10. ALL BUILDINGS AND STRUCTURES WERE LOCATED AND MEASURED AT GROUND LEVEL. THE SURVEYOR MAKES NO DETERMINATIONS OR GUARANTEES AS TO THE ABSENCE, EXISTENCE OR LOCATION OF UNDERGROUND STRUCTURES, FOUNDATIONS, FOOTINGS, PROJECTIONS, WALLS, TANKS, SEPTIC SYSTEMS, ETC. NO TEST PITS, EXCAVATIONS OR GROUND PENETRATING RADAR WERE PERFORMED AS PART OF THIS SURVEY.
11. PRIOR TO ANY DESIGN OR CONSTRUCTION, THE PROPER UTILITY AGENCIES MUST BE CONTACTED FOR VERIFICATION OF UTILITY TYPE AND FOR FIELD LOCATIONS.
12. THIS SURVEY IS NOT VALID WITHOUT THE EMBOSSED OR INKED SEAL OF THE PROFESSIONAL.



PROJECT LOCATION MAP

SCALE: 1"=1000'

SOURCE:
CONNECTICUT DEPARTMENT OF TRANSPORTATION

40 0 10 25 40

SCALE: 1 INCH = 40 FEET

STATE OF CONNECTICUT
ANDREW G. IVES
NO. 70286
LICENSED
LAND SURVEYOR

Date	Description	No.
REVISIONS		

"TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON."

ANDREW G. IVES — DATE SIGNED
PROFESSIONAL LAND SURVEYOR
CT STATE LIC. NO. 70286

LANGAN
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New Haven, CT 06511
T: 203.562.5771 F: 203.789.6142 www.langan.com

Project
HILLCREST MIDDLE SCHOOL
#530 DANIELS FARM ROAD
TRUMBULL CONNECTICUT

Drawing Title
PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY

Project No.	Drawing No.
140325901	VB102
Date: JULY 11, 2025	
Drawn By: JJS	
Checked By: AGI	Sheet 2 of 4

PROJECT NO. 140325901

LANGAN

Filename: C:\bms\langan-pw-01\d0774674\140325901-V-EX0101.dwg Date: 7/14/2025 Time: 12:16 User: jstublic Style Table: Langan.stb Layout: VB102

MATCHLINE A (SEE SHEET VB101)

PARCEL ID: G6-48
NOW OR FORMERLY
BRANDON LEE & AMANDA LEE
VOL 1927 PAGE 410
#474 DANIELS FARM ROAD

PARCEL ID: G6-49
NOW OR FORMERLY
DALE BARCHAM & STEWART BARCHAM
VOL 1414 PAGE 299
#472 DANIELS FARM ROAD

PARCEL ID: G7-51
NOW OR FORMERLY
ELIZABETH GENEL & MARK NYMAN
VOL 1896 PAGE 476
#470 DANIELS FARM ROAD

PARCEL ID: G7-50
NOW OR FORMERLY
JOHN F. SZWED & MARILYN S. SZWED
VOL 869 PAGE 205
#400 DANIELS FARM ROAD

PARCEL ID: G6-58
NOW OR FORMERLY
TOWN OF TRUMBULL
VOL 181 PAGE 354
#530 DANIELS FARM ROAD

PARCEL ID: G7-70
NOW OR FORMERLY
DAVID CHRISTOPHER WYANT
& COREEN EISLER
VOL 1749 PAGE 654
#39 HARVEST HILL DRIVE

DANIELS FARM ROAD

N15°24'14"W 217.64'
N15°24'14"W 200.00'
N05°45'24"W 117.89'
N14°05'14"W 46.76'
N17°39'34"W 27.00'
N29°57'14"W 44.00'
N33°50'04"W 91.00'
N08°12'24"W 40.71'
N02°24'44"W 63.00'
86.99' S82°15'06"W
S27°04'20"E 92.66'

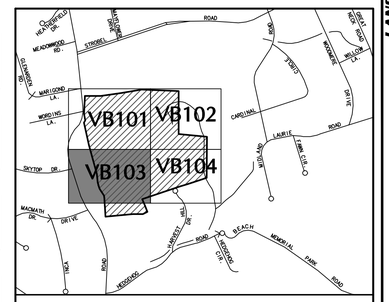
IRON PIPE FOUND (HELD)

UNABLE TO FIND OUTLET
24" RCP INV=372.79 INV=372.80
36" HDPE
INV=371.73
INV=372.80 INV=374.09
INV=380.54
INV NOT FOUND POSSIBLY BURIED
SILL=378.05
SILL=378.07
SILL=378.17
EXISTING BUILDING
CONEX BOX
CONC BLOCK WALL
BENCH
GRAVEL
BIT
BIT WALK
GRASS
WOODED AREA
100' UPLAND REVIEW AREA

1A-01 1A-02 1A-03 1A-04 1A-05 1A-06 1A-07 1A-08 1A-09 1A-10 1A-11 1A-12 1A-13 1A-14 1A-15 1A-16 1A-17 1A-18
1-01 1-02 1-03 1-04 1-05 1-06 1-07 1-08 1-09 1-10 1-11 1-12 1-13 1-14 1-15 1-16 1-17 1-18 1-19 1-20 1-21 1-22 1-23 1-24 1-25

CT NAD 83

MATCHLINE 2 (SEE SHEET VB104)



PROJECT LOCATION MAP

SCALE: 1"=1000'

SOURCE:
CONNECTICUT DEPARTMENT OF TRANSPORTATION

40 0 10 25 40
SCALE: 1 INCH = 40 FEET

STATE OF CONNECTICUT
ANDREW G. IVES
NO. 70286
LICENSED
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Date	Description	No.
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Project
HILLCREST MIDDLE SCHOOL
#530 DANIELS FARM ROAD
TRUMBULL CONNECTICUT

Drawing Title
PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY

Project No.	Drawing No.
140325901	VB103
Date: JULY 11, 2025	
Drawn By: JJS	
Checked By: AGI	

Sheet 3 of 4

LANGAN
PROJECT NO. 140325901

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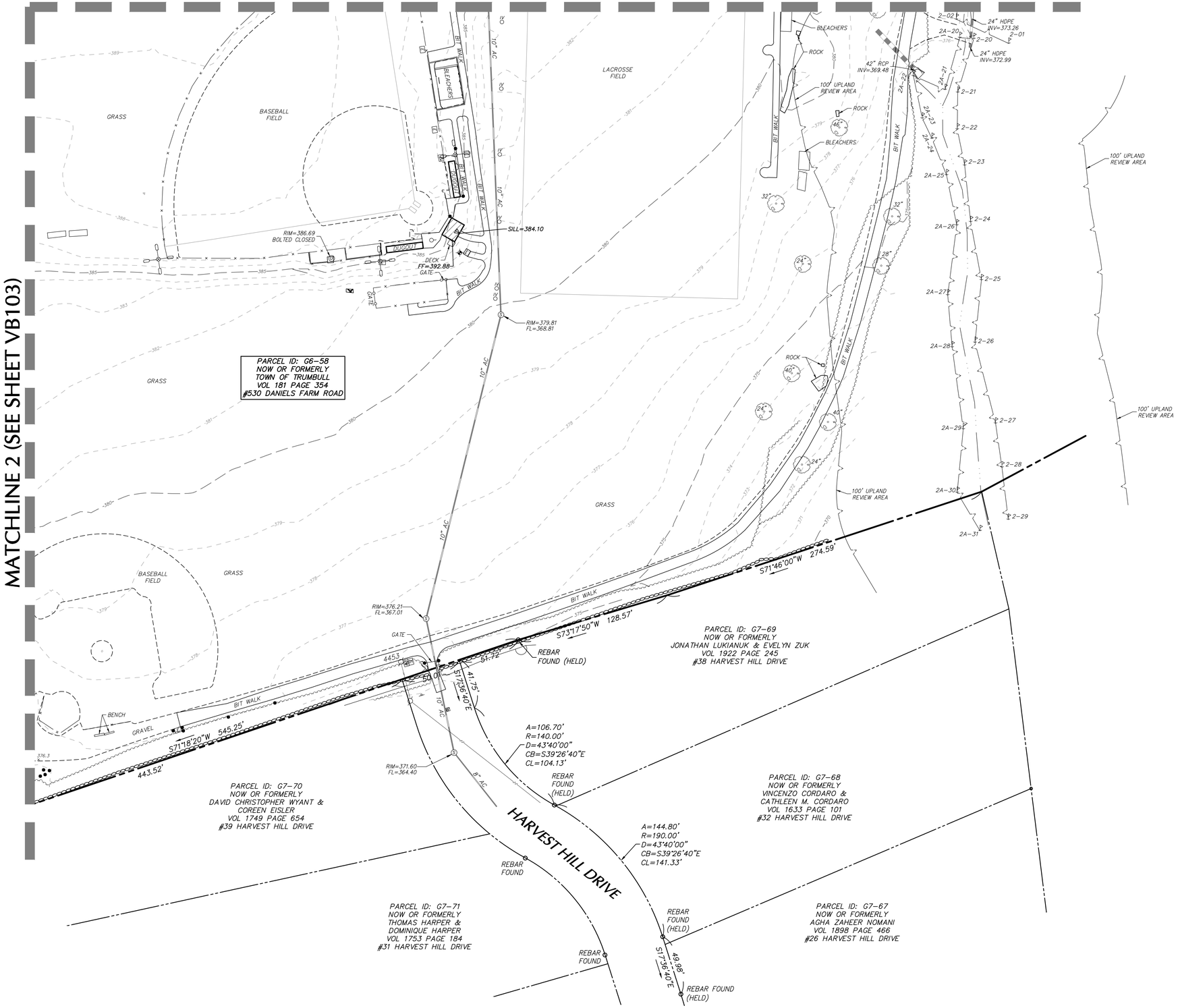
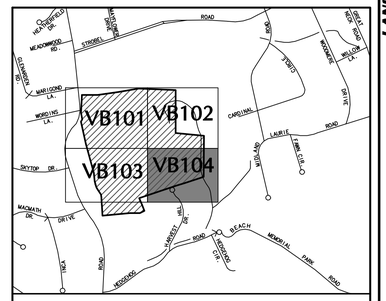
Filename: C:\bms\langan-pw-01\d0774674\140325901-V-EX0101.dwg Date: 7/14/2025 Time: 12:16 User: jstublic Style Table: Langan.stb Layout: VB103

MATCHLINE B (SEE SHEET VB102)

MATCHLINE 2 (SEE SHEET VB103)





PROJECT LOCATION MAP

SCALE: 1"=1000'

SOURCE:
CONNECTICUT DEPARTMENT OF TRANSPORTATION

CT NAD 83

40 0 10 25 40

SCALE: 1 INCH = 40 FEET

STATE OF CONNECTICUT
ANDREW G. IVES
NO. 70286
LICENSED
LAND SURVEYOR

Date	Description	No.

REVISIONS

"TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON."

ANDREW G. IVES DATE SIGNED
PROFESSIONAL LAND SURVEYOR
CT STATE LIC. NO. 70286

LANGAN

Langan CT, Inc.
555 Long Wharf Drive, 9th Floor
New Haven, CT 06511

T: 203.562.5771 F: 203.789.6142 www.langan.com

Project
HILLCREST MIDDLE SCHOOL
#530 DANIELS FARM ROAD
TRUMBULL CONNECTICUT

Drawing Title
PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY

Project No.	Drawing No.
140325901	VB104
Date: JULY 11, 2025	
Drawn By: JJS	
Checked By: AGI	Sheet 4 of 4

PROJECT NO. 140325901

LANGAN

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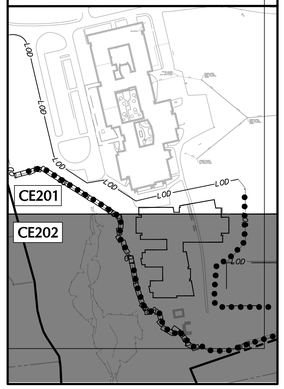
Filename: C:\bms\langan-pw-01\d0774674\140325901-V-EX0101.dwg Date: 7/14/2025 Time: 12:17 User: jstublic Style Table: Langan.stb Layout: VB104

SHEET LEGEND
1" = 250'



LEGEND

REMOVE HARDSCAPE (PAVEMENT, CONCRETE, ETC.)	
REMOVE UNDERGROUND UTILITY	
LIMIT OF DISTURBANCE	LOD
LIMIT OF PHASED DEMOLITION	

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

DEMOLITION NOTES

1. THE CONTRACTOR SHALL INSPECT THE SITE THOROUGHLY AND FIELD-VERIFY THE LOCATION AND DEPTH OF ALL EXISTING UTILITIES. SOME UNDERGROUND UTILITIES MAY BE LOCATED DIFFERENTLY THAN SHOWN ON THIS PLAN. IN ADDITION, THERE MAY BE EXISTING UNDERGROUND UTILITIES PRESENT THAT ARE NOT SHOWN ON THIS PLAN. ALL CONTRACTORS USING THESE PLANS FOR DEMOLITION OR CONSTRUCTION SHALL CONFIRM ALL UTILITIES IN THE FIELD TO ESTABLISH LOCATIONS, SIZES, MATERIALS, AND ELEVATIONS. ANY DISCREPANCIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND THE CONSTRUCTION MANAGER.
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14. NO DEBRIS AND STUMPS TO BE BURIED ON SITE

ERADICATE EXISTING PAVEMENT MARKINGS. REFER TO SITE PLAN FOR PROPOSED CROSSWALK, STOP BAR AND ASSOCIATED STRIPING LOCATION

MAINTAIN VEHICLE ACCESS FOR EXISTING BUILDING OPERATION

PROTECT AND MAINTAIN ALL EXISTING FENCING UNLESS OTHERWISE NOTED

PROTECT AND MAINTAIN ALL EXISTING HYDRANTS

PROTECT AND MAINTAIN ALL EXISTING UTILITY LINE AND POLES (TYP.)

ALL EXISTING UTILITY SERVICES TO THE EXISTING SCHOOL TO BE MAINTAINED UNTIL PHASE 2 OF DEMOLITION.

SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

EXISTING SCHOOL TO BE FULLY OPERATIONAL DURING PHASE 1 OF CONSTRUCTION. CONTRACTOR TO PROVIDE TEMPORARY PERIMETER FENCING AND OTHER SECURITY MEASURES AS REQUIRED BY THE OWNER.

CUT AND CAP EXISTING UTILITY SERVICES IN PHASE 2 OF CONSTRUCTION IN ACCORDANCE WITH TOWN AND UTILITY COMPANY STANDARDS. SEE BISMARK LOGISTIC PLANS FOR DETAILS.

AREA TO NOT BE DISTURBED DURING PHASE 1

EXISTING SCHOOL BUILDING, UTILITY CONNECTIONS, AND EMERGENCY EGRESS ROUTES TO BE PROTECTED AND MAINTAINED IN THE FIRST PHASE OF CONSTRUCTION.

MAINTAIN VEHICLE ACCESS AROUND EXISTING SCHOOL, COORDINATE DEMOLITION OF EXISTING PAVEMENT WITH SCHOOL OPERATIONS.

MAINTAIN EXISTING STORMWATER INFRASTRUCTURE WITHIN PHASE 1 LIMIT OF DISTURBANCE. ALL STORMWATER DISCHARGE FROM THE EXISTING SITE SHALL BE MAINTAINED UNTIL PHASE 2.

100' UPLAND REVIEW AREA

SILT FENCE AND SILT SOCK (TYP.)

EXISTING HEADWALL TO BE MAINTAINED AND PROTECTED

CONTRACTOR SHALL MODIFY GRADES OR PROVIDE TEMPORARY DRAINAGE AS NEEDED ENSURE THERE IS NO PONDING OF STORMWATER BETWEEN THE EXISTING SCHOOL AND NEW SCHOOL.

REMOVE AND STOCKPILE CONCRETE BLOCKS. COORDINATE WITH OWNER FOR RELOCATION (TYP.)

LIMIT OF DISTURBANCE: ±10.4 ACRES

FULL DEPTH PAVEMENT AND CURBING REMOVAL. PROCESSED AGGREGATE BASE MAY BE REUSED SO LONG AS THE CONTRACTOR CONFIRMS THE GRADATION OF THE MATERIAL MEETS PROPOSED SPECIFICATIONS.

PROPOSED BUILDING LINE. COMPLETELY REMOVAL ALL EXISTING UTILITIES AND SITE FEATURES WITHIN 10' OF THE PROPOSED BUILDING UNLESS OTHERWISE NOTED (TYP.)

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

CUT AND CAP EXISTING UTILITY SERVICES IN PHASE 2 OF CONSTRUCTION IN ACCORDANCE WITH TOWN AND UTILITY COMPANY STANDARDS. SEE BISMARK LOGISTIC PLANS FOR DETAILS.

CONTRACTOR TO COORDINATE INSTALLATION OF ALL PROPOSED UTILITIES SUCH THAT EXISTING SERVICES TO THE EXISTING SCHOOL ARE MAINTAINED. CONTRACTOR TO COORDINATE TEMPORARY UTILITY SHUTOFFS AS NEEDED WITH OWNER.

MATCHLINE - CE201

MATCHLINE - CE202

SCALE: 1 INCH = 30 FEET

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860.547.1970

ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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PROJECT NORTH

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ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	BW
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5	05/19/2026	100□ CD

CD101

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LEGEND

REMOVE HARDSCAPE (PAVEMENT, CONCRETE, ETC.)	
REMOVE UNDERGROUND UTILITY	
LIMIT OF DISTURBANCE	LOD
LIMIT OF PHASED DEMOLITION	

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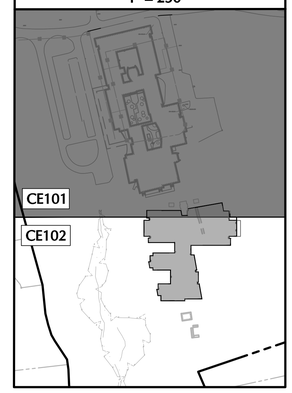
1" = 250'



MATCHLINE - CE101

MATCHLINE - CE102

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

PROPOSED BUILDING LINE. COMPLETELY REMOVAL ALL EXISTING UTILITIES AND SITE FEATURES WITHIN 10' OF THE PROPOSED BUILDING UNLESS OTHERWISE NOTED (TYP.)

PROPOSED LIMIT OF CURBING WITHIN PHASE 1 OF CONSTRUCTION (TYP.)

SILT FENCE (TYP.)

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

LIMIT OF GEOTHERMAL FIELD. REFER TO MEP PLANS FOR FIELD DEMOLITION AND PHASING INFORMATION.

FULL DEPTH PAVEMENT AND CURBING REMOVAL. PROCESSED AGGREGATE BASE MAY BE REUSED SO LONG AS THE CONTRACTOR CONFIRMS THE GRADATION OF THE MATERIAL MEETS PROPOSED SPECIFICATIONS.

SILT FENCE AND SILT SOCK (TYP.)

REMOVE EXISTING FENCE

EXISTING GRAVEL TO BE REMOVED

PROTECT AND MAINTAIN EXISTING BUILDING

EXISTING CONEX BOX AND TEMPORARY STRUCTURES TO BE REMOVED. COORDINATE REMOVE OF EQUIPMENT AND STRUCTURES WITH OWNER.

REMOVE AND STORE ALL EXISTING BASEBALL FIELD EQUIPMENT. COORDINATE REMOVAL AND STORAGE WITH OWNER

SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

PROTECT AND MAINTAIN EXISTING UTILITY POLE

RIM=376.21
FL=367.01

RIM=371.60
FL=364.40

SCALE: 1 INCH = 30 FEET

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ST□T□ □RO□ NO.	144-0108N
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5	05/19/2026	100□ CD

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SHEET LEGEND
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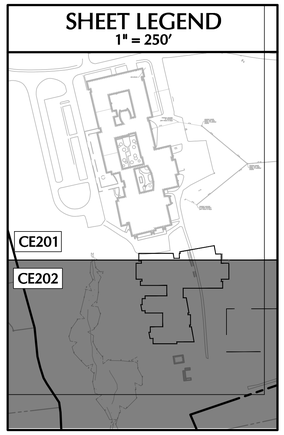

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14. NO DEBRIS ND STUMPS TO BE BURIED ON SITE.

EXISTING SIGNS WITHIN THE LIMIT OF DISTURBANCE TO BE REMOVED (TYP.)

PROTECT AND MAINTAIN ALL EXISTING FENCING UNLESS OTHERWISE NOTED

PROTECT AND MAINTAIN ALL EXISTING HYDRANTS

EXISTING UTILITY POLES TO BE PROTECTED AND MAINTAINED

EXISTING UTILITY PIPING AND STRUCTURES TO BE REMOVED UNLESS OTHERWISE NOTED. COORDINATE REMOVAL OF ALL UTILITIES WITH MEP (TYP.)

SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

FULL DEPTH PAVEMENT AND CURBING REMOVAL. PROCESSED AGGREGATE BASE MAY BE REUSED SO LONG AS THE CONTRACTOR CONFIRMS THE GRADATION OF THE MATERIAL MEETS PROPOSED SPECIFICATIONS.

CONTRACTOR TO FIELD VERIFY LOCATION OF ALL WATER AND SEWER LINES WITHIN PROJECT LIMITS. REPORT EXISTING UTILITY INFORMATION TO ENGINEER.

EXISTING BUILDING IS TO BE DEMOLISHED IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL REQUIREMENTS. REFER TO ABATEMENT AND ARCHITECTURAL PLANS FOR ALL EXISTING BUILDING DEMOLITION INFORMATION. SEE SHEETS CE101 AND CE102 FOR MORE PHASING INFORMATION

CAP AND CUT UTILITY LINES AT THE POINT THEY LEAVE THE SITE LIMIT OF DISTURBANCE (TYP.)

SILT FENCE (TYP.)

POSSIBLE LOCATION OF BURIED CLEANOUT (NOT FOUND IN FIELD)

TOTAL LIMIT OF DISTURBANCE: ±20.6 ACRES

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

SILT FENCE AND SILT FENCE (TYP.)

EXISTING HEADWALL TO BE MAINTAINED AND PROTECTED

MATCHLINE - CE201

MATCHLINE - CE202

SCALE: 1 INCH = 30 FEET

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CD201

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9. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL MATERIALS WITHIN THE PROJECT LIMITS UNLESS INDICATED TO REMAIN.
10. THE CONTRACTOR SHALL INCLUDE IN THEIR BID ALL TEMPORARY FACILITIES AND SERVICES NECESSARY TO SATISFY FEDERAL, STATE & LOCAL REQUIREMENTS INCLUDING BUT NOT LIMITED TO BRACING, SHORING, PAVEMENT REPAIR, FENCING, PEDESTRIAN AND VEHICLE ACCESS, CONCRETE PADS, ETC.
11. THE CONTRACTOR SHALL PROVIDE PERIMETER FENCING AND OTHER SECURITY MEASURES AS REQUIRED BY THE OWNER.
12. THE CONTRACTOR SHALL PROVIDE TEMPORARY PEDESTRIAN ACCESS AS REQUIRED BY THE OWNER.
13. THE CONTRACTOR SHALL REVIEW AND ADHERE TO ALL REQUIREMENTS SET FORTH IN THE PROJECT STORMWATER POLLUTION CONTROL PLAN (SWPCP) AND REQUIREMENTS OF THE PROJECT CTDEEP GENERAL PERMIT FOR THE DISCHARGE OF STORMWATER AND DEWATERING WASTEWATERS FROM CONSTRUCTION ACTIVITIES.
14. NO DEBRIS AND STUMPS TO BE BURIED ON SITE.

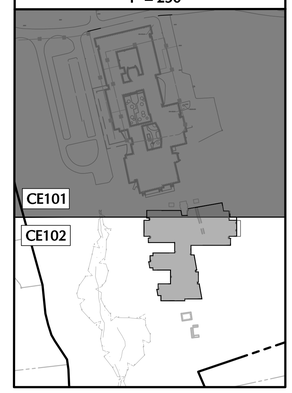
LEGEND

REMOVE HARDSCAPE (PAVEMENT, CONCRETE, ETC.)	
REMOVE UNDERGROUND UTILITY	
LIMIT OF DISTURBANCE	LOD
LIMIT OF PHASED DEMOLITION	

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

SHEET LEGEND
1" = 250'



MATCHLINE - CE101

MATCHLINE - CE102

CONTRACTOR TO COORDINATE INSTALLATION OF ALL PROPOSED UTILITIES SUCH THAT EXISTING SERVICES TO THE EXISTING SCHOOL ARE MAINTAINED. CONTRACTOR TO COORDINATE TEMPORARY UTILITY SHUTOFFS AS NEEDED WITH OWNER.

MAINTAIN AND PROTECT EXISTING BUILDING. REFER TO ARCHITECTURAL DEMOLITION PLANS FOR LIMITS OF EXISTING BUILDING TO BE PROTECTED. MAINTAIN EMERGENCY EGRESS DURING CONSTRUCTION AS DIRECTED BY OWNER.

SILT FENCE (TYP.)

PROPOSED LIMIT OF CURBING WITHIN PHASE 1 OF CONSTRUCTION (TYP.)

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

SILT FENCE AND SILT SOCK (TYP.)

SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

LIMIT OF GEOTHERMAL FIELD. REFER TO MEP PLANS FOR FIELD DEMOLITION AND PHASING INFORMATION.

EXISTING BUILDING

RIM=376.21
FL=367.01

RIM=371.60
FL=364.40

445.3

30 0 15 30
SCALE: 1 INCH = 30 FEET

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860.547.1970

ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

DR□WING TITL□

□H□S□ II SIT□
D□MOLITION □L□N
II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

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1	10/31/2025	SD
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3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

CD202

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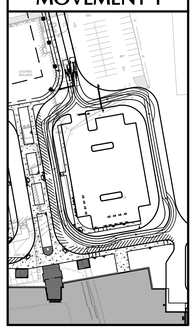
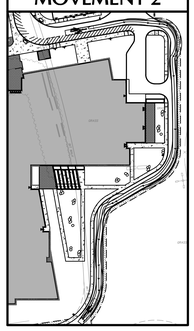
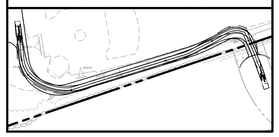
FIRE TRUCK TURNING MOVEMENT 1



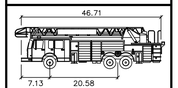
FIRE TRUCK TURNING MOVEMENT 2



FIRE TRUCK TURNING MOVEMENT 3



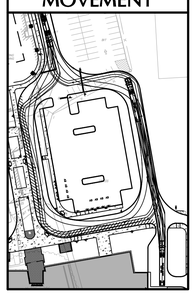
FIRE TRUCK PROFILE



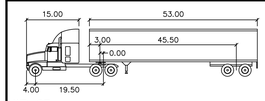
Trumbull Firetruck 1

	feet
Width	: 8.50
Track	: 8.00
Lock to Lock Time	: 6.0
Steering Angle	: 40.0

WB-67 TURNING MOVEMENT



WB-67 PROFILE

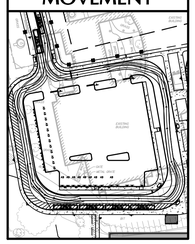


WB-67

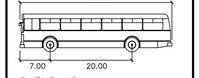
	feet		
Tractor Width	: 8.00	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 28.4
Tractor Track	: 8.00	Articulating Angle	: 75.0
Trailer Track	: 8.50		

100 0 50 100
SCALE IN FEET

SCHOOL BUS TURNING MOVEMENT



SCHOOL BUS PROFILE



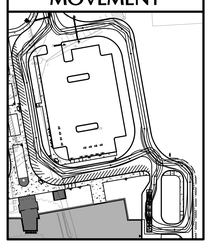
S-BUS-40

feet

Width	: 8.00
Track	: 8.00
Lock to Lock Time	: 6.0
Steering Angle	: 34.4

100 0 50 100
SCALE IN FEET

GARBAGE TRUCK TURNING MOVEMENT



GARBAGE TRUCK PROFILE

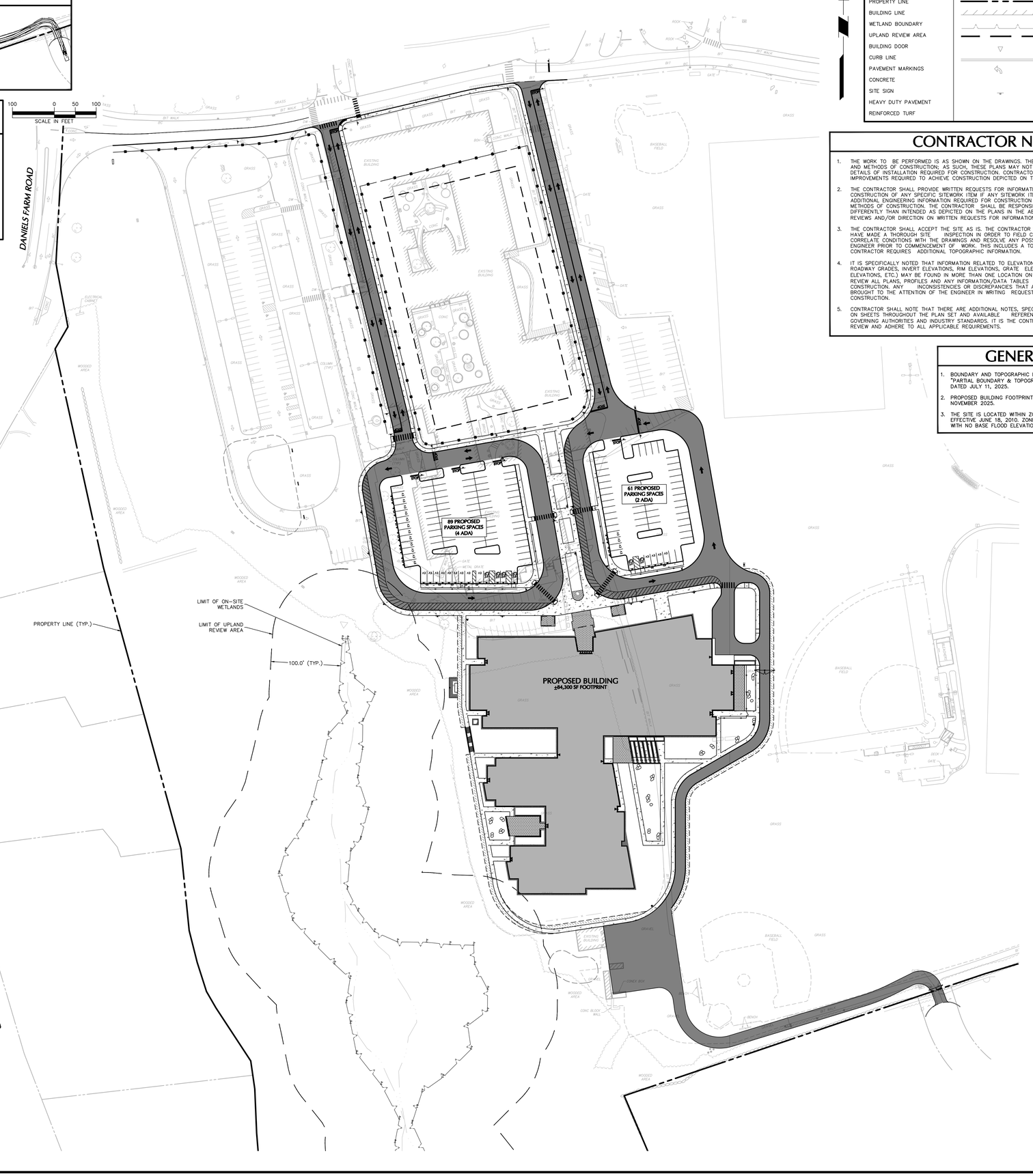


Wayne Titan

	feet
Width	: 8.46
Track	: 8.00
Lock to Lock Time	: 6.0
Steering Angle	: 45.0

100 0 50 100
SCALE IN FEET

100 0 50 100
SCALE IN FEET



60 0 20 40 60
SCALE IN FEET

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
BUILDING DOOR		
CURB LINE		
PAVEMENT MARKINGS		
CONCRETE		
SITE SIGN		
HEAVY DUTY PAVEMENT		
REINFORCED TURF		

CONTRACTOR NOTES

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ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

OV□R□LL SIT□ □L□N

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

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1	10/31/2025	SD
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3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

CS100

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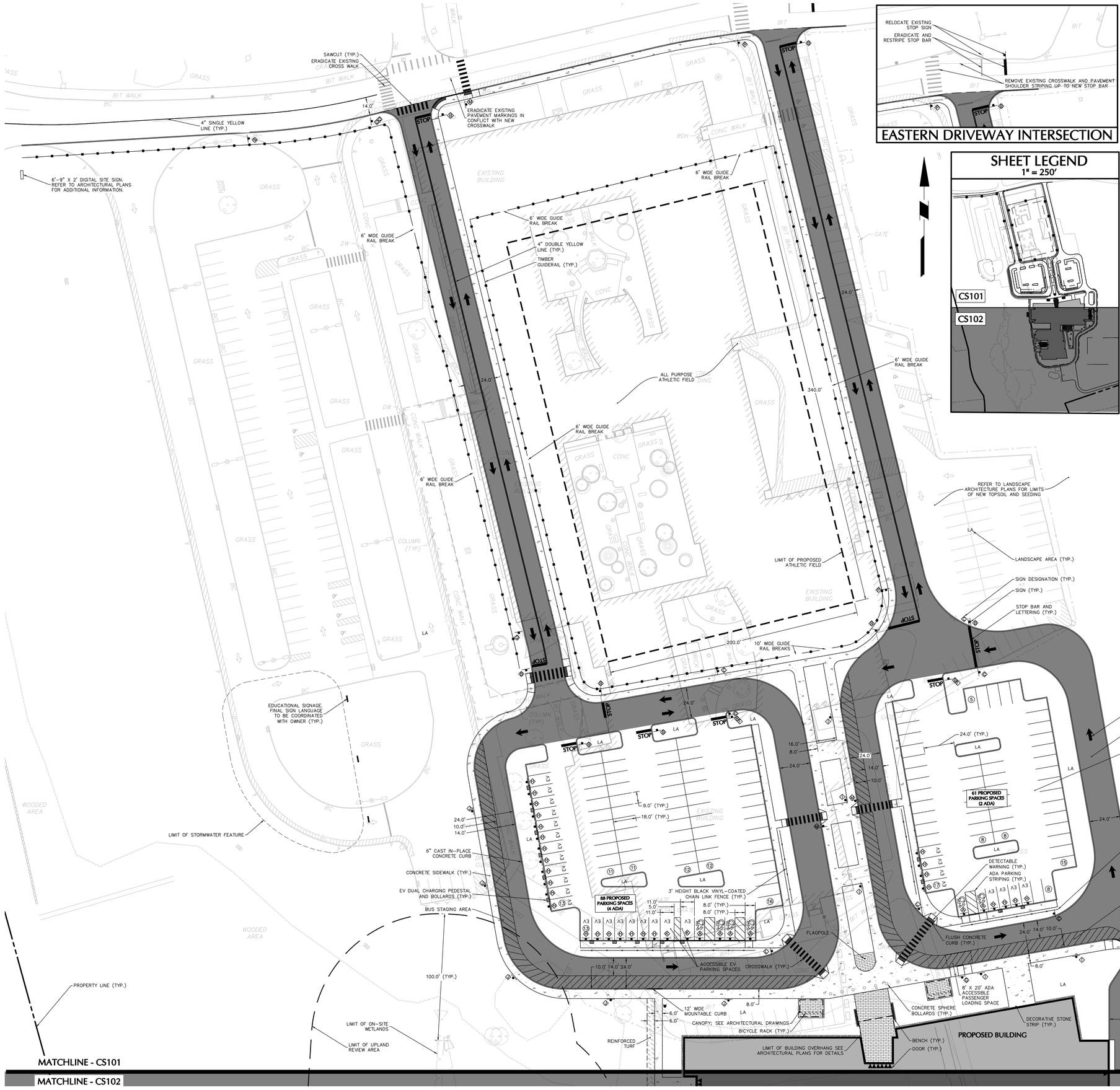

EASTERN DRIVEWAY INTERSECTION

SHEET LEGEND
1" = 250'

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
BUILDING DOOR		
CURB LINE		
PAVEMENT MARKINGS		
CONCRETE		
SITE SIGN		
HEAVY DUTY PAVEMENT		
REINFORCED TURF		

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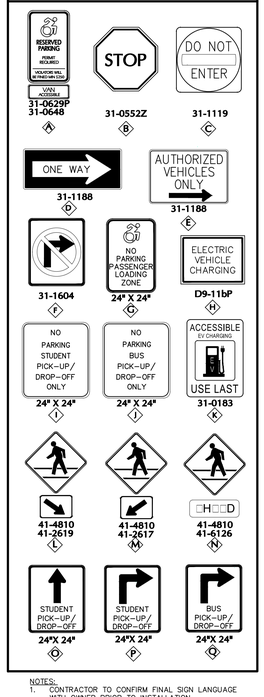
SIGN LEGEND



NOTES:
1. CONTRACTOR TO CONFIRM FINAL SIGN LANGUAGE WITH OWNER PRIOR TO INSTALLATION.

SCALE: 1 INCH = 30 FEET

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ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

PROJECT NORTH

DRAWING TITLE

SITE PLAN

START PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	AS NOTED
DATE	08/15/2025
DRAWN BY	CD
APPROVED BY	BC

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	CHANGES 1
5	05/19/2026	100% CD

Drawing No.

CS101

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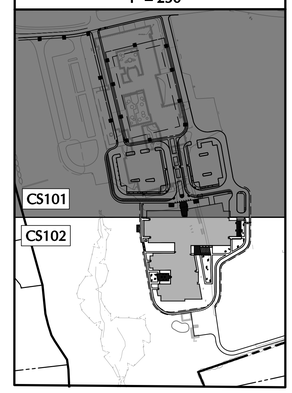
LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
BUILDING DOOR		
CURB LINE		
PAVEMENT MARKINGS		
CONCRETE		
SITE SIGN		
HEAVY DUTY CONCRETE		
REINFORCED TURF		

SHEET LEGEND

1" = 250'



MATCHLINE - CS101

MATCHLINE - CS102

PROPOSED BUILDING
±84,300 SF FOOTPRINT

100.0' (TYP.)

CONCRETE PAD (TYP.)

48 LF MODULAR BLOCK RETAINING WALL WITH FENCE

REINFORCED TURF

CONCRETE STAIRS (TYP.)

HAND RAILS (TYP.)

CHEEK WALL (TYP.)

DOOR (TYP.)

FREESTANDING PLANTER

AMPHITHEATER

UNIT PAVERS (TYP.)

DECORATIVE STONE STRIP (TYP.)

BOULDERS (TYP.)

SEATWALL (FREESTANDING)

SEAT WALL (PLANTER)

UNIT PAVERS (TYP.)

MOVEABLE SEATING (TYP.)

LOADING DOCK

FREESTANDING PLANTER

STEEL PICKET FENCE

METAL TRAFFIC GATES, 28' WIDE

PICNIC TABLE (TYP.)

UNIT PAVERS (TYP.)

SWING GATE

SWING GATE

BOULDERS (TYP.)

CHEEK WALL

CONCRETE STAIRS (TYP.)

HANDRAIL (TYP.), CENTER RAILING ON STAIRCASE

6" CAST IN-PLACE CONCRETE CURB

CONCRETE SIDEWALK (TYP.)

HEAVY DUTY BITUMINOUS PAVEMENT (TYP.)

REINFORCED TURF (TYP.)

FLUSH CONCRETE CURB (TYP.)

LIMIT OF WETLAND ON SITE

LIMIT OF UPLAND REVIEW AREA

100' UPLAND REVIEW AREA

REFER TO LANDSCAPE ARCHITECTURE PLANS FOR LIMITS OF NEW TOPSOIL AND SEEDING

EXISTING BUILDING TO REMAIN

LIMIT OF STORMWATER FEATURE

LIMIT OF REPAVING

INFIELD, FENCING, BASES, AND OTHER ANCILLARY EQUIPMENT TO BE SHIFTED AS NEEDED DUE TO GEOTHERMAL DISTURBANCE. COORDINATE WITH OWNER

PROTECT AND MAINTAIN EXISTING UTILITY POLE

20' SWING GATE

SAWCUT (TYP.)

APPROXIMATE LOCATION OF EXISTING CURB

RELOCATE EXISTING UTILITY POLES AS NEEDED (TYP.)

BASEBALL FIELD

GRASS

GRAVEL

WOODED AREA

CONC BLOCK WALL

CONEX BOX

BENCH

BIT WALK

GATE

SCALE: 1 INCH = 30 FEET

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□ro□ect Status

K□Y □L□N

DR□WING TITL□

SIT□ □L□N II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

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Drawing No.

CS102

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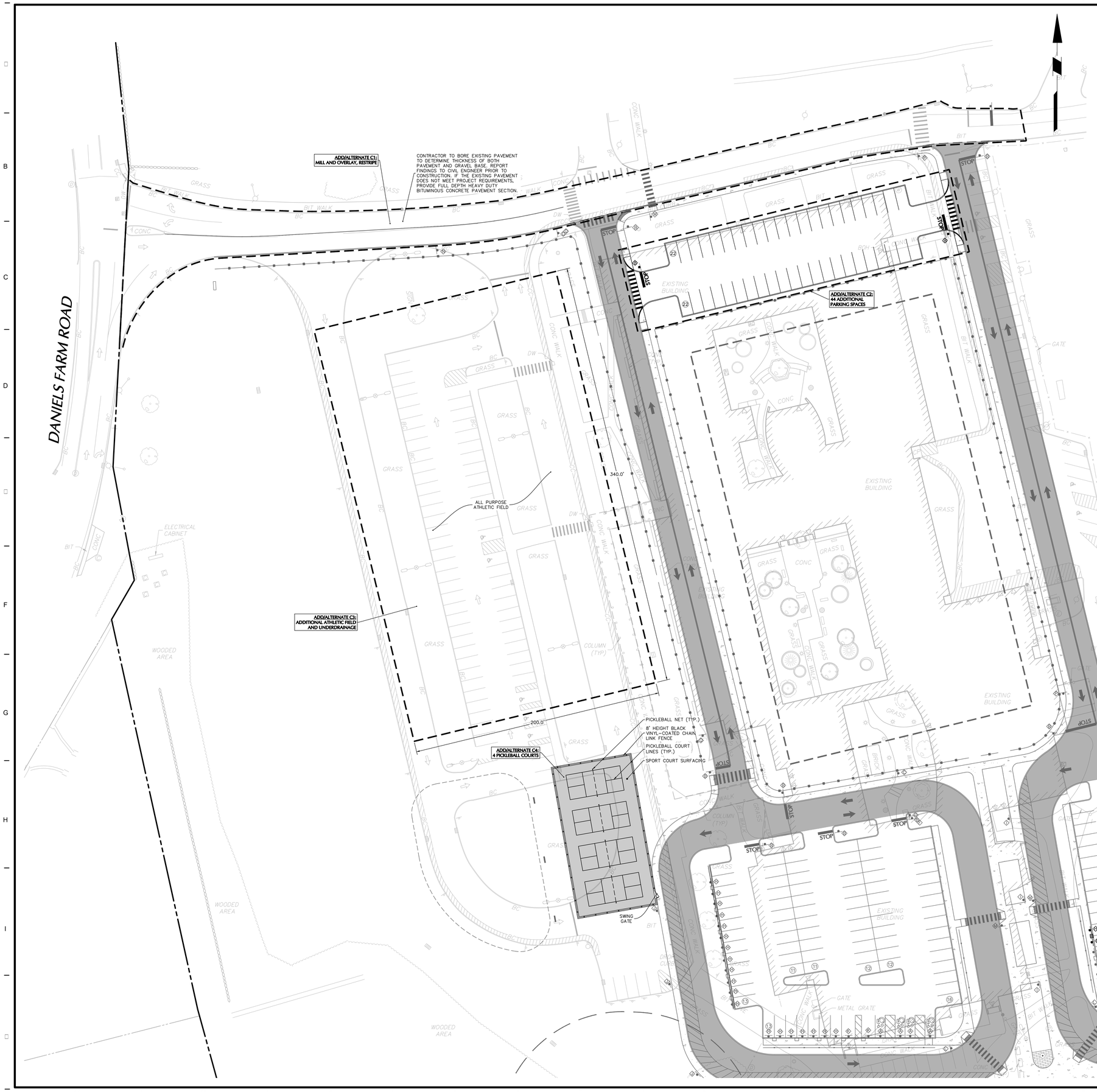

LEGEND

	EXISTING	PROPOSED
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BUILDING LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
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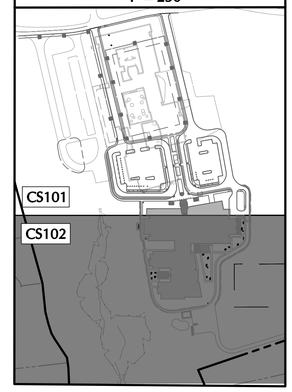
SHEET LEGEND
1" = 250'



GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

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860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

SIT□ □L□N I - □LT□RN□T□S

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

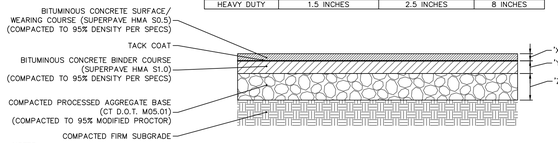
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

CS201

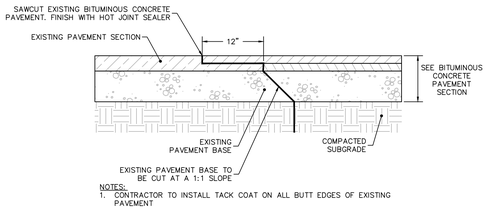
9/2/2025 4:30:02 □M □utodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS- □rch_BIM360-R26.rvt

ASPHALT SECTION	SURFACE COURSE – 'X'	BINDER COURSE – 'Y'	BASE – 'Z'
STANDARD DUTY	1.5 INCHES	1.5 INCHES	6 INCHES
HEAVY DUTY	1.5 INCHES	2.5 INCHES	8 INCHES



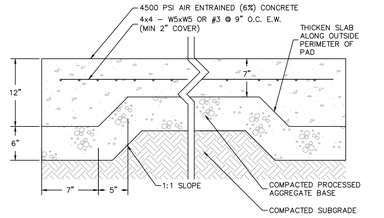
NOTES:
1. PROVIDE BITUMINOUS CONCRETE PAVEMENT AS INDICATED ON THE SITE PLAN.
2. PRIOR TO ANY PAVING ACTIVITIES, THE SUBGRADE OR BASE SHALL BE PROOF ROLLED.
3. PAVING BASE COURSE SHALL BE CONSTRUCTED IN LAYERS NOT LESS THAN 2 INCHES AND NOT MORE THAN 5 INCHES THICK PER LIFT.
4. ALL AREAS TO BE PAVED SHALL BE PROOFROLLED WITH AT LEAST 4 PASSES OF EITHER A SMOOTH ROLLER HAVING A MINIMUM STATIC DRUM WEIGHT OF 5–TONS OR A FULLY LOADED TANDEM DUMP TRUCK. ANY SOFT AREAS SHALL BE REMOVED AND REPLACED WITH CLEAN, GRANULAR, FREE–DRAINING SOIL. FILL SHALL BE PLACED IN LOOSE LIFTS NOT TO EXCEED 12–INCHES AND SHALL BE COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D–1557.
5. BITUMINOUS CONCRETE SUPERPAVE SHALL CONFORM TO CONNECTICUT D.O.T. STANDARD SPECIFICATIONS, FORM 818, SECTION 4.06, LATEST EDITION.
6. PROCESSED AGGREGATE BASE SHALL CONFORM TO CONNECTICUT D.O.T. STANDARD SPECIFICATIONS, FORM 818, SECTION 3.04, LATEST EDITION.
7. CONTRACTOR SHALL COORDINATE WITH GEOTECHNICAL REPORT PROVIDED BY LANGAN CT, INC. FOR MORE INFORMATION.

1 BITUMINOUS PAVEMENT - SUPERPAVE
N.T.S.

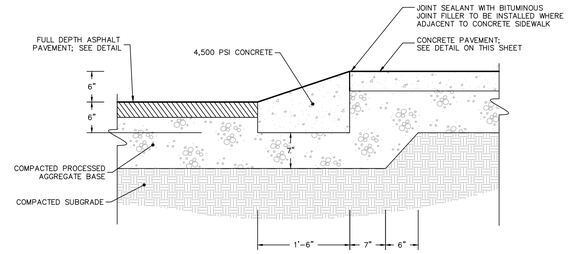


NOTES:
1. CONTRACTOR TO INSTALL TACK COAT ON ALL BUTT EDGES OF EXISTING PAVEMENT

2 SAWCUT PAVEMENT SECTION
N.T.S

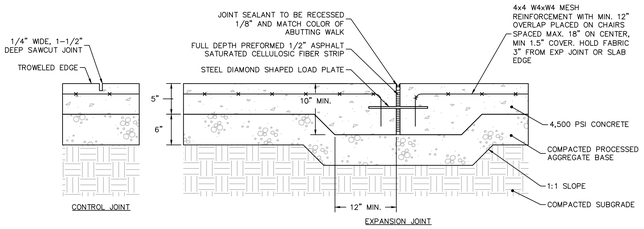


3 CONCRETE PAD
N.T.S



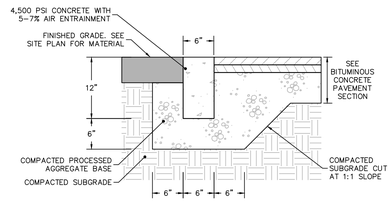
NOTE:
CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF LAYOUT TO LANDSCAPE ARCHITECT FOR REVIEW.

4 MOUNTABLE CONCRETE CURB
N.T.S.



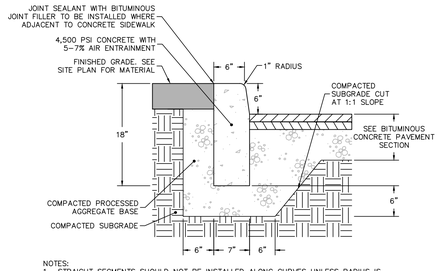
NOTES:
1. ALL CONTROL JOINTS TO BE SAWCUT
2. SIDEWALKS TO COMPLY WITH CITY STANDARDS WHERE APPLICABLE.
3. EXPANSION AND CONTROL JOINTS SHALL BE INSTALLED PER LAYOUT AND DIMENSIONING PLANS. IF NOT SPECIFICALLY DETAILED MAXIMUM SPACING OF JOINTS SHALL BE AS FOLLOWS:
   EXPANSION – 20 FT.
   CONTROL – 5 FT.
4. CONTROL JOINTS SHALL BE SPACED EQUAL TO THE WIDTH. CARE SHALL BE TAKEN TO ASSURE UNIFORM GRADE, FREE OF SAGS AND SHORT GRADE CHANGES.
5. SURFACE TEXTURE SHALL BE A LIGHT BROOMING, TRANSVERSE TO THE LENGTH OF THE WALK.
6. CONTRACTOR TO PROVIDE 5'x5' MOCKUP SHOWING EXPANSION JOINTS, SAWCUT JOINTS, AND BROOM FINISH PRIOR TO INSTALLATION.
7. EXPANSION JOINT SHALL BE INSTALLED AT ALL CURBS AND STRUCTURES. SIDEWALKS AT BUILDING ENTRANCES ARE TO BE PINNED TO FOUNDATION. COORDINATE WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS.

5 CONCRETE SIDEWALK
N.T.S



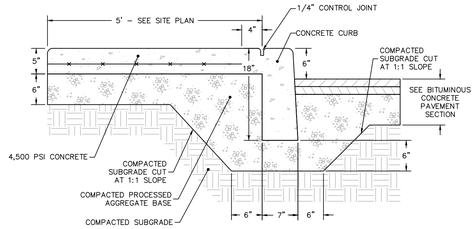
NOTES:
1. PROVIDE ¾"W x 3" DEPTH CONTROL JOINTS, SPACED MAX. 10' O.C.

6 FLUSH CONCRETE CURB
N.T.S



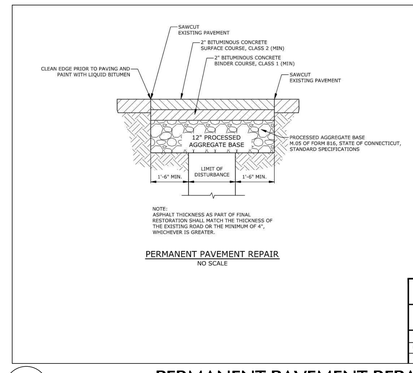
NOTES:
1. STRAIGHT SEGMENTS SHOULD NOT BE INSTALLED ALONG CURVES UNLESS RADIUS IS GREATER THAN 50'.
2. INDIVIDUAL SEGMENTS TO BE GREATEST LENGTH POSSIBLE IN ORDER TO MINIMIZE NUMBER OF JOINTS. CORNERS TO BE SINGLE PIECE.
3. JOINT SEALANT TO BE INSTALLED AT ALL JOINTS BETWEEN CURB SEGMENTS.
4. PROCESSED AGGREGATE SHALL CONFORM TO CT D.O.T. SPECIFICATIONS, FORM 817 SECTION 3.04, LATEST REVISION.
5. CONTRACTOR TO PROVIDE PRODUCT DATA FOR REVIEW PRIOR TO INSTALLATION.
6. CONTRACTOR TO PROVIDE LAYOUT SHOP DRAWINGS FOR REVIEW PRIOR TO INSTALLATION. LAYOUT DRAWING TO INCLUDE PLAN VIEW INDICATING LOCATIONS OF INDIVIDUAL SEGMENTS.

7 CAST-IN-PLACE CONCRETE CURB
N.T.S



NOTES:
1. SURFACE TEXTURE SHALL BE A LIGHT BROOMING, TRANSVERSE TO THE LENGTH OF THE WALK.
2. CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE, FREE OF SAGS AND SHORT GRADE CHANGES.
3. CONTROL JOINTS SHALL BE SPACED EQUAL TO THE WIDTH BUT SHALL NOT EXCEED 6 FT. WITHOUT REINFORCING.
4. REFERENCE SITE PLAN FOR LOCATION OF EXPANSION JOINTS.
5. PROCESSED AGGREGATE SHALL CONFORM TO MASS D.O.T. SPECIFICATIONS, M2.01.01 OR M1.03.1, LATEST REVISION

8 MONOLITHIC SIDEWALK
N.T.S.



NOTE:
ASPHALT THICKNESS AS PART OF FINAL RESTORATION SHALL MATCH THE THICKNESS OF THE EXISTING ROAD OR THE MINIMUM OF 4", WHICHEVER IS GREATER.

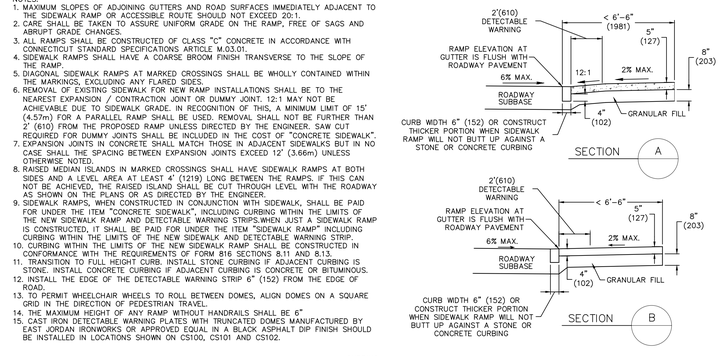
PERMANENT PAVEMENT REPAIR
NO SCALE

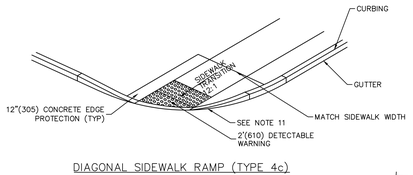
OFFICE OF THE TOWN ENGINEER TOWN OF TRUMBULL 5866 Main Street (203) 452-5050	
PERMANENT PAVEMENT REPAIR DETAIL TRUMBULL, CONNECTICUT	
Scale: NTS	Date: 8/15/2014
Drawn by:	Grid:
Approved by:	Sheet: PM-01

10 PERMANENT PAVEMENT REPAIR
N.T.S

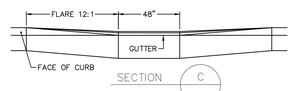
DETAIL PROVIDED BY TRUMBULL ENGINEERING

NOTES:
1. MAXIMUM SLOPES OF ADJOINING GUTTERS AND ROAD SURFACES IMMEDIATELY ADJACENT TO THE SIDEWALK RAMP OR ACCESSIBLE ROUTE SHOULD NOT EXCEED 20:1.
2. CARE SHALL BE TAKEN TO ASSURE UNIFORM GRADE ON THE RAMP, FREE OF SAGS AND ABRUPT GRADE CHANGES.
3. ALL RAMPS SHALL BE CONSTRUCTED OF CLASS "C" CONCRETE IN ACCORDANCE WITH CONNECTICUT STANDARD SPECIFICATIONS ARTICLE M.03.01.
4. SIDEWALK RAMPS SHALL HAVE A COARSE BROOM FINISH TRANSVERSE TO THE SLOPE OF THE RAMP.
5. DIAGONAL SIDEWALK RAMPS AT MARKED CROSSINGS SHALL BE WHOLLY CONTAINED WITHIN THE MARKINGS, EXCLUDING ANY FLARED SIDES.
6. REMOVAL OF EXISTING SIDEWALK FOR NEW RAMP INSTALLATIONS SHALL BE TO THE NEAREST EXPANSION / CONTRACTION JOINT OR DUMMY JOINT. 12:1 MAY NOT BE ACHIEVABLE DUE TO SIDEWALK GRADE. IN RECOGNITION OF THIS, A MINIMUM LIMIT OF 15' (4.57m) FOR A PARALLEL RAMP SHALL BE USED. REMOVAL SHALL NOT BE FURTHER THAN 2' (610) FROM THE PROPOSED RAMP UNLESS DIRECTED BY THE ENGINEER. SAW CUT REQUIRED FOR DUMMY JOINTS SHALL BE INCLUDED IN THE COST OF "CONCRETE SIDEWALK".
7. EXPANSION JOINTS IN CONCRETE SHALL MATCH THOSE IN ADJACENT SIDEWALKS BUT IN NO CASE SHALL THE SPACING BETWEEN EXPANSION JOINTS EXCEED 12' (3.66m) UNLESS OTHERWISE NOTED.
8. RAISED MEDIAN ISLANDS IN MARKED CROSSINGS SHALL HAVE SIDEWALK RAMPS AT BOTH SIDES AND A LEVEL AREA AT LEAST 4' (1219) LONG BETWEEN THE RAMPS. IF THIS CAN NOT BE ACHIEVED, THE RAISED ISLAND SHALL BE CUT THROUGH LEVEL WITH THE ROADWAY AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
9. SIDEWALK RAMPS, WHEN CONSTRUCTED IN CONJUNCTION WITH SIDEWALK, SHALL BE PAID FOR UNDER THE ITEM "CONCRETE SIDEWALK", INCLUDING CURBING WITHIN THE LIMITS OF THE NEW SIDEWALK RAMP AND DETECTABLE WARNING STRIPS.WHEN JUST A SIDEWALK RAMP IS CONSTRUCTED, IT SHALL BE PAID FOR UNDER THE ITEM "SIDEWALK RAMP" INCLUDING CURBING WITHIN THE LIMITS OF THE NEW SIDEWALK AND DETECTABLE WARNING STRIP.
10. CURBING WITHIN THE LIMITS OF THE NEW SIDEWALK RAMP SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE REQUIREMENTS OF FORM 816 SECTIONS 8.11 AND 8.13.
11. TRANSITION TO FULL HEIGHT CURB. INSTALL STONE CURBING IF ADJACENT CURBING IS STONE. INSTALL CONCRETE CURBING IF ADJACENT CURBING IS CONCRETE OR BITUMINOUS.
12. INSTALL THE EDGE OF THE DETECTABLE WARNING STRIP 6" (152) FROM THE EDGE OF ROAD.
13. TO PERMIT WHEELCHAIR WHEELS TO ROLL BETWEEN DOMES, ALIGN DOMES ON A SQUARE GRID IN THE DIRECTION OF PEDESTRIAN TRAVEL.
14. THE MAXIMUM HEIGHT OF ANY RAMP WITHOUT HANDRAILS SHALL BE 6"
15. CAST IRON DETECTABLE WARNING PLATES WITH TRUNCATED DOMES MANUFACTURED BY EAST JORDAN IRONWORKS OR APPROVED EQUAL IN A BLACK ASPHALT DIP FINISH SHOULD BE INSTALLED IN LOCATIONS SHOWN ON CS100, CS101 AND CS102.

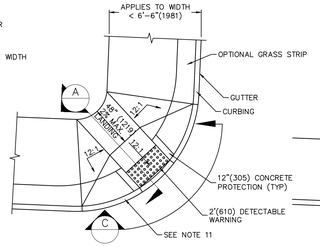




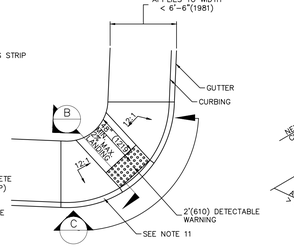
DIAGONAL SIDEWALK RAMP (TYPE 4c)



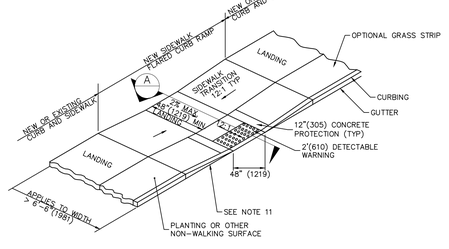
ALL METRIC DIMENSIONS ARE IN MILLIMETERS (mm) UNLESS OTHERWISE NOTED



DIAGONAL SIDEWALK RAMP (TYPE 4a)



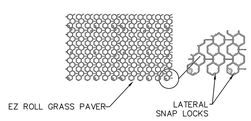
DIAGONAL/PARALLEL SIDEWALK RAMP (TYPE 4b)



PERPENDICULAR SIDEWALK RAMP (TYPE 2)

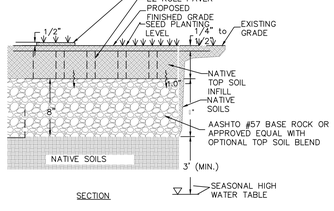
NOTES:
1. DETECTABLE WARNING ONLY TO BE INSTALLED WHERE SHWON ON THE SITE PLAN.

9 ADA ACCESSIBLE CURB RAMP
N.T.S.



PLAN VIEW

EZ ROLL GRASS PAVER PRODUCT DESCRIPTION
CELL SIZE: 2–1/4" HEXAGONAL CELLS
STOCK ROLL SIZES: 4'W X 150'L (600 SQ. FT.)



SECTION

ENGINEERING PROPERTIES:
1. COMPRESSIVE STRENGTH OF EZ ROLL:
   EMPTY PAVERS: ULTIMATE LOAD = 53,683 LBS / 373 PSI
   FILLED PAVERS: ULTIMATE LOAD = 400,000 LBS

TOP SOIL FILL:
2. NDS RECOMMENDS NATIVE TOP SOIL FOR BACKFILL INSIDE THE PAVERS.
3. EXTEND TOP SOIL INSIDE PAVER AN ADDITIONAL ¼ TO ½ INCH ABOVE PAVER SURFACE AND MATCH SURROUNDING GRADE. PROPOSED FINISHED GRADE SLOPE PER PROJECT GRADING PLAN. PROTECT PAVER AREA UNTIL GRASS IS SUFFICIENTLY ESTABLISHED TO HANDLE TRAFFIC. PROVIDE 1" (MIN.) CLEARANCE BETWEEN ANY CONCRETE EDGE AND PAVER.
4. GRASS PAVERS ARE TO BE USED FOR AREAS OF PEDESTRIAN USE, EROSION CONTROL, AND OCCASIONAL VEHICULAR TRAFFIC USE. (E.G., OVERFLOW PARKING AND EMERGENCY/FIRE LANES).

AASHTO #57 BASE ROCK:
5. GRADATION OF AASHTO #57 COARSE BASE ROCK: 100% PASSING 1 ½ SCREEN, 95–100% PASSING 1", 25–60% PASSING ½", AND 0–10% PASSING #8 SCREEN. OPTIONAL: ADD PULVERIZED NATIVE TOP SOIL EQUAL TO 15% OF TOTAL VOLUME. BLEND TO OBTAIN HOMOGENEOUS MIXTURE PRIOR TO PLACEMENT.
6. THICKNESS OF AGGREGATE LAYER IS AS FOLLOWS: NO BASE REQUIRED FOR EROSION CONTROL AND PEDESTRIAN–ONLY LOADS (COMPACTION OF NATIVE SOIL RECOMMENDED FOR SLOPES UP TO 3%); 4 INCHES FOR LIGHT LOADS (GOLF CARTS); 6 INCHES FOR MEDIUM LOADS (CARS AND PICKUP TRUCKS); 8 INCHES FOR HEAVY LOADS (FIRE TRUCKS).
7. COMPACT WITH ONE TO THREE PASSES OF 5–TON STEEL WHEEL ROLLER. SINCE IT IS DIFFICULT TO MEASURE DENSITY OF COARSE AGGREGATE, APPROACH OF REQUIRING A FIXED DENSITY IS NOT APPLICABLE.

SUBGRADE NATIVE SOIL:
8. COMPACT SUBGRADE NATIVE SOILS TO 95% STANDARD PROCTOR DENSITY PER ASTM D696 FOR SOILS WITH CALIFORNIA BEARING RATIO >20%, R VALUE >30, AASHTO A–1, A–2, AND A–3 SOILS.
9. NDS RECOMMENDS THAT ENGINEER–OF–RECORD CONSIDER HIGHER LEVEL OF COMPACTION FOR CBR ≤ 5 20%, R–VALUE 10 TO 30, AASHTO A–4 SOILS FOR HEAVY LOADS WHERE INFILTRATION INTO NATIVE SOILS IS NOT A REQUIREMENT.
10. NDS RECOMMENDS THAT ENGINEER–OF–RECORD CONSULT WITH PROJECT GEOTECHNICAL ENGINEER FOR POTENTIAL SOIL MODIFICATION (E.G., LIME TREATMENT) AND COMPACTION LEVEL FOR CBR <5% AND R–VALUE <10, AASHTO A–5, A–6, AND A–7 SOILS.

11 REINFORCED TURF (EZ ROLL GRASS PAVERS OR APPROVED EQUAL)
N.T.S

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ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status
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PROJECT NORTH

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ST□T□ □RO□ NO.	144-0108N
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ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□1
5	05/19/2026	100□ CD

Drawing No.
CS501

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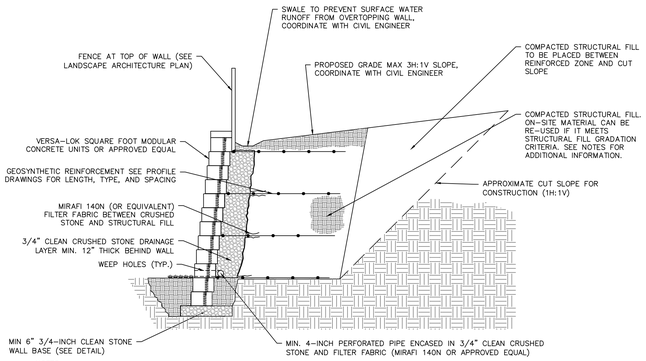
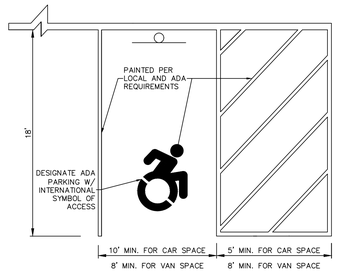


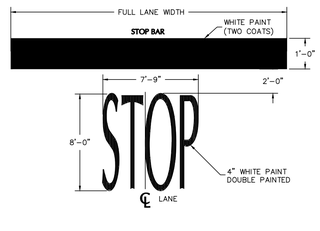
NOTES:
1. DETAIL IS SHOWN FOR GENERAL CONCEPT OF A GEOSYNTHETIC REINFORCED MODULAR BLOCK RETAINING WALL.
2. ALL MODULAR BLOCK RETAINING WALLS THREE FEET OR GREATER IN EXPOSED HEIGHT MUST BE DESIGNED AND CERTIFIED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF CONNECTICUT. STABILITY FOR RETAINING WALLS, INCLUDING GLOBAL STABILITY, MUST BE ANALYZED BY THE RETAINING WALL DESIGN ENGINEER OF RECORD.
3. CONTRACTOR TO SUBMIT SIGNED AND SEALED DESIGN AND DRAWINGS BY CT P.E. FOR REVIEW DURING SHOP DRAWING PROCESS.

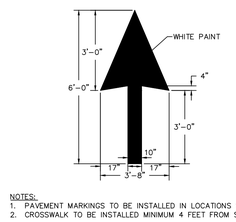
1 MODULAR BLOCK RETAINING WALL SECTION
N.T.S.

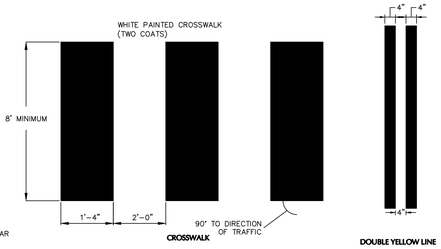


NOTES:
1. ALL PAINT SHALL BE EPOXY RESIN PAINT, MEETING THE REQUIREMENTS OF AASHTO M248 TYPE F, PAINT SHALL BE APPLIED AS SPECIFIED BY THE MANUFACTURER.
2. SYMBOLS & PARKING STALLS SHALL CONFORM TO THE REQUIREMENTS OF THE AMERICAN DISABILITIES ACT (ADA) AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.
3. APPLY TWO COATS OF TRAFFIC PAINT. ALLOW FOR A MINIMUM CURE TIME OF 24 HOURS BETWEEN APPLICATIONS.

2 ADA PARKING STALL STRIPING
N.T.S

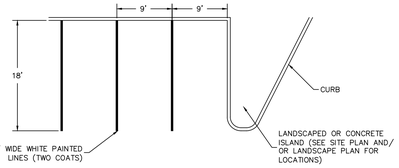






NOTES:
1. PAVEMENT MARKINGS TO BE INSTALLED IN LOCATIONS SHOWN.
2. CROSSWALK TO BE INSTALLED MINIMUM 4 FEET FROM STOP BAR

3 ON-SITE PAVEMENT MARKINGS
N.T.S

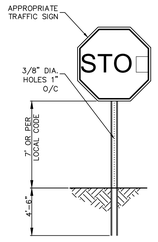


90 DEGREE PARKING STALL

NOTES:
1. ALL PAINT SHALL BE SHERWIN-WILLIAMS "SETFAST" PAINT. #TM2160 – WHITE APPLY 2 COATS OF TRAFFIC TYPE PAINT.
2. APPLY THE FIRST COAT NOT LESS THAN 5 DAYS AFTER THE PLACING OF BITUMINOUS PAVEMENT APPLY SECOND COAT JUST PRIOR TO BUILDING OPENING.

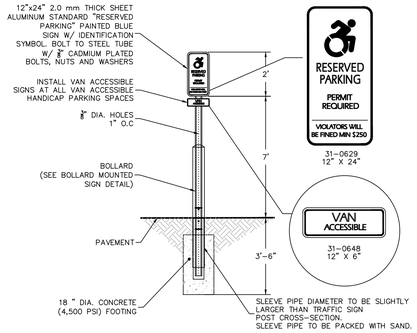
4 PARKING STALL STRIPING
N.T.S

NOTES:
1. ALL POSTS SHALL BE OF ADEQUATE LENGTH TO MEET THE REQUIREMENTS FOR ERECTION AS STATED IN THE CURRENT "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS".
2. ALL POSTS SHALL BE EMBEDDED 4'-6" MINIMUM BELOW GRADE.
3. ALL STEEL POSTS AND BRACKETS SHALL BE CUT, BENT, AND HOLES PUNCHED AND DRILLED BEFORE GALVANIZING. GALVANIZING SHALL BE IN CONFORMANCE WITH CURRENT A.S.T.M. SPECIFICATION A123-78 (OR LATEST REVISED).
4. POSTS SHALL BE BREAKAWAY TYPE II TWO-PIECE U-POST OR OTHER BREAKAWAY STRUCTURAL SUPPORT HARDWARE AS NOTED IN THE LATEST EDITION OF AASHTO'S "SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS."
5. SIGN PANEL SIZES SHALL DETERMINE POST TYPE AND NUMBERS AS SHOWN ON THIS DETAIL AND DIRECTIONAL SIGN SHEET.
6. BOLTS SHALL NOT PROTRUDE MORE THAN 3/4" BEYOND THE NUT WHEN TIGHT BUT SHALL ENGAGE ALL THREADS IN THE NUT.
7. ALL TRAFFIC AND PEDESTRIAN SIGNAGE AND LOCATION SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND ALL CURRENT AMENDMENTS.

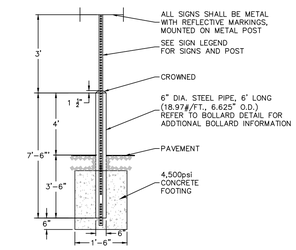


5 ON-SITE SIGN DETAIL
N.T.S

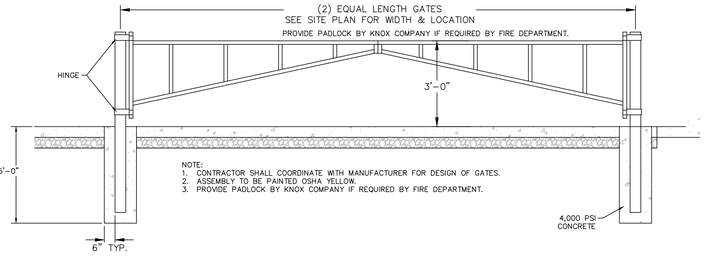
NOTES:
1. ALL POSTS SHALL BE OF ADEQUATE LENGTH TO MEET THE REQUIREMENTS FOR ERECTION AS STATED IN THE CURRENT "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS".
2. ALL POSTS SHALL BE EMBEDDED 3'-6" MINIMUM BELOW GRADE.
3. ALL STEEL POSTS AND BRACKETS SHALL BE CUT, BENT, AND HOLES PUNCHED AND DRILLED BEFORE GALVANIZING. GALVANIZING SHALL BE IN CONFORMANCE WITH CURRENT A.S.T.M. SPECIFICATION A123-78 (OR LATEST REVISED).
4. POSTS SHALL BE BREAKAWAY TYPE II TWO-PIECE U-POST OR OTHER BREAKAWAY STRUCTURAL SUPPORT HARDWARE AS NOTED IN THE LATEST EDITION OF AASHTO'S "SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS."
5. SIGN PANEL SIZES SHALL DETERMINE POST TYPE AND NUMBERS AS SHOWN ON THIS DETAIL AND DIRECTIONAL SIGN SHEET.
6. BOLTS SHALL NOT PROTRUDE MORE THAN 3/4" BEYOND THE NUT WHEN TIGHT BUT SHALL ENGAGE ALL THREADS IN THE NUT.
7. ADA PARKING SIGN, INCLUDING FINE AMOUNT, SHALL CONFORM WITH CURRENT STATE & LOCAL CODES AND REGULATIONS.



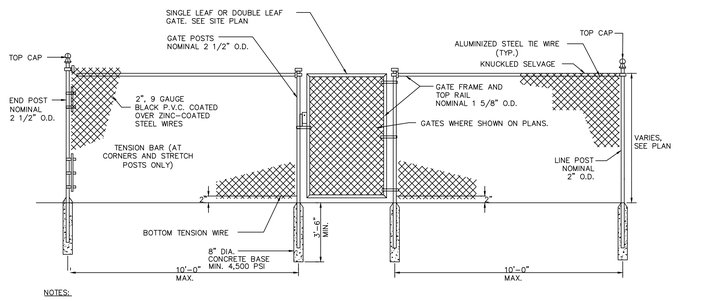
6 ADA PARKING SIGN
N.T.S



7 BOLLARD MOUNTED SIGN
N.T.S

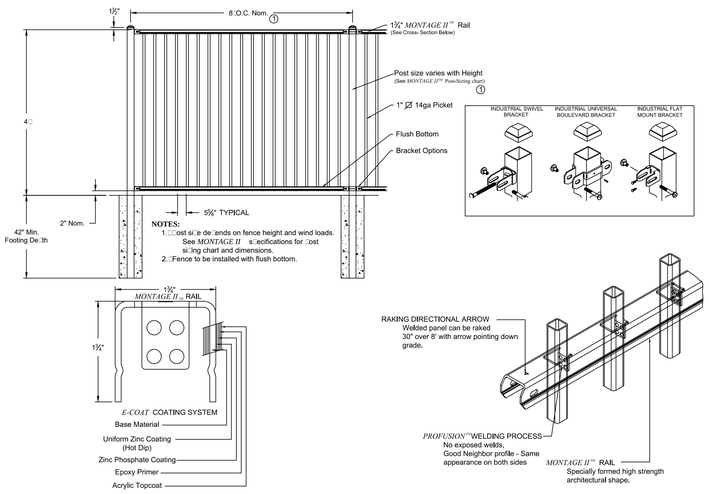


9 METAL TRAFFIC GATES
N.T.S



NOTES:
1. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO THE CIVIL ENGINEER ILLUSTRATING THE HEIGHTS & LAYOUT OF FENCING AND GATES REQUIRED FOR THE PROJECT. SHOP DRAWINGS SHALL INCLUDE MANUFACTURER CUTS AND SPECIFICATIONS.
2. ALL CHAIN LINK FENCE GREATER THAN 6 FOOT HEIGHT TO HAVE MID-RAIL.
3. GATES TO BE 3' MIN. CLEAR OPENING UNLESS NOTED OTHERWISE ON PLAN.
4. CONTRACTOR TO PROVIDE RECEIVING POST SLEEVE FOR ALL GATES IN BOTH OPEN AND CLOSED CONDITIONS.

10 CHAIN LINK FENCE
N.T.S

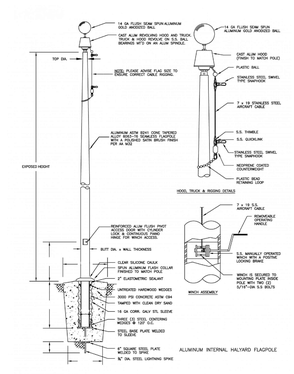


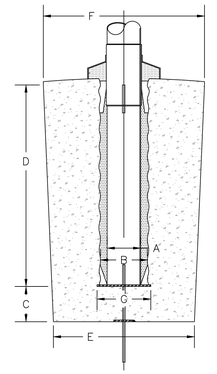
NOTES:
1. MONTAGE II BY AMERISTAR (OR APPROVED EQUAL).
2. FENCE TO BE PAINTED TO ALIGN WITH ARCHITECTURE, COLOR TO BE SELECTED BY THE PROJECT LANDSCAPE ARCHITECT.
3. CONTRACTOR TO SUBMIT PRODUCT DATA FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
4. CONTRACTOR TO SUBMIT LAYOUT SHOP DRAWINGS FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. SHOP DRAWINGS TO INCLUDE SCALED PLAN VIEW AND ELEVATION SHOWING ALL ANTICIPATED POST LOCATIONS.

11 STEEL PICKET FENCE
N.T.S

FLAG POLE LENGTH TABLE			
POLE LENGTH	BURIED LENGTH	STRAIGHT SECTION LENGTH	TAPERED SECTION LENGTH
25' – 0"	3' – 0"	12' – 6"	12' – 6"

FOUNDATION & BUTT TABLE – TAPERED POLE								
POLE LENGTH	A	B	C	D	E	F	G	
28' – 0"	7"	9"	12"	36"	36"	45"	16"	





Ⓐ FLAG POLE/ IN-GROUND ELEVATION

Ⓑ FLAG POLE/ IN-GROUND FOUNDATION DETAIL

NOTES:
1. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR REVIEW PRIOR TO INSTALLATION
2. FLAGPOLE TO BE PT257CIW AS MANUFACTURED BY POLE-TECH CO. (OR APPROVED EQUAL).

12 FLAGPOLE
N.T.S

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TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

SIT□ D□T□ILS II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

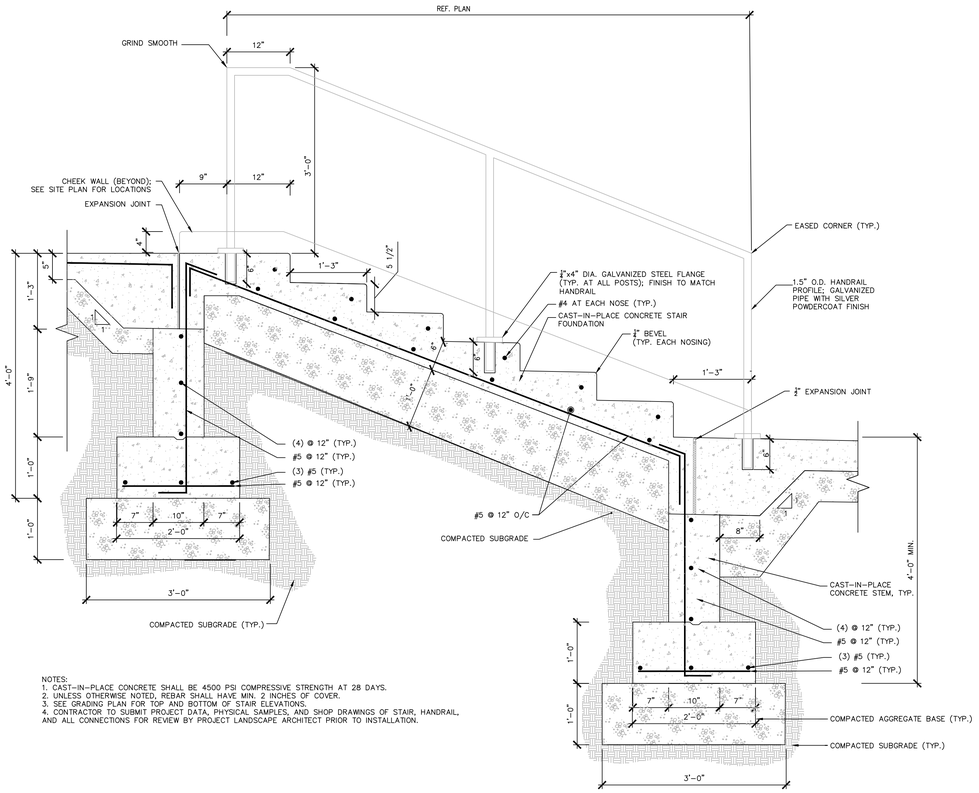
ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S 1
5	05/19/2026	100□ CD

Drawing No.

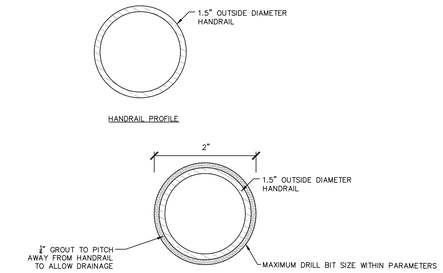
CS502

9/2/2025 4:30:02 □M □utodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-□rch. BIM360-R26.rvt



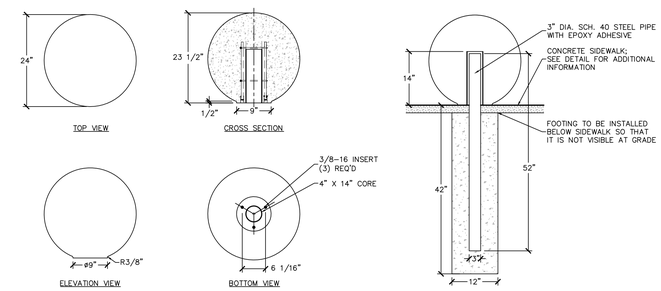
NOTES:
1. CAST-IN-PLACE CONCRETE SHALL BE 4500 PSI COMPRESSIVE STRENGTH AT 28 DAYS.
2. UNLESS OTHERWISE NOTED, REBAR SHALL HAVE MIN. 2 INCHES OF COVER.
3. SEE GRADING PLAN FOR TOP AND BOTTOM OF STAIR ELEVATIONS.
4. CONTRACTOR TO SUBMIT PROJECT DATA, PHYSICAL SAMPLES, AND SHOP DRAWINGS OF STAIR, HANDRAIL, AND ALL CONNECTIONS FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

1 CONCRETE STAIRS
1" = 1'-0"



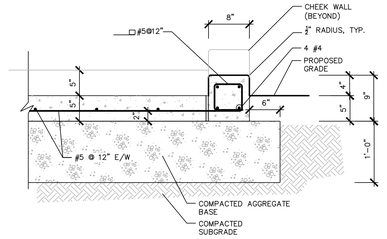
NOTES:
1. ALL RAILINGS, POSTS, AND ACCESSORIES TO BE GALVANIZED STEEL WITH SILVER POWDERCOAT FINISH.
2. CONTRACTOR TO SUBMIT PRODUCT DATA, PHYSICAL SAMPLES, AND SHOP DRAWINGS OF HANDRAIL AND ALL CONNECTIONS PRIOR TO INSTALLATION (TYP.)

2 HANDRAIL PROFILE
N.T.S.



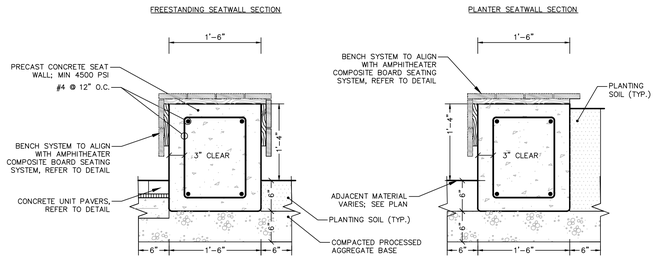
NOTE:
WASAU MADE MODEL NO. TF 6091, 24" DIA. SPHERE BOLLARD (OR APPROVED EQUAL). CONTRACTOR TO SUBMIT SHOP DRAWINGS, PHYSICAL COLOR SAMPLES, AND PRODUCT DATA FOR REVIEW BY PROJECT ENGINEER PRIOR TO INSTALLATION.

3 CONCRETE SPHERE BOLLARDS
N.T.S



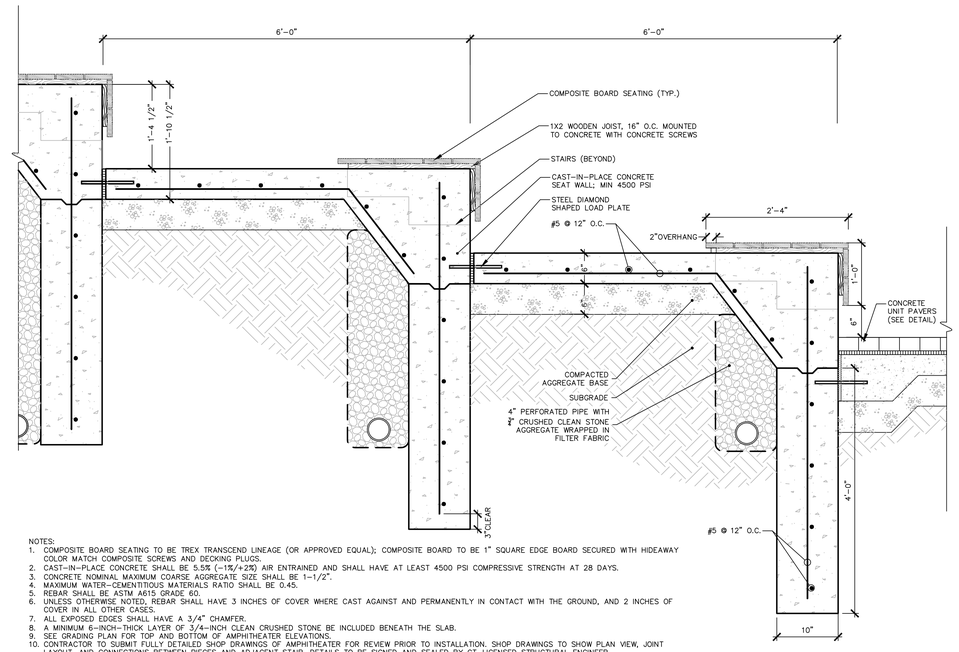
NOTES:
1. CAST-IN-PLACE CONCRETE SHALL BE 4500 PSI COMPRESSIVE STRENGTH AT 28 DAYS.
2. UNLESS OTHERWISE NOTED, REBAR SHALL HAVE MIN. 2 INCHES OF COVER.
3. CONTRACTOR TO SUBMIT PROJECT DATA, PHYSICAL SAMPLES, AND SHOP DRAWINGS OF CHEEK WALL AND ALL STAIR CONNECTIONS FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

4 CHEEK WALL
1" = 1'-0"



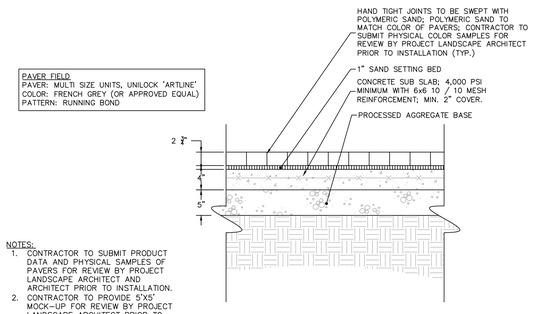
NOTES:
1. CONTRACTOR TO SUBMIT FULLY DETAILED SHOP DRAWINGS FOR SEAT WALL FOR REVIEW PRIOR TO INSTALLATION. SHOP DRAWINGS TO SHOW PLAN VIEW, JOINT LAYOUT, AND CONNECTIONS BETWEEN PRECAST PIECES. DETAILS TO BE SIGNED AND SEALED BY CT-LICENSED STRUCTURAL ENGINEER.
2. ACCEPTABLE MANUFACTURERS:
   a. WASAUMADE
   b. SOUTHSIDE PRECAST
   c. PRECAST SPECIALTIES CORP (PSC)
   d. QCP CORP.
3. LIGHT INTEGRAL COLORED CONCRETE WITH ETCHED FINISH. FINAL TEXTURES AND FINISHES TO BE SUBMITTED BASED ON SELECTED PRECASTER'S FULL RANGE OF COLORS. CONTRACTOR TO SUBMIT PHYSICAL SAMPLES OF CONCRETE AND WOOD FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
4. CONTRACTOR TO SUBMIT PRODUCT DATA FOR LANDSCAPE FORMS LINK BENCH SYSTEM (OR APPROVED EQUAL) FOR REVIEW BY LANDSCAPE ARCHITECT.

5 SEAT WALL
N.T.S



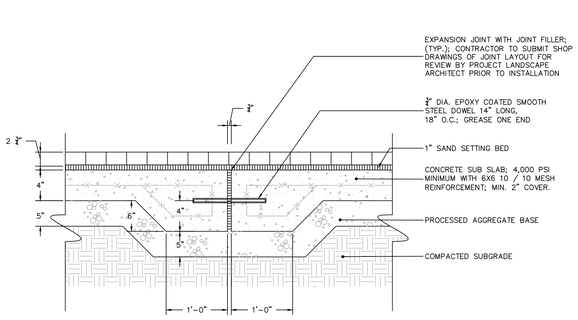
NOTES:
1. COMPOSITE BOARD SEATING TO BE TREX TRANSCEND LINEAGE (OR APPROVED EQUAL); COMPOSITE BOARD TO BE 1" SQUARE EDGE BOARD SECURED WITH HIDEAWAY COLOR MATCH COMPOSITE SCREWS AND DECKING PLUGS.
2. CAST-IN-PLACE CONCRETE SHALL BE 5.5% (-1%/+2%) AIR ENTRAINED AND SHALL HAVE AT LEAST 4500 PSI COMPRESSIVE STRENGTH AT 28 DAYS.
3. CONCRETE NOMINAL MAXIMUM COARSE AGGREGATE SIZE SHALL BE 1-1/2".
4. MAXIMUM WATER-CEMENTITIOUS MATERIALS RATIO SHALL BE 0.45.
5. REBAR SHALL BE ASTM A615 GRADE 60.
6. UNLESS OTHERWISE NOTED, REBAR SHALL HAVE 3 INCHES OF COVER WHERE CAST AGAINST AND PERMANENTLY IN CONTACT WITH THE GROUND, AND 2 INCHES OF COVER IN ALL OTHER CASES.
7. ALL EXPOSED EDGES SHALL HAVE A 3/4" CHAMFER.
8. A MINIMUM 6-INCH-THICK LAYER OF 3/4-INCH CLEAN CRUSHED STONE BE INCLUDED BENEATH THE SLAB.
9. SEE GRADING PLAN FOR TOP AND BOTTOM OF AMPHITHEATER ELEVATIONS.
10. CONTRACTOR TO SUBMIT FULLY DETAILED SHOP DRAWINGS OF AMPHITHEATER FOR REVIEW PRIOR TO INSTALLATION. SHOP DRAWINGS TO SHOW PLAN VIEW, JOINT LAYOUT, AND CONNECTIONS BETWEEN PIECES AND ADJACENT STAIR. DETAILS TO BE SIGNED AND SEALED BY CT-LICENSED STRUCTURAL ENGINEER.
11. CONTRACTOR TO SUBMIT PRODUCT DATA AND PHYSICAL SAMPLES OF CONCRETE AND TREX DECKING FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

6 AMPHITHEATER
N.T.S

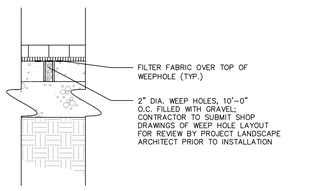


NOTES:
1. CONTRACTOR TO SUBMIT PRODUCT DATA AND PHYSICAL SAMPLES OF PAVERS FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT AND ARCHITECT PRIOR TO INSTALLATION.
2. CONTRACTOR TO PROVIDE 5'X5' MOCK-UP FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

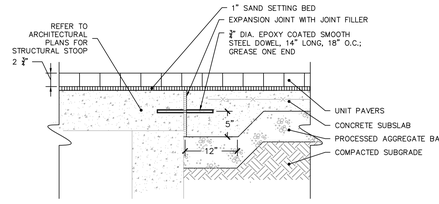
7 CONCRETE UNIT PAVERS
N.T.S



8 SUBSLAB EXPANSION JOINT
N.T.S



9 SUBSLAB WEEPHOLE
N.T.S



NOTES:
1. REFER TO STRUCTURAL DRAWINGS FOR STOOP DIMENSIONS AND DETAILS.

10 PAVERS OVER STRUCTURAL STOOP
N.T.S

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ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

SITE DETAILS III

STATE PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	AS NOTED
DATE	08/15/2025
DRAWN BY	CD
APPROVED BY	BC

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	CHANGE 1
5	05/19/2026	100% CD

Drawing No.

CS503

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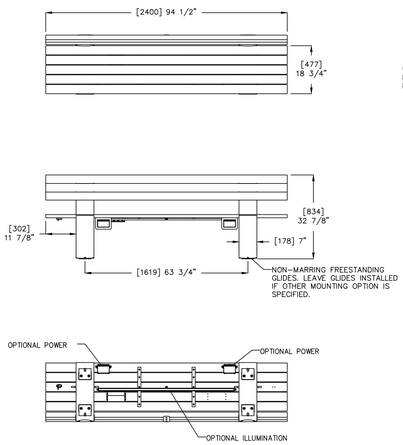
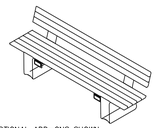
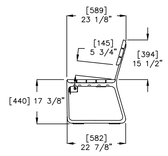
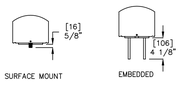
REFER TO INSTALLATION GUIDE FOR MORE DETAILS

SURFACE MOUNT OPTION INCLUDES (4) 5/8–11 THREADED ANCHORS. CONCRETE DROP–IN ANCHORS NOT INCLUDED. EMBEDDED OPTION INCLUDES (4) 3/8–16 THREADED RODS.




OPTIONAL ADD–ONS SHOWN:
POWER RECEPTACLE (1–2 LOCATIONS, 2 SHOWN)
LIGHTING (NOT SHOWN)

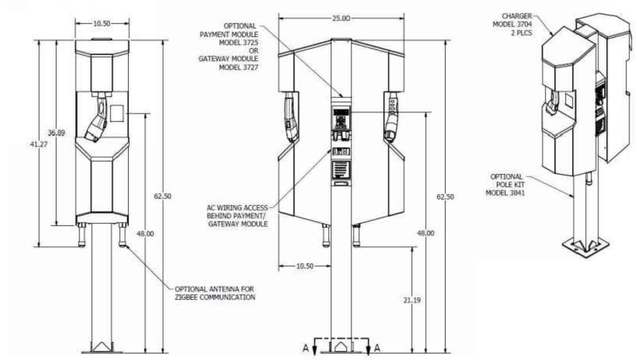




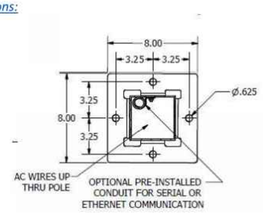
NOTES:
1. CONTRACTOR TO SUBMIT PRODUCT DATA FOR LANDSCAPE FORMS MUTIPLICITY BENCH (OR APPROVED EQUAL) FOR REVIEW BY LANDSCAPE ARCHITECT.
2. CONTRACTOR TO SUBMIT PHYSICAL SAMPLES FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

1 BENCH
N.T.S

3704 Mechanical Drawings (Dual Illustrated, Relevant Dimensions Apply to Single Pole and Wall Versions):

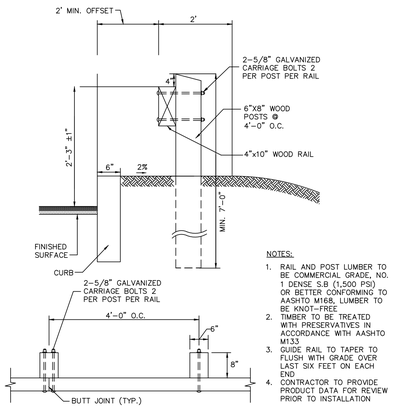


3704 Pole Base Mounting Dimensions:



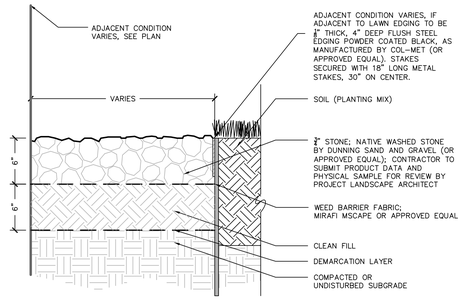
NOTES:
1. ALL LOCATIONS ARE TO RECEIVE DUAL CHARGER HEADS AS SHOWN IN CUT SHEET ABOVE.
2. FACE OF CHARGING UNIT TO BE INSTALLED 1'–4" BEHIND FACE OF CURB.
3. CONTRACTOR TO CARRY OPTION FOR BOTH PAYMENT MODULE OR GATEWAY MODULE; FINAL SELECTION AND FINAL PROGRAMMING REQUIREMENTS WILL BE MADE DURING SUBMITTAL PROCESS.

2 EV CHARGING STATION (OR APPROVED EQUAL)
N.T.S.

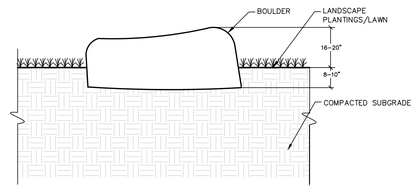


NOTES:
1. RAIL AND POST LUMBER TO BE COMMERCIAL GRADE, NO. 1 DENSE S.B (1,500 PSI) OR BETTER CONFORMING TO AASHTO M168, LUMBER TO BE KNOT–FREE
2. TIMBER TO BE TREATED WITH PRESERVATIVES IN ACCORDANCE WITH AASHTO M133
3. GUIDE RAIL TO TAPER TO FLUSH WITH GRADE OVER LAST SIX FEET ON EACH END
4. CONTRACTOR TO PROVIDE PRODUCT DATA FOR REVIEW PRIOR TO INSTALLATION

3 TIMBER GUIDERAIL
N.T.S



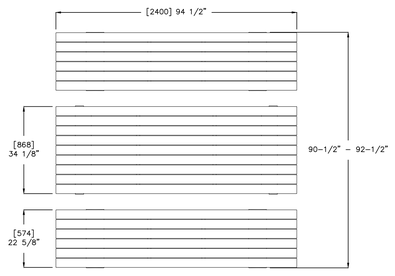
6 DECORATIVE STONE STRIP
N.T.S

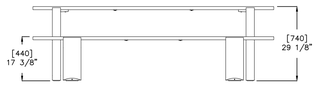


NOTES:
1. BOULDERS TO BE LOCATED IN THE FIELD BY PROJECT LANDSCAPE ARCHITECT.
2. EMBED MINIMUM 1/3 OF BOULDER INTO GROUND ON COMPACTED SUBGRADE.
3. CONTRACTOR TO SUBMIT PRODUCT DATA, PHOTO DOCUMENTATION, AND QUARRY SOURCE FOR REVIEW PRIOR TO INSTALLATION.
4. CONTRACTOR TO PROVIDE FULL MOCK–UP OF BOULDER INSTALLATION. FINAL BOULDER LOCATIONS TO BE VERIFIED IN FIELD BY PROJECT LANDSCAPE ARCHITECT.
5. BOULDER SIZING PARAMETERS:
   MINIMUM 36" LONG BY 24" WIDE.
   TOP OF BOULDER TO BE 16" TO 20" HEIGHT ABOVE FINISHED GRADE AFTER 8–10" EMBEDMENT PER DETAIL.

7 BOULDER
N.T.S

REFER TO INSTALLATION GUIDE FOR MORE DETAILS

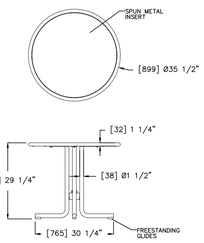


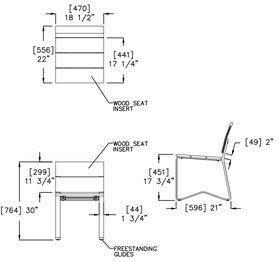




NOTES:
1. CONTRACTOR TO SUBMIT PRODUCT DATA FOR LANDSCAPE FORMS MUTIPLICITY BENCH (OR APPROVED EQUAL) FOR REVIEW BY LANDSCAPE ARCHITECT.
2. CONTRACTOR TO SUBMIT PHYSICAL SAMPLES FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

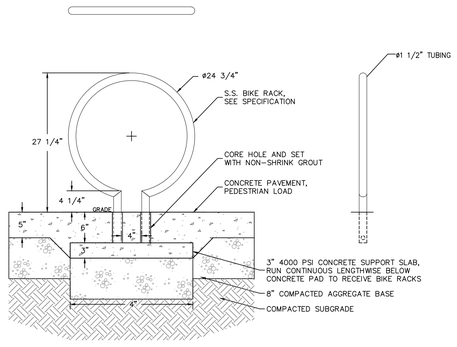
4 PICNIC TABLE
N.T.S





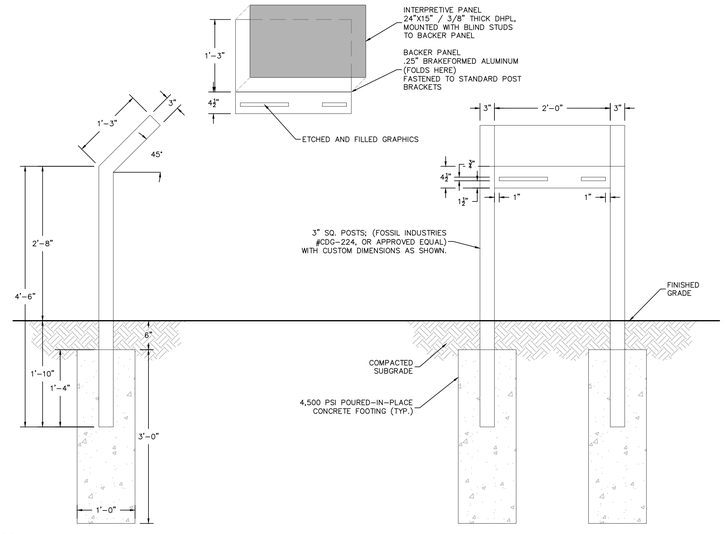
NOTES:
1. CONTRACTOR TO SUBMIT PRODUCT DATA FOR LANDSCAPE FORMS STEELHEAD METAL TABLE AND WINDMARK CHAIR (OR APPROVED EQUAL) FOR REVIEW BY LANDSCAPE ARCHITECT.
2. CONTRACTOR TO SUBMIT PHYSICAL SAMPLES FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

5 MOVEABLE SEATING
N.T.S



NOTE:
1. BIKE RACK TO BE RING BY LANDSCAPE FORMS (OR APPROVED EQUAL).
2. CONTRACTOR TO SUBMIT PRODUCT DATA AND PHYSICAL SAMPLES FOR REVIEW PRIOR TO INSTALLATION.
3. CENTERLINE OF BIKE RACKS TO BE SPACED MINIMUM 36" APART FROM ONE ANOTHER AND ANY OTHER STATIONARY OBJECT IN ANY DIRECTION.

8 BICYCLE RACK
N.T.S



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PROJECT NORTH

DR□WING TITL□

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5	05/19/2026	100□ CD

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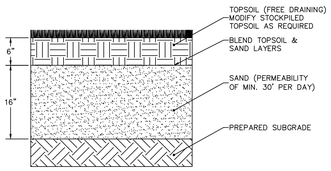

1 ATHLETIC FIELD CONSTRUCTION
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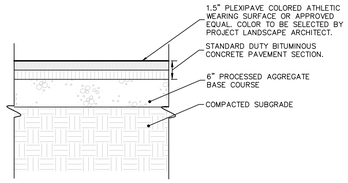
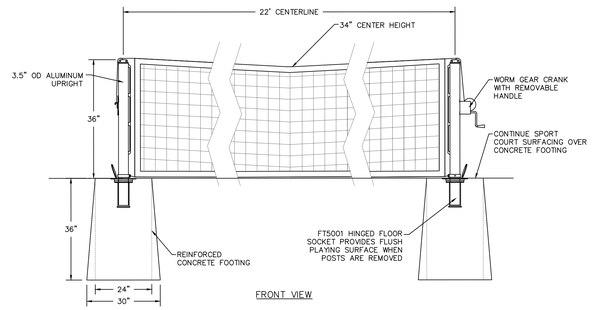


NOTE:
1. SPORT COURT SURFACING TO BE PLEXIPAVE BY CALIFORNIA SPORTS SURFACING (OR APPROVED EQUAL).
2. CONTRACTOR TO PROVIDE PRODUCT DATA FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
3. CONTRACTOR TO PROVIDE 5'x5' MOCKUP WITH FULL DEPTH BASE FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

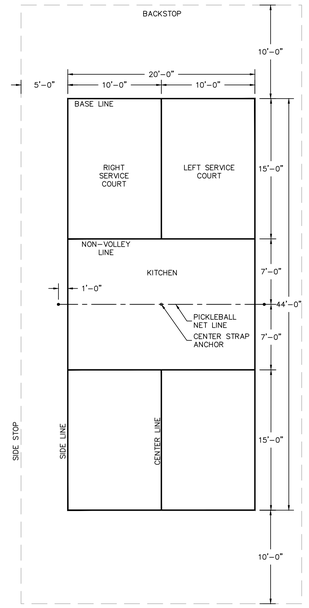
2 SPORT COURT SURFACING
N.T.S



MANUFACTURER NOTES:
1. ADDED FEATURE ALLOWS TOP OF PICKLEBALL POST TO TELESCOPE 6" TALLER FOR USE AS A TENNIS POST.

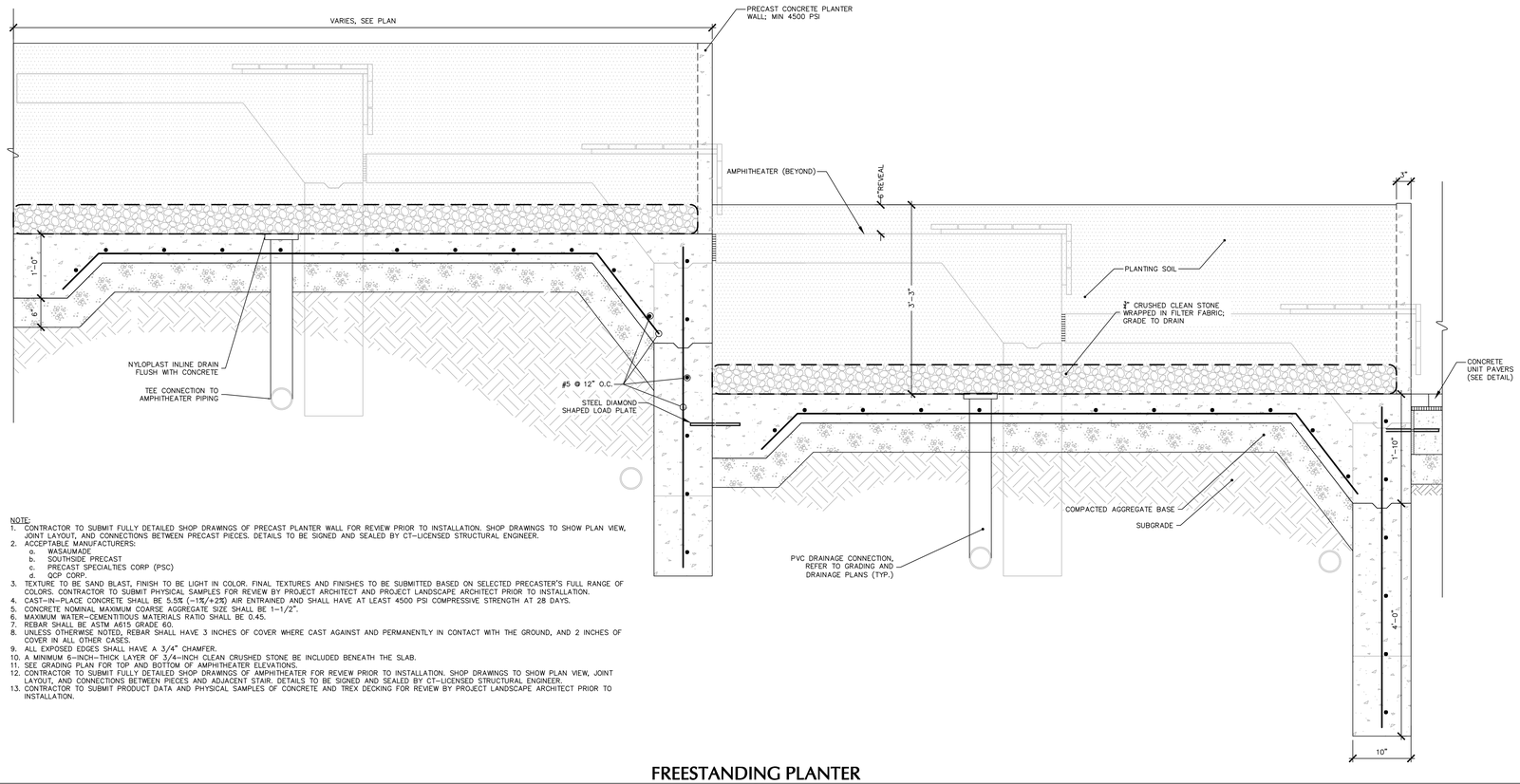
NOTES:
1. PRODUCT TO BE SENTRY PICKLEBALL POST SYSTEM BY FIRST TEAM (OR APPROVED EQUAL).
2. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. ALL INFORMATION CONTAINED HEREIN WAS CURRENT AT THE TIME OF DEVELOPMENT BUT MUST BE REVIEWED AND APPROVED BY THE PRODUCT MANUFACTURER TO BE CONSIDERED ACCURATE.
4. CONTRACTOR TO SUBMIT PRODUCT DATA AND PHYSICAL SAMPLES FOR REVIEW PRIOR TO INSTALLATION.
5. CONTRACTOR TO SUBMIT SIGNED AND SEALED SHOP DRAWINGS OF CONCRETE FOOTINGS AND NET COMPONENTS FOR REVIEW BY ENGINEER.

3 PICKLEBALL COURT POST
N.T.S



NOTE:
1. DIMENSIONS ARE TO THE CENTER OF PAINTED LINES THROUGHOUT THE COURT. ALL COURT MARKINGS TO BE 2" WIDE WHITE PAINT.
2. PICKLEBALL COURTS ARE TO BE COATED WITH COLORED SPORT COURT SURFACING.
3. CONTRACTOR TO PROVIDE PRODUCT DATA FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

4 PICKLEBALL COURT LAYOUT
N.T.S



NOTE:
1. CONTRACTOR TO SUBMIT FULLY DETAILED SHOP DRAWINGS OF PRECAST PLANTER WALL FOR REVIEW PRIOR TO INSTALLATION. SHOP DRAWINGS TO SHOW PLAN VIEW, JOINT LAYOUT, AND CONNECTIONS BETWEEN PRECAST PIECES. DETAILS TO BE SIGNED AND SEALED BY CT-LICENSED STRUCTURAL ENGINEER.
2. ACCEPTABLE MANUFACTURERS:
   a. WASAUMADE
   b. SOUTHSIDE PRECAST
   c. PRECAST SPECIALTIES CORP (PSC)
   d. QCP CORP.
3. TEXTURE TO BE SAND BLAST, FINISH TO BE LIGHT IN COLOR. FINAL TEXTURES AND FINISHES TO BE SUBMITTED BASED ON SELECTED PRECASTER'S FULL RANGE OF COLORS. CONTRACTOR TO SUBMIT PHYSICAL SAMPLES FOR REVIEW BY PROJECT ARCHITECT AND PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
4. CAST-IN-PLACE CONCRETE SHALL BE 5.5% (-1%/+2%) AIR ENTRAINED AND SHALL HAVE AT LEAST 4500 PSI COMPRESSIVE STRENGTH AT 28 DAYS.
5. CONCRETE NOMINAL MAXIMUM COARSE AGGREGATE SIZE SHALL BE 1-1/2".
6. MAXIMUM WATER-CEMENTITIOUS MATERIALS RATIO SHALL BE 0.45.
7. REBAR SHALL BE ASTM A615 GRADE 60.
8. UNLESS OTHERWISE NOTED, REBAR SHALL HAVE 3 INCHES OF COVER WHERE CAST AGAINST AND PERMANENTLY IN CONTACT WITH THE GROUND, AND 2 INCHES OF COVER IN ALL OTHER CASES.
9. ALL EXPOSED EDGES SHALL HAVE A 3/4" CHAMFER.
10. A MINIMUM 6-INCH-THICK LAYER OF 3/4-INCH CLEAN CRUSHED STONE BE INCLUDED BENEATH THE SLAB.
11. SEE GRADING PLAN FOR TOP AND BOTTOM OF AMPHITHEATER ELEVATIONS.
12. CONTRACTOR TO SUBMIT FULLY DETAILED SHOP DRAWINGS OF AMPHITHEATER FOR REVIEW PRIOR TO INSTALLATION. SHOP DRAWINGS TO SHOW PLAN VIEW, JOINT LAYOUT, AND CONNECTIONS BETWEEN PIECES AND ADJACENT STAIR. DETAILS TO BE SIGNED AND SEALED BY CT-LICENSED STRUCTURAL ENGINEER.
13. CONTRACTOR TO SUBMIT PRODUCT DATA AND PHYSICAL SAMPLES OF CONCRETE AND TREX DECKING FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

5 FREESTANDING PLANTER
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DRAINAGE NOTES

1. ALL PROPOSED STORM DRAINAGE PIPING TO UTILIZE WATER-TIGHT JOINTS.
2. LOCATIONS AND ELEVATIONS OF ROOF LEADERS SHOULD BE COORDINATED WITH ARCHITECTURAL DRAWINGS PRIOR TO CONSTRUCTION.
3. CLEANOUTS SHALL BE PROVIDED FLUSH TO GRADE AT ALL LOCATIONS OF ROOF DRAIN INTERSECTIONS, BENDS AND UPSTREAM ENDS.
4. ALL REQUIRED STORM LATERALS SERVICING THE BUILDING SHALL BE COORDINATED AND CONSTRUCTED TO WITHIN FIVE FEET OF EACH BUILDING LATERAL ENTRANCE LOCATION AT THE INVERTS NOTED. ANY NECESSARY EXTENSIONS, RELOCATIONS, OR CORRECTIONS WITHIN FIVE FEET OF THE BUILDING NECESSARY TO COMPLETE CONNECTION OF LATERALS TO THE BUILDINGS SHALL BE MADE BY THE BUILDING CONTRACTOR.
5. CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE APPROPRIATE SIZES OF THE DRAINAGE CATCH BASINS AND MANHOLES TO RECEIVE PIPING SHOWN.
6. STORM DRAINAGE PIPING INSTALLATION SHALL COMMENCE AT THE FURTHEST DOWNSTREAM POINT AND PROCEED UPSTREAM "IN THE DRY".
7. ABBREVIATIONS: RCP=REINFORCED CONCRETE PIPE
   HDPE=HIGH DENSITY POLYETHYLENE PIPE
   CCB=CURBED CATCH BASIN
   CLCB=CURBLESS CATCH BASIN
   MH=MANHOLE
   YD=YARD DRAIN
   WQU=WATER QUALITY UNIT
   HW=HEADWALL
   RIM=TOP OF RIM ELEVATION
   GR=TOP OF GRATE ELEVATION

GRADING NOTES

1. ACCESSIBLE PARKING AREAS NOT TO EXCEED 2% IN ANY DIRECTION.
2. ACCESSIBLE ROUTES NOT TO EXCEED 5% RUNNING SLOPE OR 2% CROSS-SLOPE.
3. BUILDING ENTRANCES AND RAMP LANDINGS NOT TO EXCEED 2% IN ANY DIRECTION.
4. ACCESSIBLE RAMPS TO BE CONSTRUCTED PER ADA REQUIREMENTS
5. ABBREVIATIONS: TC=TOP OF CURB
   BC=BOTTOM OF CURB
   LP=LOW POINT
   TW=TOP OF WALL
   BW=BOTTOM OF WALL

STORMWATER BASIN NOTES

1. DURING CLEARING AND GRADING OF THE SITE, MEASURES MUST BE TAKEN TO ELIMINATE SOIL COMPACTION AT THE LOCATION OF PROPOSED STORMWATER BASINS.
2. THE LOCATION OF PROPOSED STORMWATER BASINS MUST BE CORDONED OFF DURING CONSTRUCTION TO PREVENT COMPACTION OF THE SUBSOIL BY CONSTRUCTION EQUIPMENT OR MATERIAL STOCKPILES AND PREVENT SILT ACCUMULATION.
3. THE USE OF A PROPOSED STORMWATER BASIN LOCATION FOR A TEMPORARY SEDIMENT TRAP DURING CONSTRUCTION IS DISCOURAGED, HOWEVER, WHEN UNAVOIDABLE, EXCAVATION FOR THE TEMPORARY SEDIMENT TRAP MUST BE A MINIMUM OF TWO FEET ABOVE THE FINAL DESIGN ELEVATION OF THE BOTTOM OF THE PROPOSED STORMWATER BASIN.
4. EXCAVATION AND CONSTRUCTION OF A STORMWATER BASIN MUST BE PERFORMED USING EQUIPMENT PLACED OUTSIDE OF THE LIMITS OF THE BASIN.
5. THE EXCAVATION TO THE FINAL DESIGN ELEVATION OF A STORMWATER BASIN MAY ONLY OCCUR AFTER ALL CONSTRUCTION WITHIN ITS DRAINAGE AREA IS COMPLETED AND THE DRAINAGE AREA IS STABILIZED. IF CONSTRUCTION OF A STORMWATER BASIN OR RAIN GARDEN CANNOT BE DELAYED, BERMS MUST BE PLACED AROUND THE PERIMETER OF THE BASIN THROUGHOUT ALL PHASES OF CONSTRUCTION TO DIVERT FLOWS AWAY FROM THE BASIN. THE BERMS MAY NOT BE REMOVED UNTIL ALL CONSTRUCTION WITHIN THE DRAINAGE AREA IS COMPLETED AND THE DRAINAGE AREA IS STABILIZED.
6. THE CONTRIBUTING DRAINAGE AREA MUST BE COMPLETELY STABILIZED PRIOR TO STORMWATER BASIN USE.
7. PRIOR TO PLACING THE BASIN SOIL MIX AND PLANTINGS, CONTRACTOR TO REMOVE ALL ACCUMULATED SILT AND SEDIMENT AND PERFORM THREE PERCOLATION TESTS IN THE PRESENCE OF THE ENGINEER TO ENSURE INFILTRATION CAPABILITIES.
8. STORMWATER BASINS ARE TO BE INSPECTED AFTER EVERY MAJOR STORM EVENT FOR THE FIRST 6 MONTHS POST CONSTRUCTION TO ENSURE PROPER INFILTRATION IS REALIZED. INSPECTION LOG TO CAPTURE THE DURATION OF STANDING WATER IN THE BASIN POST STORM AND AMOUNT OF ANY SEDIMENT BUILDUP TO DETERMINE IF BASIN IS CLOGGED. IF BASIN IS CLOGGED, CONTRACTOR TO REMOVE CLOGGED BASIN MATERIALS AND REPLACE WITH NEW. ADDITIONALLY, CONTRACTOR TO REMOVE ANY ACCUMULATED SEDIMENT PRIOR TO PLACING TOPSOIL AND PLANTINGS.
9. POST 6 MONTHS OF OPERATION, STORMWATER BASIN MAINTENANCE TO CONTINUE IN ACCORDANCE WITH MOST CURRENT CONNECTICUT STORMWATER QUALITY MANUAL.
10. CONTRACTOR TO PERFORM FIELD PERMEABILITY TESTS BOTH PRE- AND POST-CONSTRUCTION TO CONFIRM PERCOLATION RATES WITHIN THE DETENTION BASINS REMAIN THE SAME AS DESIGNED.



LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
MINOR CONTOUR	149	149
MAJOR CONTOUR	150	150
SPOT GRADE	×150.1	×150.1
STORM LINE		
CATCH BASIN		
YARD DRAIN		
STORM MANHOLE	Ⓟ	

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

CONTRACTOR NOTES

1. THE WORK TO BE PERFORMED IS AS SHOWN ON THE DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION; AS SUCH, THESE PLANS MAY NOT COMPLETELY REPRESENT ALL SPECIFIC DETAILS OF INSTALLATION REQUIRED FOR CONSTRUCTION. CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL IMPROVEMENTS REQUIRED TO ACHIEVE CONSTRUCTION DEPICTED ON THESE PLANS.
2. THE CONTRACTOR SHALL PROVIDE WRITTEN REQUESTS FOR INFORMATION TO THE ENGINEER PRIOR TO THE CONSTRUCTION OF ANY SPECIFIC SITEWORK ITEM IF ANY SITEWORK ITEM DEPICTED ON THE PLANS WARRANTS ADDITIONAL ENGINEERING INFORMATION REQUIRED FOR CONSTRUCTION AND IS NOT RELATED TO MEANS AND METHODS OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITEWORK ITEMS INSTALLED DIFFERENTLY THAN INTENDED AS DEPICTED ON THE PLANS IN THE ABSENCE OF SUBMITTING AND RECEIVING REVIEWS AND/OR DIRECTION ON WRITTEN REQUESTS FOR INFORMATION.
3. THE CONTRACTOR SHALL ACCEPT THE SITE AS IS. THE CONTRACTOR SHALL MAKE AND SHALL BE DEEMED TO HAVE MADE A THOROUGH SITE INSPECTION IN ORDER TO FIELD CHECK EXISTING SITE CONDITIONS, CORRELATE CONDITIONS WITH THE DRAWINGS AND RESOLVE ANY POSSIBLE CONSTRUCTION CONFLICTS WITH THE ENGINEER PRIOR TO COMMENCEMENT OF WORK. THIS INCLUDES A TOPOGRAPHIC SURVEY OF ANY AREAS THE CONTRACTOR REQUIRES ADDITIONAL TOPOGRAPHIC INFORMATION.
4. IT IS SPECIFICALLY NOTED THAT INFORMATION RELATED TO ELEVATIONS AND PROPOSED UTILITIES (SUCH AS ROADWAY GRADES, INVERT ELEVATIONS, RIM ELEVATIONS, GRATE ELEVATIONS, BUILDING FINISHED FLOOR ELEVATIONS, ETC.) MAY BE FOUND IN MORE THAN ONE LOCATION ON THE DRAWINGS. CONTRACTOR SHALL REVIEW ALL PLANS, PROFILES AND ANY INFORMATION/DATA TO ENABLES FOR CONSISTENCY PRIOR TO CONSTRUCTION. ANY INCONSISTENCIES OR DISCREPANCIES THAT ARE FOUND SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING REQUESTING CLARIFICATION PRIOR TO CONSTRUCTION.
5. CONTRACTOR SHALL NOTE THAT THERE ARE ADDITIONAL NOTES, SPECIFICATIONS AND REQUIREMENTS CONTAINED ON SHEETS THROUGHOUT THE PLAN SET AND AVAILABLE REFERENCES TO SPECIFICATIONS FROM APPLICABLE GOVERNING AUTHORITIES AND INDUSTRY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN, REVIEW AND ADHERE TO ALL APPLICABLE REQUIREMENTS.

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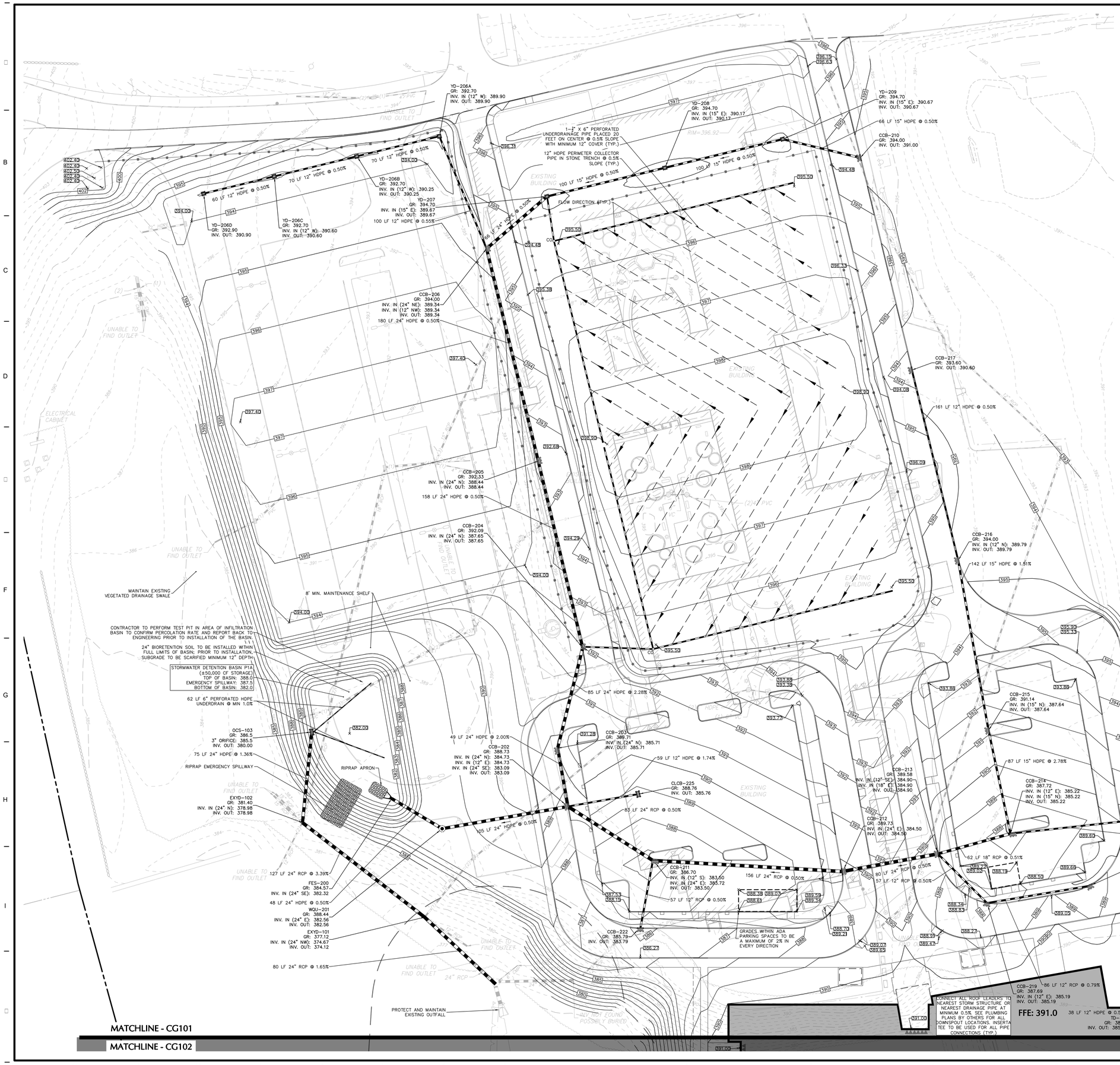
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MATCHLINE - CG102
YD-206A
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GR: 392.70
INV. IN (12" W): 390.25
INV. OUT: 390.25
YD-206C
GR: 392.70
INV. IN (12" W): 390.60
INV. OUT: 390.60
YD-206D
GR: 392.90
INV. OUT: 390.90
YD-207
GR: 394.70
INV. IN (15" E): 389.67
INV. OUT: 389.67
100 LF 12" HDPE @ 0.55%
YD-208
GR: 394.70
INV. IN (15" E): 390.17
INV. OUT: 390.17
YD-209
GR: 394.70
INV. IN (15" E): 390.67
INV. OUT: 390.67
66 LF 15" HDPE @ 0.50%
CCB-210
GR: 394.00
INV. OUT: 391.00
100 LF 15" HDPE @ 0.50%
1-4" X 6" PERFORATED UNDERDRAINAGE PIPE PLACED 20 FEET ON CENTER @ 0.5% SLOPE WITH MINIMUM 12" COVER (TYP.)
12" HDPE PERIMETER COLLECTOR PIPE IN STONE TRENCH @ 0.5% SLOPE (TYP.)
FLOW DIRECTION (TYP.)
EXISTING BUILDING
70 LF 12" HDPE @ 0.50%
60 LF 12" HDPE @ 0.50%
70 LF 12" HDPE @ 0.50%
UNABLE TO FIND OUTLET
CCB-206
GR: 394.00
INV. IN (24" NE): 389.34
INV. IN (12" NW): 389.34
INV. OUT: 389.34
180 LF 24" HDPE @ 0.50%
CCB-205
GR: 392.33
INV. IN (24" N): 388.44
INV. OUT: 388.44
158 LF 24" HDPE @ 0.50%
CCB-204
GR: 392.09
INV. IN (24" N): 387.65
INV. OUT: 387.65
CCB-217
GR: 393.60
INV. OUT: 390.60
161 LF 12" HDPE @ 0.50%
CCB-216
GR: 394.00
INV. IN (12" N): 389.79
INV. OUT: 389.79
142 LF 15" HDPE @ 1.51%
CCB-215
GR: 391.14
INV. IN (15" N): 387.64
INV. OUT: 387.64
87 LF 15" HDPE @ 2.78%
CCB-214
GR: 387.72
INV. IN (12" E): 385.22
INV. IN (15" N): 385.22
INV. OUT: 385.22
CCB-213
GR: 389.58
INV. IN (12" SE): 384.90
INV. IN (18" E): 384.90
INV. OUT: 384.90
CCB-212
GR: 389.73
INV. IN (24" E): 384.50
INV. OUT: 384.50
CCB-218
GR: 390.51
INV. OUT: 387.51
92 LF 12" HDPE @ 2.49%
CCB-219A
GR: 388.37
INV. OUT: 385.87
62 LF 18" RCP @ 0.51%
80 LF 24" RCP @ 0.50%
57 LF 12" RCP @ 0.50%
156 LF 24" RCP @ 0.50%
CCB-211
GR: 386.70
INV. IN (12" S): 383.50
INV. IN (24" E): 383.72
INV. OUT: 383.50
57 LF 12" RCP @ 0.50%
CCB-222
GR: 385.79
INV. OUT: 383.79
GRADES WITHIN ADA PARKING SPACES TO BE A MAXIMUM OF 2% IN EVERY DIRECTION
CCB-219
GR: 387.69
INV. IN (12" E): 385.19
INV. OUT: 385.19
86 LF 12" RCP @ 0.79%
CONNECT ALL ROOF LEADERS TO NEAREST STORM STRUCTURE OR NEAREST DRAINAGE PIPE AT A MINIMUM 0.5% SEE PLUMBING PLANS BY OTHERS FOR ALL DOWNSPOUT LOCATIONS. INSERTA TEE TO BE USED FOR ALL PIPE CONNECTIONS (TYP.)
FFE: 391.0
TD-412
GR: 388.8
INV. OUT: 385.93
38 LF 12" HDPE @ 0.50%
CCB-411
GR: 389.40
INV. OUT: 386.30
66 LF 12" HDPE @ 0.50%
MH-410
GR: 389.74
INV. IN (12" W): 385.74
INV. IN (12" N): 385.98
INV. OUT: 385.64
OCS-103
GR: 386.5
3" ORIFICE: 385.5
INV. OUT: 380.00
75 LF 24" HDPE @ 1.36%
RIPRAP EMERGENCY SPILLWAY
RIPRAP APRON
EXYD-102
GR: 381.40
INV. IN (24" N): 378.98
INV. OUT: 378.98
127 LF 24" RCP @ 3.39%
FES-200
GR: 384.57
INV. IN (24" SE): 382.32
48 LF 24" HDPE @ 0.50%
WQU-201
GR: 388.44
INV. IN (24" E): 382.56
INV. OUT: 382.56
EXYD-101
GR: 377.12
INV. IN (24" NW): 374.67
INV. OUT: 374.12
80 LF 24" RCP @ 1.65%
49 LF 24" HDPE @ 2.00%
CCB-202
GR: 388.73
INV. IN (24" N): 384.73
INV. IN (12" E): 384.73
INV. IN (24" SE): 383.09
INV. OUT: 383.09
CCB-203
GR: 389.71
INV. IN (24" N): 385.71
INV. OUT: 385.71
59 LF 12" HDPE @ 1.74%
CLCB-225
GR: 388.76
INV. OUT: 385.76
83 LF 24" RCP @ 0.50%
105 LF 24" HDPE @ 0.50%
85 LF 24" HDPE @ 2.28%
MAINTAIN EXISTING VEGETATED DRAINAGE SWALE
8' MIN. MAINTENANCE SHELF
CONTRACTOR TO PERFORM TEST PIT IN AREA OF INFILTRATION BASIN TO CONFIRM PERCOLATION RATE AND REPORT BACK TO ENGINEERING PRIOR TO INSTALLATION OF THE BASIN.
24" BIORETENTION SOIL TO BE INSTALLED WITHIN FULL LIMITS OF BASIN; PRIOR TO INSTALLATION, SUBGRADE TO BE SCARIFIED MINIMUM 12" DEPTH
STORMWATER DETENTION BASIN P1A
(±50,000 CF STORAGE)
TOP OF BASIN: 388.0
EMERGENCY SPILLWAY: 387.5
BOTTOM OF BASIN: 382.0
62 LF 6" PERFORATED HDPE UNDERDRAIN @ MIN 1.0%
PROTECT AND MAINTAIN EXISTING OUTFALL
ELECTRICAL CABINET
HDPE
24" RCP
(2)24" RCP
(2)24" PVC
(2)12" PVC
(2)12" HDPE
(1)12" HDPE
(2)24" HDPE
(2)24" RCP
(1)24" RCP
(2)24" PVC

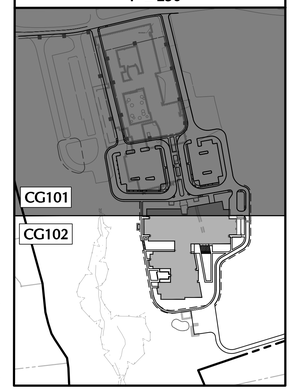
GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
MINOR CONTOUR	149	149
MAJOR CONTOUR	150	150
SPOT GRADE	×150.1	×150.1
STORM LINE		
CATCH BASIN		
YARD DRAIN		
STORM MANHOLE		

SHEET LEGEND
1" = 250'



MATCHLINE - CG101

MATCHLINE - CG102

CONNECT ALL ROOF LEADERS TO NEAREST STORM STRUCTURE OR NEAREST DRAINAGE PIPE AT MINIMUM 0.5% SEE PLUMBING PLANS BY OTHERS FOR ALL DOWNSPOUT LOCATIONS. INSERT A TEE TO BE USED FOR ALL PIPE CONNECTIONS (TYP.)

FFE: 391.0

FFE: 377.0

YD-301 GR: 375.50 INV. IN (12" S): 371.33 INV. IN (12" NE): 372.40 INV. OUT: 373.05
25 LF 12" HDPE @ 0.50%
FES-300 GR: 374.12 INV. IN (12" NE): 372.93
PREFORMED SCOUR HOLE
83 LF 12" HDPE @ 0.50%
39 LF 12" HDPE @ 2.82%
YD-305 GR: 374.90 INV. IN (12" E): 371.85 INV. OUT: 371.75
30 LF 12" HDPE @ 0.85%
YD-306 GR: 375.10 INV. IN (12" NE): 372.10 INV. IN (12" SE): 372.10 INV. OUT: 372.10
39 LF 12" HDPE @ 2.80%
YD-309 GR: 375.70 INV. IN (12" E): 373.20 INV. OUT: 373.20
30 LF 12" HDPE @ 2.66%
YD-302 GR: 376.00 INV. IN (12" E): 372.90 INV. OUT: 372.80
35 LF 12" HDPE @ 1.15%
30 LF 12" HDPE @ 2.66%
YD-307 GR: 375.70 INV. IN (12" E): 373.20 INV. OUT: 373.20
YD-308 GR: 376.50 INV. OUT: 374.00
YD-310 GR: 376.50 INV. OUT: 374.00
44 LF 12" HDPE @ 1.57%
YD-303 GR: 376.40 INV. IN (12" E): 373.58 INV. OUT: 373.58
42 LF 12" HDPE @ 1.00%
YD-304 GR: 376.40 INV. OUT: 374.00
25 LF 6" HDPE FOOTING DRAIN
CONNECT BUILDING FOUNDATION DRAINAGE TO STORM NETWORK. COORDINATE WITH ARCHITECT FOR FOUNDATION DRAINAGE CONNECTION.
14 LF 6" HDPE @ MIN 0.5%
YD-418 GR: 376.20 INV. OUT: 373.70
36 LF 12" HDPE @ 0.50%
YD-417 GR: 375.50 INV. IN (12" NW): 373.52 INV. OUT: 373.52
24 LF 12" HDPE @ 0.50%
YD-416 GR: 375.50 INV. IN (12" N): 373.40 INV. OUT: 373.40
23 LF 12" HDPE @ 0.50%
14 LF 8" HDPE @ 0.50%
ROOF DRAIN INV.: 372.28 SEE MEP PLANS.
YD-415 GR: 376.30 INV. IN (12" N): 373.29 INV. IN (8" W): 373.21 INV. OUT: 373.21
63 LF 12" HDPE @ 0.50%
YD-414 GR: 376.30 INV. IN (12" N): 372.89 INV. OUT: 372.89
63 LF 12" HDPE @ 0.50%
YD-413 GR: 376.30 INV. IN (12" N): 372.58 INV. OUT: 372.58
23 LF 12" HDPE @ 0.50%
YD-418A GR: 376.10 INV. IN (12" NE): 372.46 INV. IN (12" W): 371.89 INV. OUT: 371.89
ROOF DRAIN INV.: 372.33 SEE MEP PLANS.
30 LF 8" HDPE @ 0.50%
YD-419 GR: 376.10 INV. IN (8" N): 372.18 INV. IN (12" W): 373.38 INV. OUT: 372.18
YD-420 GR: 376.10 INV. OUT: 373.94
56 LF 12" HDPE @ 1.00%
58 LF 12" HDPE @ 0.50%
4" PERFORATED HDPE PIPE. REFER TO DETAIL CS503/6.
NYLOPLAST INLINE DRAIN FLUSH WITH BOTTOM OF PLANTER BED. REFER TO DETAIL CS505/5.
33 LF 12" HDPE @ 2.00%
ROOF DRAIN INV.: 383.50 SEE MEP PLANS.
89 LF 15" HDPE @ 1.00%
17 LF 12" HDPE @ 1.38%
CCB-409 GR: 389.40 INV. IN (12" N): 385.40 INV. OUT: 385.30
77 LF 12" HDPE @ 0.50%
CCB-408 GR: 389.16 INV. IN (12" N): 384.92 INV. OUT: 384.82
40 LF 12" HDPE @ 0.50%
17 LF 12" HDPE @ 2.00%
CCB-407 GR: 388.00 INV. IN (12" NW): 382.49 INV. IN (12" NE): 384.62 INV. OUT: 382.49
CCB-406 GR: 386.98 INV. IN (15" NE): 381.61 INV. IN (12" NW): 383.16 INV. OUT: 381.61
48 LF 15" HDPE @ 1.00%
CCB-405 GR: 385.28 INV. IN (15" NE): 381.13 INV. OUT: 381.13
92 LF 15" HDPE @ 4.36%
CCB-404 GR: 380.93 INV. IN (15" N): 377.12 INV. OUT: 377.12
50 LF 15" HDPE @ 3.84%
CCB-403 GR: 378.62 INV. IN (15" N): 375.20 INV. OUT: 375.20
42 LF 18" HDPE @ 1.00%
33 LF 12" HDPE @ 0.50%
MH-402 GR: 377.72 INV. IN (18" NE): 374.79 INV. IN (12" NW): 371.73 INV. OUT: 371.73
59 LF 18" HDPE @ 0.50%
WQU-401 GR: 376.18 INV. IN (18" N): 371.43 INV. OUT: 371.43
60 LF 18" HDPE @ 0.50%
RIPRAP SPLASH PAD
LEVEL SPREADER CURB PIECE
RIPRAP EMERGENCY SPILLWAY
FES-400 INV. (18"): 371.13
EXISTING BUILDING
CONC. BLOCK WALL
CURB BOX
BENCH
BIT. WALK
GATE
GRAVEL
BASEBALL FIELD
WOODED AREA
GRASS

30 0 15 30
SCALE: 1 INCH = 30 FEET

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

GRADING AND DRAINAGE PLAN II

START PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	AS NOTED
DATE	08/15/2025
DRAWN BY	CD
APPROVED BY	BS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	ADDENDUM 1
5	05/19/2026	100% CD

Drawing No.

CG102

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ADD/ALTERNATE C1:
MILL AND OVERLAY, RESTRIPE

CONTRACTOR TO BORE EXISTING PAVEMENT TO DETERMINE THICKNESS OF BOTH PAVEMENT AND GRAVEL BASE. REPORT FINDINGS TO CIVIL ENGINEER PRIOR TO CONSTRUCTION. IF THE EXISTING PAVEMENT DOES NOT MEET PROJECT REQUIREMENTS, PROVIDE FULL DEPTH HEAVY DUTY BITUMINOUS CONCRETE PAVEMENT SECTION.

STRUCTURES YD-207, YD-208, YD-209 AND CONNECTED PIPING NOT TO BE INSTALLED FOR ADD/ALTERNATE C2

ADD/ALTERNATE C2:
44 ADDITIONAL PARKING SPACES

111 LF 15" HDPE @ 0.56%
54 LF 12" HDPE @ MIN 1.0%

95 LF 15" HDPE @ 0.50%
CLCB-207A
GR: 393.50
INV. IN (15" E): 389.97
INV. OUT: 389.97

111 LF 15" HDPE @ 0.50%
CLCB-208A
GR: 393.50
INV. IN (15" E): 390.45
INV. OUT: 390.45

UNABLE TO FIND OUTLET

FLOW DIRECTION (TYP.)

1-4" X 6" PERFORATED UNDERDRAINAGE PIPE PLACED 20 FEET ON CENTER @ 0.5% SLOPE WITH MINIMUM 12" COVER (TYP.)

ALL PURPOSE ATHLETIC FIELD

340.0'

ADD/ALTERNATE C1:
ADDITIONAL ATHLETIC FIELD AND UNDERDRAINAGE

200.0'

12" HDPE PERIMETER COLLECTOR PIPE IN STONE TRENCH @ 0.5% SLOPE (TYP.)

ADD/ALTERNATE C4:
4 PICKLEBALL COURTS

SWING GATE

EXISTING BUILDING

24" RCP

(2)4" PVC

HDPE

UNLV NOT FOUND POSSIBLY BURIED

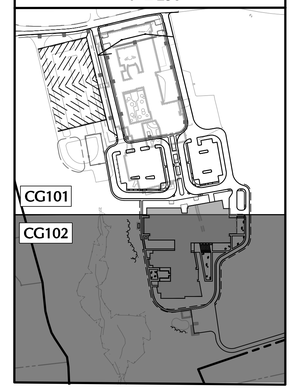
MATCHLINE - CG101

MATCHLINE - CG102

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
WETLAND BOUNDARY		
UPLAND REVIEW AREA		
MINOR CONTOUR	149	149
MAJOR CONTOUR	150	150
SPOT GRADE	×150.1	×150.1
STORM LINE		
CATCH BASIN		
YARD DRAIN		
STORM MANHOLE		

SHEET LEGEND
1" = 250'



GENERAL NOTES

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30 0 15 30
SCALE: 1 INCH = 30 FEET

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TRUMBULL HILLCR□ST MIDDL□ SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

DR□WING TITL□

GR□DING □
DR□IN□G□ □L□N -
□LT□RN□T□S

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD □
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S □ 1
5	05/19/2026	100□ CD

Drawing No.

CG201

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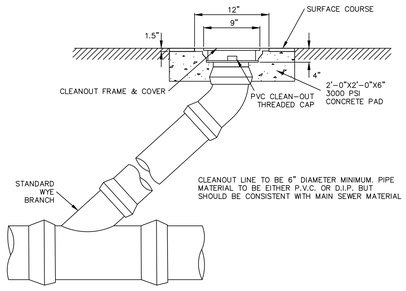
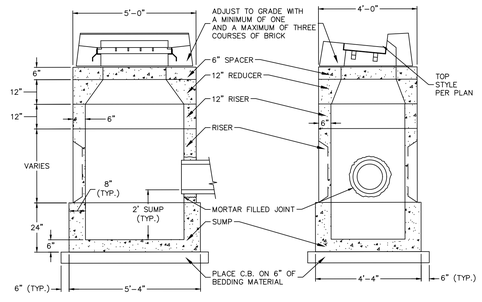


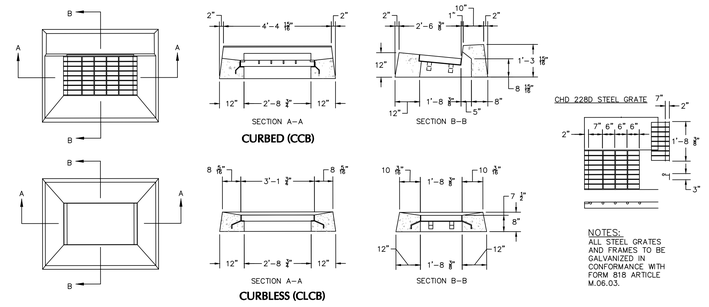
NOTES:
1. THE CONTRACTOR SHALL PROVIDE ALL APPROPRIATE AND NECESSARY FITTING AND ADAPTORS.

1 STORM CLEANOUT
N.T.S

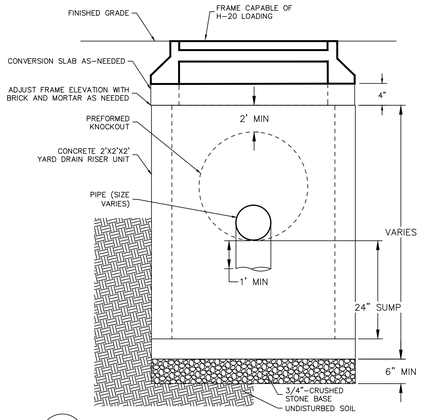


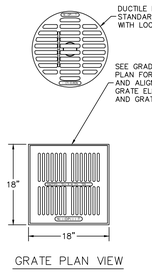
NOTES:
ALL CATCH BASIN COMPONENTS TO BE PRE-CAST REINFORCED CONCRETE, ABLE TO WITHSTAND THE APPLIED EARTH LOADS WITH AN HS-20 TRUCK LOAD. ALL JOINTS TO BE MORTARED. CATCH BASIN SHALL CONFORM TO ASTM C478.

2 CATCH BASIN
N.T.S

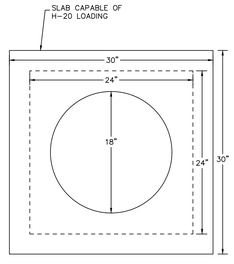


3 CATCH BASIN TOP
N.T.S





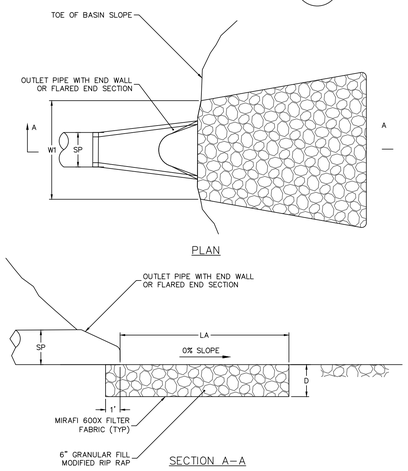
GRATE PLAN VIEW



CONVERSION SLAB PLAN VIEW

NOTES:
1. GRATES SHALL BE ROUND IN LAWN/FIELD AREAS AND SQUARE IN HARDSCAPE AREAS.
2. NEENAH ADA COMPLIANT TYPE "Q" GRATES OR APPROVED EQUAL (MAXIMUM SLOT OPENING 1/2" MAX.) SHALL BE USED IN ALL ADA ACCESSIBLE AREAS AND WHERE SPECIFIED. CONTRACTOR TO CONFIRM WHETHER OR NOT A GRATE IS LOCATED WITHIN AN ACCESSIBLE ROUTE.
3. GRATES SHALL BE CAPABLE OF H20 LOADING.
4. ALL INLET GRADES TO BE ADA COMPLIANT.

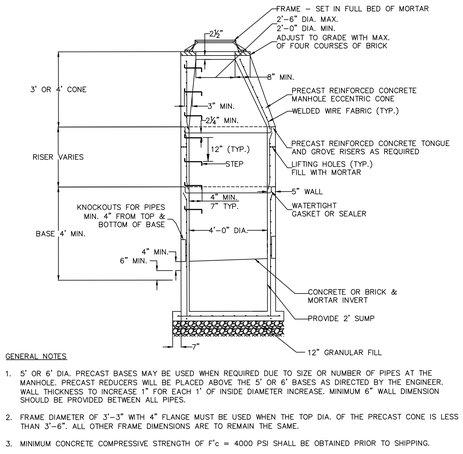
4 YARD DRAIN
N.T.S



SECTION A-A

NOTES:
1. SEE GRADING AND DRAINAGE PLAN FOR SIZES/DIMENSIONS
2. MATERIALS AND SIZE OF OUTLET PROTECTION TO BE CONSISTENT WITH REQUIREMENTS OF CONNDOT DRAINAGE MANUAL SECTION 11.13 – OUTLET PROTECTION.

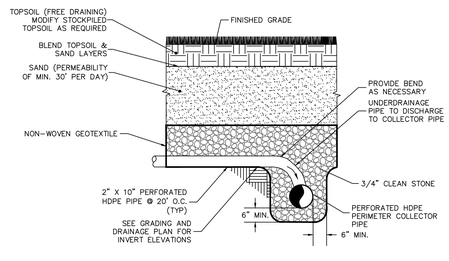
5 RIPRAP APRON WITH FLARED END SECTION
N.T.S.

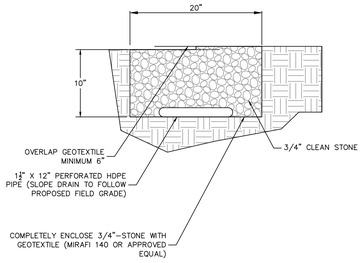


GENERAL NOTES

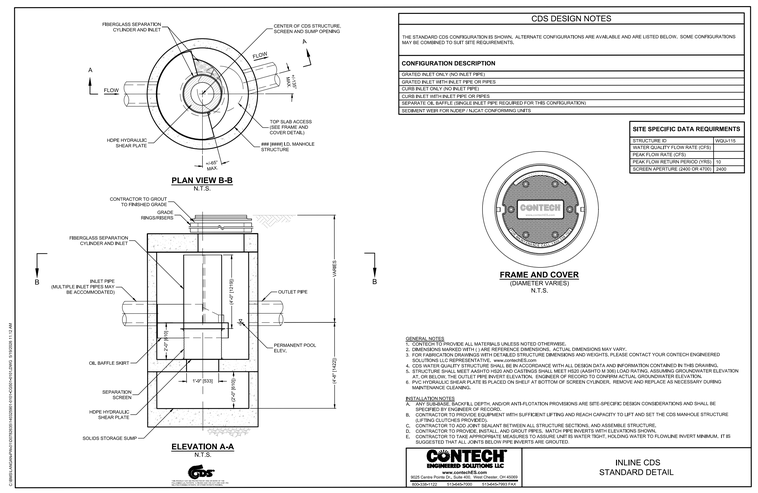
1. 5' OR 6' DIA. PRECAST BASES MAY BE USED WHEN REQUIRED DUE TO SIZE OR NUMBER OF PIPES AT THE MANHOLE. PRECAST REDUCERS WILL BE PLACED ABOVE THE 5' OR 6' BASES AS DIRECTED BY THE ENGINEER. WALL THICKNESS TO INCREASE 1" FOR EACH 1' OF INSIDE DIAMETER INCREASE. MINIMUM 6" WALL DIMENSION SHOULD BE PROVIDED BETWEEN ALL PIPES.
2. FRAME DIAMETER OF 3'–3" WITH 4" FLANGE MUST BE USED WHEN THE TOP DIA. OF THE PRECAST CONE IS LESS THAN 3'–6". ALL OTHER FRAME DIMENSIONS ARE TO REMAIN THE SAME.
3. MINIMUM CONCRETE COMPRESSIVE STRENGTH OF $f'c$ = 4000 PSI SHALL BE OBTAINED PRIOR TO SHIPPING.

6 MANHOLE
N.T.S





7 NATURAL TURF UNDERDRAINAGE
N.T.S



CDS DESIGN NOTES

THE STANDARD CDS CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

SITE SPECIFIC DATA REQUIRMENTS	
STRUCTURE ID	WQU115
WATER QUALITY FLOW RATE (CFS)	
PEAK FLOW RATE (CFS)	
PEAK FLOW RETURN PERIOD (YRS)	10
SCREEN APERTURE (2400 OR 4700)	2400

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS, INCLUDING ACTUAL DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE, www.contechES.com.
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO H20 AND CASTINGS SHALL MEET H20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. FOR CDS STRUCTURES, SUMP PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. CDS STRUCTURE WITH WET SEAL DEPTH AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO PROVIDE SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
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800.338.1122 513.645.7000 513.645.7993 FAX

INLINE CDS
STANDARD DETAIL

8 WATER QUALITY UNIT (OR APPROVED EQUAL)
N.T.S

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146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

Project Status
KEY PLAN
PROJECT NORTH

DRAWING TITLE
GRADING AND DRAINAGE DETAILS I

STATE PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	AS NOTED
DATE	08/15/2025
DRAWN BY	CD
CHECKED BY	BC

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

Drawing No.
CG501

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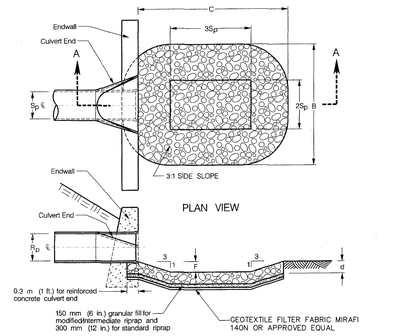
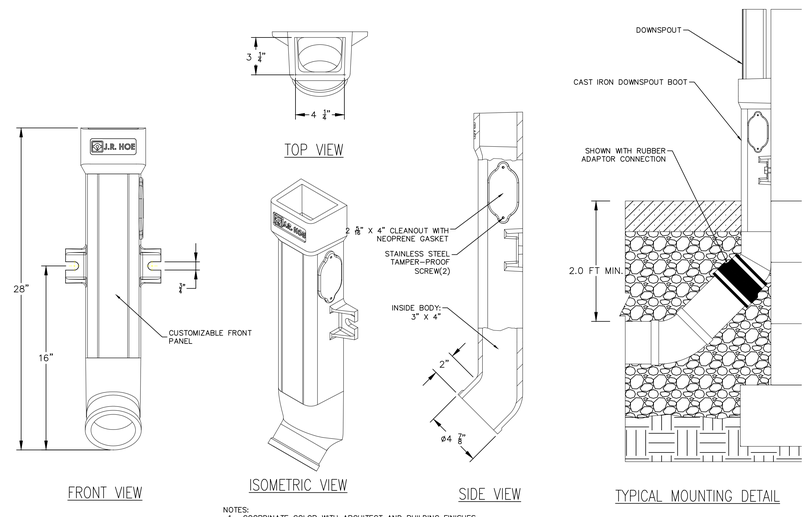


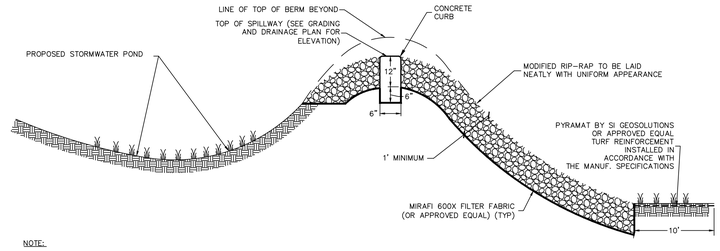
NOTES:
1. SEE GRADING AND DRAINAGE PLAN FOR SIZES/DIMENSIONS
2. MATERIALS AND SIZE OF OUTLET PROTECTION TO BE CONSISTENT WITH REQUIREMENTS OF CONNDOT DRAINAGE MANUAL SECTION 11.13 – OUTLET PROTECTION.

1 PREFORMED SCOUR HOLE
N.T.S.



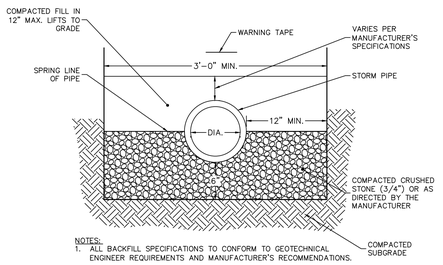
NOTES:
1. COORDINATE COLOR WITH ARCHITECT AND BUILDING FINISHES.
2. CONTRACTOR TO COORDINATE ROOF LEADER BOOT ATTACHMENT WITH THE ROUND CONCRETE PIER.
3. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO INSTALLATION. COORDINATE WITH ARCHITECT.

2 ROOF LEADER BOOT WITH CLEANOUT (OR APPROVED EQUAL)
N.T.S



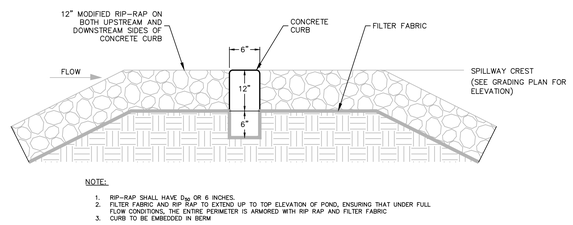
NOTE:
1. RIP–RAP SHALL HAVE D_{50} OR 6 INCHES.
2. FILTER FABRIC AND RIP RAP TO EXTEND UP TO TOP ELEVATION OF BERM, ENSURING THAT UNDER FULL FLOW CONDITIONS, THE ENTIRE SPILLWAY PERIMETER IS ARMORED WITH RIP RAP AND FILTER FABRIC
3. FOR LOCATION AND SIZE OF PROPOSED SPILLWAY, SEE GRADING AND DRAINAGE PLAN

3 EMERGENCY SPILLWAY
N.T.S.



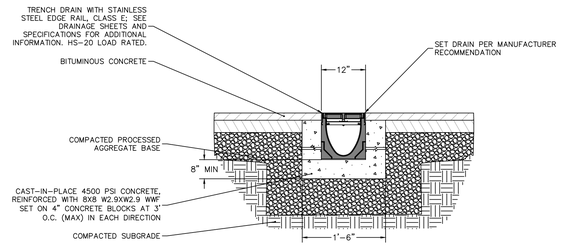
NOTES:
1. ALL BACKFILL SPECIFICATIONS TO CONFORM TO GEOTECHNICAL ENGINEER REQUIREMENTS AND MANUFACTURER'S RECOMMENDATIONS.

4 STORM PIPE BEDDING
N.T.S

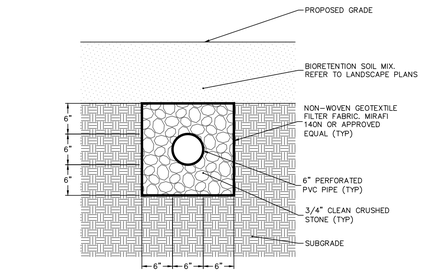


NOTE:
1. RIP–RAP SHALL HAVE D_{50} OR 6 INCHES.
2. FILTER FABRIC AND RIP RAP TO EXTEND UP TO TOP ELEVATION OF POND, ENSURING THAT UNDER FULL FLOW CONDITIONS, THE ENTIRE PERIMETER IS ARMORED WITH RIP RAP AND FILTER FABRIC
3. CURB TO BE EMBEDDED IN BERM

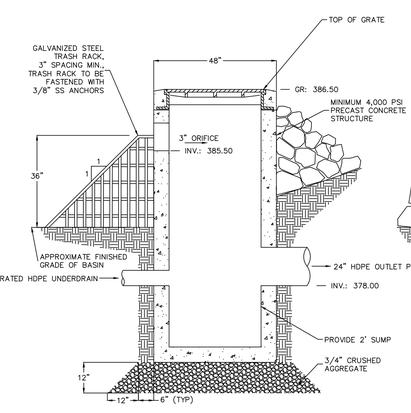
5 LEVEL SPREADER CURB PIECE
N.T.S.

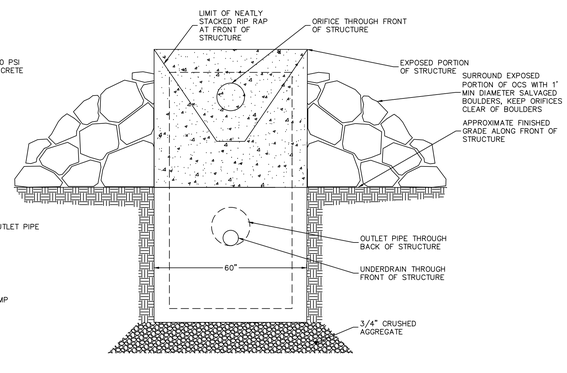


6 TRENCH DRAIN IN LOADING DOCK
N.T.S.



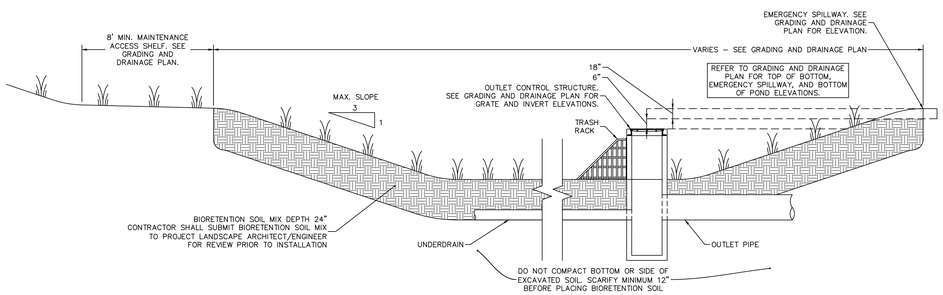
7 UNDERDRAIN
N.T.S.





NOTES:
1. SEE GRADING AND DRAINAGE PLANS FOR INVERT AND ELEVATION DETAILS FOR EACH OUTLET CONTROL STRUCTURE.

8 OUTLET CONTROL STRUCTURE
N.T.S.



ENGINEERED BIORETENTION SOIL MEDIA SPECIFICATIONS:

1. BIORETENTION SOIL MIX IS TO BE USED IN ALL DETENTION BASINS AND RAIN GARDENS.
2. THE ENGINEERED BIORETENTION SOIL MEDIA SHOULD BE A HOMOGENEOUS SOIL MIX OF (BY VOLUME):
   60–85% SAND
   15–25% TOPSOIL
   3–8% ORGANIC MATTER
3. SAND SHOULD BE WASHED CONCRETE SAND (ASTM C33 OR AASHTO M–6) OR COARSE WASHED SAND THAT MEETS THE GRADATION SCHEDULE AS SHOWN IN STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, SECTION M.01 (AGGREGATES), TABLE M.01.04–1 FOR FINE AGGREGATE GRADATIONS.
4. TOPSOIL SHOULD CONTAIN 5–20% ORGANIC MATERIAL, HAVE A PH RANGE OF 5.5 TO 7.0, AND BE A SANDY LOAM, LOAMY SAND, OR LOAM PER USDA SOIL TEXTURE WITH LESS THAN 5% CLAY CONTENT. TOPSOIL THAT MEETS THE STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, SECTION M.13.01 (ROADSIDE DEVELOPMENT) FOR TOPSOIL MAY ALSO BE USED, EXCEPT IT SHOULD CONTAIN LESS THAN 5% CLAY CONTENT.
5. ORGANIC MATTER SHOULD CONSIST OF ONE OF THE FOLLOWING MATERIALS
   5.1. SPHAGNUM PEAT: PARTIALLY DECOMPOSED SPHAGNUM PEAT MOSS, FINELY DIVIDED OR OF GRANULAR TEXTURE WITH 100 PERCENT PASSING THROUGH A 1/2– INCH (13–MM) SIEVE, A PH OF 3.4 TO 4.8.
   5.2. WOOD DERIVATIVES: SHREDDED WOOD, WOOD CHIPS, GROUND BARK, OR WOOD WASTE; OF UNIFORM TEXTURE AND FREE OF STONES, STICKS, SOIL, OR TOXIC MATERIALS.
   5.3. COMPOST SHALL NOT BE USED AS ORGANIC MATTER SINCE THE USE OF COMPOST IN BIORETENTION SOIL MEDIA CAN RESULT IN NUTRIENT EXPORT FROM THE SYSTEM.
6. OTHER SOIL AMENDMENTS SUCH AS ZEROVALENT IRON AND/OR PROCESSED DRINKING WATER TREATMENT RESIDUALS (ALUM) MAY BE USED TO FURTHER ENHANCE PHOSPHORUS SORPTION AS SPECIFIED BY THE DESIGNER. PROCESSED DRINKING WATER TREATMENT RESIDUALS SHOULD HAVE A MINIMUM OF 30% SOLIDS. DRINKING WATER TREATMENT RESIDUALS ARE TYPICALLY PROCESSED AND DRIED USING A BELT FILTER PRESS.
7. BIORETENTION SOIL MEDIA SHOULD MEET THE FOLLOWING PARTICLE SIZE DISTRIBUTION ACCORDING TO ASTM D422 (STANDARD TEST METHOD FOR PARTICLE–SIZE ANALYSIS OF SOILS) AS SPECIFIED IN TABLE 13–6.

MEDIA TYPE	SIEVE #	SIZE (INCHES)	SIZE (MM)	% PASSING
COARSE SAND	4	0.187	4.7600	100
MEDIUM SAND	10	0.079	2.00	95
FINE SAND	40	0.017	0.42	10–20
SILT/CLAY	200	0.003	0.075	0–5

8. BIORETENTION SOIL MEDIA SHOULD ALSO MEET THE FOLLOWING SPECIFICATIONS:
   8.1. PH (SOIL REACTION): 5.5 TO 7.5
   8.2. CATION EXCHANGE CAPACITY (CEC): MINIMUM OF 10 MILLIEQUIVALENTS PER 100 GRAMS OF SOIL (MEQ/100 G) AT PH OF 7.0
   8.3. ORGANIC MATTER (PERCENTAGE BY VOLUME): 3% TO 10%
   8.4. TOTAL PHOSPHORUS: <100 MG/KG
9. BIORETENTION SOIL MEDIA SHOULD NOT CONTAIN ANY OF THE FOLLOWING MATERIALS: STONES, CLODS, ROOTS, CLAY LUMPS, AND POCKETS OF COARSE SAND EXCEEDING 0.187 INCHES (4.76 MM) IN ANY DIMENSION; PLANTS, SOD, CONCRETE SLURRY, CONCRETE LAYERS OR CHUNKS, CEMENT, PLASTER, BUILDING DEBRIS, ASPHALT, BRICKS, OILS, GASOLINE, DIESEL FUEL, PAINT THINNER, TURPENTINE, TAR, ROOFING COMPOUND, ACID, SOLID WASTE, AND ANY OTHER EXTRANEOUS MATERIALS THAT ARE HARMFUL TO PLANT GROWTH.

9 DETENTION BASIN SECTION
N.T.S.

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TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

GR□DING □ND DR□IN□G□ D□T□ILS II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
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ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD □
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□1
5	05/19/2026	100□ CD

Drawing No.

CG502

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UTILITY NOTES

GENERAL:

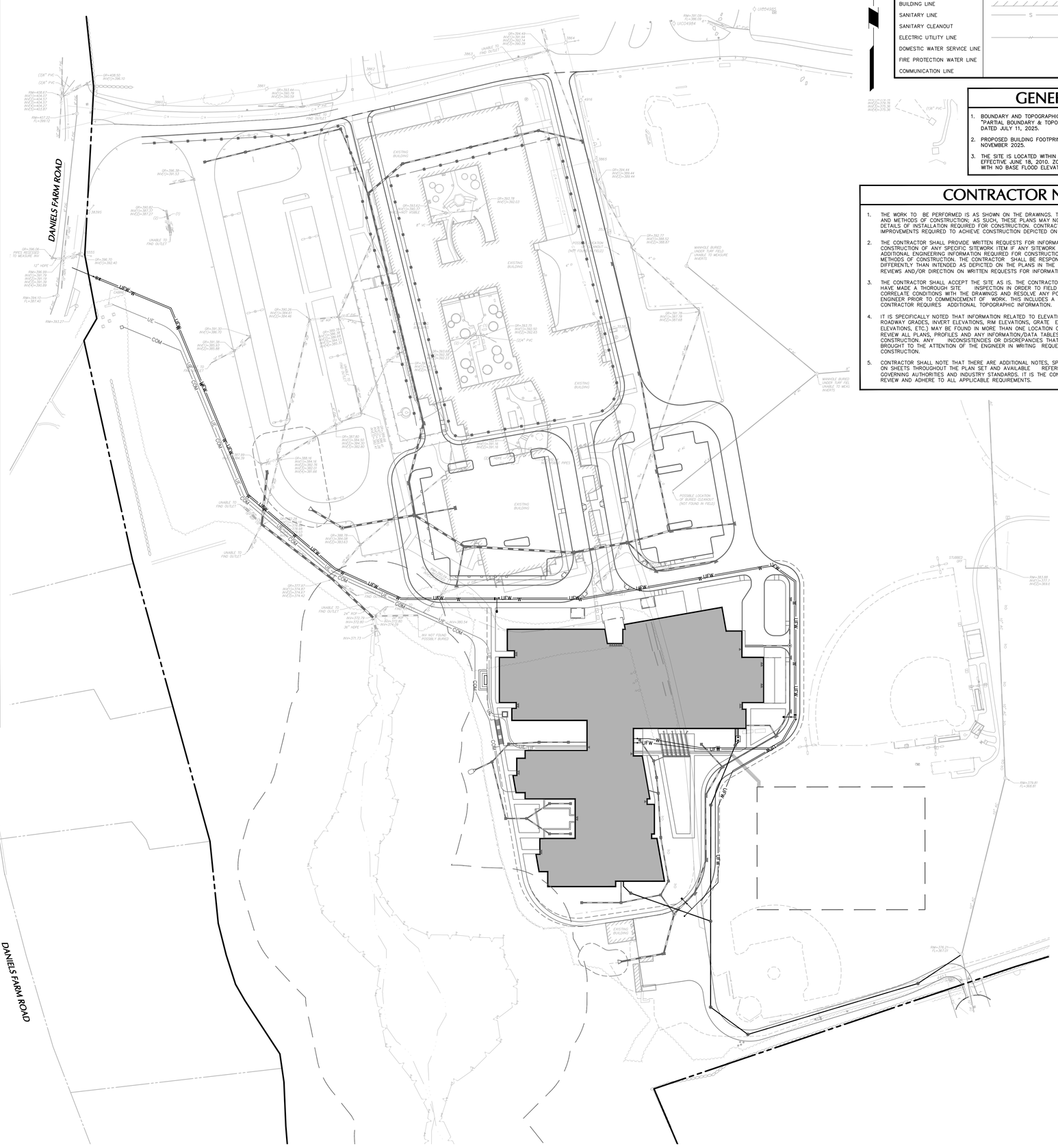
1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS IN A MANNER WHICH WILL NOT NEGATIVELY AFFECT ANY EXISTING USERS OF THESE UTILITIES.
2. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LOCATIONS (WATER, SEWER, GAS, ELECTRIC, TELEPHONE AND CABLE), INVERTS AND CONDITIONS PRIOR TO CONSTRUCTION. ANY CONDITIONS FOUND TO SUBSTANTIALLY DIFFER FROM THOSE SHOWN ON THE DRAWINGS AND REQUIRING MODIFICATIONS TO THE SITE DESIGN SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE CONSTRUCTION. SUBSTANTIALLY DIFFERING UTILITY CONDITIONS THAT ARE ENCOUNTERED BY THE CONTRACTOR, THAT REQUIRE MODIFICATION OF SITE DESIGN AND THAT ARE NOT BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO.
3. THE CONTRACTOR SHALL ARRANGE FOR AND COORDINATE WITH THE RESPECTIVE UTILITY PROVIDERS FOR SERVICE INSTALLATIONS AND CONNECTIONS. THE CONTRACTOR SHALL COORDINATE WORK TO BE PERFORMED BY THE VARIOUS UTILITY PROVIDERS AND SHALL PAY ALL FEES FOR CONNECTIONS, DISCONNECTIONS RELOCATIONS, INSPECTIONS, AND DEMOLITION UNLESS OTHERWISE STATED IN THE PROJECT SPECIFICATIONS MANUAL AND/OR GENERAL CONDITIONS OF THE CONTRACT.
4. ALL UNDERGROUND UTILITIES MUST BE CLEARLY & PERMANENTLY MARKED WITH UNDERGROUND MARKING TAPE AND AS REQUIRED BY THE APPROPRIATE UTILITY COMPANY.
5. BUILDING UTILITY PENETRATIONS AND LOCATIONS ARE SHOWN FOR THE CONTRACTOR'S INFORMATION. CONTRACTOR SHALL REFER TO ARCHITECTURAL AND MEP PLANS AND SPECIFICATIONS FOR ACTUAL LOCATIONS OF ALL UTILITY ENTRANCES TO INCLUDE SANITARY SEWER LATERALS, DOMESTIC AND FIRE PROTECTION WATER SERVICE, ELECTRICAL, TELEPHONE AND GAS SERVICE, ROOF DRAINS, AND ALL OTHER UTILITIES.
6. CONTRACTOR SHALL COORDINATE INSTALLATION OF UTILITIES IN SUCH A MANNER AS TO AVOID CONFLICTS AND TO ENSURE PROPER DEPTHS ARE ACHIEVED AS WELL AS COORDINATING WITH THE REGULATORY AGENCY AS TO LOCATION OF AND SCHEDULING OF CONNECTIONS TO THEIR FACILITIES.
7. ALL MANHOLE COVERS, GRATES, RIMS, AND UTILITY STRUCTURES TO REMAIN SHALL BE ADJUSTED TO PROPOSED ELEVATION.
8. CONTRACTOR TO PROVIDE ALL FITTINGS AND BENDS NECESSARY TO ACCOMPLISH WORK.
9. A MINIMUM EIGHTEEN (18) INCHES VERTICAL CLEARANCE BETWEEN WATER, GAS, ELECTRICAL, AND TELEPHONE LINES AND STORM PIPING SHALL BE PROVIDED.
10. UTILITY CONNECTION DESIGN AS REFLECTED ON THE PLAN MAY CHANGE SUBJECT TO UTILITY PROVIDER AND GOVERNING AUTHORITY STAFF REVIEW.
11. ALL EXISTING PAVEMENT WHERE UTILITY PIPING IS TO BE INSTALLED SHALL BE SAW CUT. AFTER UTILITY INSTALLATION IS COMPLETED, THE CONTRACTOR SHALL INSTALL PERMANENT PAVEMENT REPAIR AS DETAILED ON THE DRAWINGS OR AS REQUIRED BY THE OWNER HAVING JURISDICTION. IN THE EVENT THAT PAVEMENT REPAIR CANNOT BE PROVIDED DUE TO WEATHER CONDITIONS, PROVIDE TEMPORARY PAVEMENT REPAIR UNTIL PERMANENT REPAIR CAN BE PROVIDED.
12. ALL UTILITY LINES SHALL BE INSPECTED AND APPROVED PRIOR TO PLACEMENT OF BACKFILL. INSPECTION SHALL OCCUR ONLY WHEN THE LINES ARE FULLY BEDDED IN THE SPECIFIED MATERIAL AND AFTER ANY APPLICABLE TESTS ARE SUCCESSFULLY COMPLETED. INSPECTIONS SHALL BE PERFORMED BY THE APPLICABLE UTILITY PROVIDER, THE AHJ, AND/OR THE OWNER'S SPECIAL INSPECTOR. IF APPLICABLE, BACKFILLING SHALL BE MONITORED AND TESTED BY THE OWNER'S SPECIAL INSPECTOR.
13. SITE CONTRACTOR SHALL COORDINATE INSTALLATION OF CONDUIT AND CABLES FOR SITE LIGHTING WITH THE BUILDING ELECTRICAL CONTRACTOR.
14. THE CONTRACTOR SHALL ARRANGE AND COORDINATE WITH UTILITY PROVIDERS FOR WORK TO BE PERFORMED BY UTILITY PROVIDERS. THE CONTRACTOR SHALL PAY ALL UTILITY FEES UNLESS OTHERWISE STATED IN THE PROJECT SPECIFICATION MANUAL AND GENERAL CONDITIONS, AND REPAIR PAVEMENTS AS NECESSARY.
15. ALTERNATIVE METHODS AND PRODUCTS OTHER THAN THOSE SPECIFIED MAY BE USED IF REVIEWED AND APPROVED BY THE OWNER, ENGINEER, AND APPROPRIATE REGULATORY AGENCIES PRIOR TO INSTALLATION.
16. THE CONTRACTOR SHALL MAINTAIN ALL FLOWS AND UTILITY CONNECTIONS TO EXISTING BUILDINGS WITHOUT INTERRUPTION UNLESS/UNTIL AUTHORIZED TO DISCONNECT BY THE OWNERS, THE CIVIL ENGINEER, UTILITY PROVIDERS AND GOVERNING AUTHORITIES.
17. ALL REQUIRED UTILITIES SERVING THE BUILDINGS SHALL BE COORDINATED AND CONSTRUCTED TO WITHIN FIVE FEET OF BUILDING UTILITY ENTRANCE LOCATION AT THE INVERTS NOTED. ALL REQUIRED CONNECTION FEES SHALL BE PAID BY THE BUILDING CONTRACTOR. ANY NECESSARY EXTENSIONS, RELOCATIONS, OR CORRECTIONS WITHIN FIVE FEET OF THE BUILDING NECESSARY TO COMPLETE CONNECTION OF UTILITIES TO THE BUILDINGS SHALL BE MADE BY THE BUILDING CONTRACTOR.
18. ALL ON-SITE UTILITIES SHALL BE UNDERGROUND, WHERE APPLICABLE.
19. CONTRACTOR IS REQUIRED TO DIGITALLY PHOTOGRAPH 75% OF THE UTILITIES INSTALLED.

ELECTRIC, TELEPHONE, & GAS:

1. THE LOCATIONS OF EXISTING GAS MAINS ARE APPROXIMATE. THE CONTRACTOR MUST CONSULT THE LOCAL UTILITY COMPANIES FOR ADDITIONAL INFORMATION. ALL PROPOSED GAS WORK AND OTHER ASSOCIATED APPURTENANCES WILL BE IN CONFORMANCE WITH APPLICABLE LOCAL COUNTY, STATE AND FEDERAL GUIDELINES AND REQUIREMENTS.
2. THE LOCATION OF EXISTING ELECTRIC LINES ARE APPROXIMATE. THE CONTRACTOR MUST CONSULT THE LOCAL UTILITY COMPANIES FOR ADDITIONAL INFORMATION. ALL PROPOSED ELECTRICAL WORK, TRANSFORMER PADS, AND ASSOCIATED APPURTENANCES WILL BE IN CONFORMANCE WITH APPLICABLE LOCAL, COUNTY, STATE AND FEDERAL GUIDELINES AND REQUIREMENTS.
3. CONTRACTOR SHALL MAINTAIN A MINIMUM OF 30 INCHES OF COVER FOR ALL UNDERGROUND GAS UTILITIES OR AS REQUIRED BY THE UTILITY COMPANY, WHICHEVER IS MORE RESTRICTIVE.
4. ALL DETAILS OF ELECTRIC, GAS, & TELEPHONE UTILITY SERVICE SHALL BE APPROVED BY THE APPLICABLE UTILITY COMPANY AND INSTALLED TO THEIR REQUIREMENTS.
5. ELECTRICAL DUCT BANK SHALL RUN BELOW GAS LINES. A MINIMUM SEPARATION OF 3' AND 6" FOAM GLASS INSULATION (4' IN BOTH DIRECTIONS) IS REQUIRED WHERE THE DUCT BANK CROSSES HIGH TEMPERATURE WATER LINES.

WATER & SANITARY:

1. SEWER AND WATER SERVICES TO THE EXISTING BUILDINGS SHALL REMAIN CONTINUOUS THROUGHOUT CONSTRUCTION. THESE BUILDINGS WILL BE OCCUPIED THROUGHOUT CONSTRUCTION.
2. THE CONTRACTOR MUST VERIFY THE LOCATION, SIZE, AND SERVICEABILITY OF THE EXISTING WATER AND SANITARY SEWER MAINS PRIOR TO BEGINNING ANY SITE OR BUILDING CONSTRUCTION.
3. ALL WATER MAIN PIPING SHALL BE CLASS 54 DUCTILE IRON PIPE.
4. CONTRACTOR SHALL MAINTAIN A MINIMUM OF 4 FEET OF COVER FOR ALL WATER DISTRIBUTION PIPING.
5. THRUST BLOCKS SHALL BE PROVIDED ALONG WATER AND FORCE MAIN LINES 6" IN DIAMETER OR LARGER AT ALL TEES, ELBOWS AND PLUGS.
6. ALL NEW WATER LINES SHALL BE PRESSURE TESTED AND LEAKAGE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF AWWA STANDARD C600, OR THE REGIONAL WATER AUTHORITY REQUIREMENTS, WHICHEVER IS MORE RESTRICTIVE.
7. ALL NEW WATER MAINS SHALL BE DISINFECTED AND TESTED IN ACCORDANCE WITH AWWA STANDARD C651 AND LOCAL PROVIDER REQUIREMENTS.
8. ALL SANITARY SEWER PIPE TO BE SDR 35 PVC PIPE UNLESS OTHERWISE NOTED.
9. CONTRACTOR SHALL MAINTAIN 4.5 FEET OF COVER ON ALL SEWER PIPES.
10. WATER MAINS CROSSING SEWERS SHALL BE LAID TO PROVDE A MINIMUM HORIZONTAL DISTANCE OF 10 FEET AND MINIMUM VERTICAL DISTANCE OF 18-INCHES BETWEEN THE OUTSIDE OF WATER MAIN AND THE OUTSIDE OF SEWER. IN CASES WHERE THE VERTICAL SEPARATION IS LESS THAN 18-INCHES OR AS OTHERWISE SPECIFIED ON THIS DRAWING OR THE PROFILE SHEETS, STORM OR SANITARY SEWER PIPE SHALL BE ENCASED WITH K-KRETE 5-FT MINIMUM IN EACH DIRECTION OF PIPE RUN AND 6-INCHES MINIMUM AROUND THE PIPE DIAMETER. AT ALL CROSSING ONE FULL LENGTH OF WATER PIPE SHALL BE LOCATED SO BOTH JOINTS ARE MAXIMUM DISTANCE FROM SEWER.
11. CONTRACTOR TO PROVIDE NECESSARY MATERIALS TO ENSURE CONTINUOUS SERVICE OF THE FORCE MAIN THROUGHOUT CONSTRUCTION. ITEMS NEEDED INCLUDE BUT ARE NOT LIMITED TO TEMPORARY PUMPS, STORAGE TANKS, AND POWER. IF A SHUTDOWN IS NEEDED, PRIOR COORDINATION AND AUTHORIZATION FROM THE AFFECTED PROPERTIES MUST BE OBTAINED BY THE CONTRACTOR.
12. HYDRANT LOCATION AND INSTALLATION TO BE COORDINATED WITH UTILITY COMMISSION.



LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
SANITARY LINE	S	
SANITARY CLEANOUT		CO
ELECTRIC UTILITY LINE		UE
DOMESTIC WATER SERVICE LINE		W
FIRE PROTECTION WATER LINE		UFW
COMMUNICATION LINE		COM

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

CONTRACTOR NOTES

1. THE WORK TO BE PERFORMED IS AS SHOWN ON THE DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION; AS SUCH, THESE PLANS MAY NOT COMPLETELY REPRESENT ALL SPECIFIC DETAILS OF INSTALLATION REQUIRED FOR CONSTRUCTION. CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL IMPROVEMENTS REQUIRED TO ACHIEVE CONSTRUCTION DEPICTED ON THESE PLANS.
2. THE CONTRACTOR SHALL PROVIDE WRITTEN REQUESTS FOR INFORMATION TO THE ENGINEER PRIOR TO THE CONSTRUCTION OF ANY SPECIFIC SITEWORK ITEM IF ANY SITEWORK ITEM DEPICTED ON THE PLANS WARRANTS ADDITIONAL ENGINEERING INFORMATION REQUIRED FOR CONSTRUCTION AND IS NOT RELATED TO MEANS AND METHODS OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITEWORK ITEMS INSTALLED DIFFERENTLY THAN INTENDED AS DEPICTED ON THE PLANS IN THE ABSENCE OF SUBMITTING AND RECEIVING REVIEWS AND/OR DIRECTION ON WRITTEN REQUESTS FOR INFORMATION.
3. THE CONTRACTOR SHALL ACCEPT THE SITE AS IS. THE CONTRACTOR SHALL MAKE AND SHALL BE DEEMED TO HAVE MADE A THOROUGH SITE INSPECTION IN ORDER TO FIELD CHECK EXISTING SITE CONDITIONS, CORRELATE CONDITIONS WITH THE DRAWINGS AND RESOLVE ANY POSSIBLE CONSTRUCTION CONFLICTS WITH THE ENGINEER PRIOR TO COMMENCEMENT OF WORK. THIS INCLUDES A TOPOGRAPHIC SURVEY OF ANY AREAS THE CONTRACTOR REQUIRES ADDITIONAL TOPOGRAPHIC INFORMATION.
4. IT IS SPECIFICALLY NOTED THAT INFORMATION RELATED TO ELEVATIONS AND PROPOSED UTILITIES (SUCH AS ROADWAY GRADES, INVERT ELEVATIONS, RIM ELEVATIONS, GRATE ELEVATIONS, BUILDING FINISHED FLOOR ELEVATIONS, ETC.) MAY BE FOUND IN MORE THAN ONE LOCATION ON THE DRAWINGS. CONTRACTOR SHALL REVIEW ALL PLANS, PROFILES AND ANY INFORMATION/DATA TABLES FOR CONSISTENCY PRIOR TO CONSTRUCTION. ANY INCONSISTENCIES OR DISCREPANCIES THAT ARE FOUND SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING REQUESTING CLARIFICATION PRIOR TO CONSTRUCTION.
5. CONTRACTOR SHALL NOTE THAT THERE ARE ADDITIONAL NOTES, SPECIFICATIONS AND REQUIREMENTS CONTAINED ON SHEETS THROUGHOUT THE PLAN SET AND AVAILABLE REFERENCES TO SPECIFICATIONS FROM APPLICABLE GOVERNING AUTHORITIES AND INDUSTRY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN, REVIEW AND ADHERE TO ALL APPLICABLE REQUIREMENTS.

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STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

OV□R□LL SIT□ UTILITY □L□N

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

CU100

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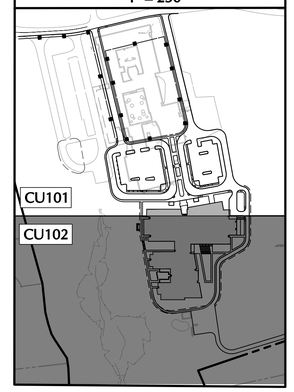
LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
SANITARY LINE	S	
SANITARY CLEANOUT		CO
ELECTRIC UTILITY LINE		UE
DOMESTIC WATER SERVICE LINE		W
FIRE PROTECTION WATER LINE		UFW
COMMUNICATION LINE		COM

SHEET LEGEND
1" = 250'



GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

30 0 15 30
SCALE: 1 INCH = 30 FEET

EXISTING UTILITY STRUCTURES AND CONNECTIONS TO BE REMOVED. COORDINATE REMOVAL WITH OWNER, PHASED DEMOLITION, AND UTILITY PROVIDERS

CONTRACTOR TO CONFIRM LOCATION OF EXISTING WATER MAIN AND INSTALL NEW 8" DIP CONNECTIONS PER AQUARION PROVIDER REQUIREMENTS

WATER METER VAULT. COORDINATE FINAL SIZE AND LOCATION WITH UTILITY PROVIDER.

TIE ELECTRIC UTILITY LINE INTO THE EXISTING ELECTRICAL CABINET ON SITE. CONNECTION TO BE COORDINATED WITH THE MEP AND UTILITY PROVIDER.

APPROXIMATE LOCATION OF PROPOSED COMMUNICATIONS SERVICE HANDHOLE SHOWN FOR REFERENCE ONLY. REFER TO MEP PLANS.

UNDERGROUND ELECTRIC UTILITY LINE, FOR REFERENCE ONLY. SEE MEP PLANS

6" DIP DOMESTIC WATER SERVICE LINE (TYP.)

6" DIP FIRE WATER SERVICE LINE (TYP.)

COMMUNICATIONS SERVICE LINE, FOR REFERENCE ONLY. SEE MEP PLANS

GATE VALVE (TYP.)

FIRE HYDRANT

PROPOSED BUILDING

POSSIBLE LOCATION OF BURIED CLEANOUT (NOT FOUND IN FIELD)

MATCHLINE - CU101

MATCHLINE - CU102

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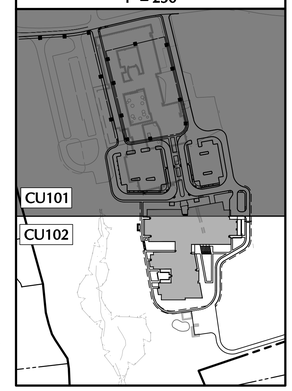
LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
BUILDING LINE		
SANITARY LINE	S	
SANITARY CLEANOUT		CO
ELECTRIC UTILITY LINE	UE	UE
DOMESTIC WATER SERVICE LINE	W	W
FIRE PROTECTION WATER LINE	UFW	UFW
COMMUNICATION LINE	COM	COM

SHEET LEGEND
1" = 250'



MATCHLINE - CU101

MATCHLINE - CU102

PROPOSED BUILDING
±84,300 SF FOOTPRINT

GENERATOR. SEE MEP PLANS FOR DETAILS

TRANSFORMER. SEE MEP PLANS FOR DETAILS

COMMUNICATIONS SERVICE LINE FOR REFERENCE ONLY. SEE MEP PLANS

25 LF 6" HDPE FOOTING DRAIN

WATER SERVICE CONNECTIONS. REFERENCE TO STORM NETWORK. COORDINATE WITH ARCHITECT FOR FOUNDATION DRAINAGE CONTINUATION (TYP.)

CONNECT BUILDING FOUNDATION DRAINAGE TO MEP PLANS

DOMESTIC WATER SERVICE LINE (TYP.)

14 LF 6" HDPE @ MIN 0.5%

UNDERGROUND ELECTRIC UTILITY LINE. FOR REFERENCE ONLY. SEE MEP PLANS

LOCATION AND INVERT OF ELECTRIC UTILITY CONNECTION TO BE COORDINATED WITH THE MEP

4" PERFORATED HDPE LINE SHOWN FOR REFERENCE BOTTOM OF TO DETAIL CS501 & SEE MEP PLANS

22 LF 6" PVC @ 2.5%

SAN MH-6
RIM: 388.80
INV. IN: 382.20
INV. IN: 382.20
INV. OUT: 382.10

6" PVC SANITARY LINE
INV.: 382.75
NYLOPLAST IN-LINE DRAIN

6" DIP FIRE WATER SERVICE LINE (TYP.)

GATE VALVE (TYP.)

10 LF 6" PVC @ 2.0%

1,000 GALLON GREASE TRAP
INV. IN: 382.55
INV. OUT: 382.30

5 LF 6" PVC @ 2.0%

GEOTHERMAL SUPPLY PIPING AND EXTENTS OF GEOTHERMAL FIELD SHOWN FOR REFERENCE ONLY. COORDINATE WITH MEP.

88 LF 6" PVC @ 3.75%

SAN MH-5
RIM: 384.80
INV. IN(6" NW): 378.80
INV. OUT: 378.70

6" DIP FIRE PROTECTION WATER SERVICE LINE (TYP.)

162 LF 6" PVC @ 5.0%

FIRE HYDRANT (TYP.)

117 LF 6" PVC @ 0.5%

6" PVC SANITARY LINE
INV.: 371.50

19 LF 6" PVC @ 1.0%

SAN MH-7
RIM: 376.50
INV. IN: 371.30
INV. OUT: 371.20

SAN MH-4
RIM: 379.00
INV. IN (6" N): 370.61
INV. IN: (6" NW): 370.61
INV. OUT: 370.51

120 LF 8" PVC @ 0.5%

EXISTING BUILDING

CONNECT TO EXISTING SANITARY MANHOLE

RIM=376.21
FL=367.01

71 LF 8" PVC @ 0.7%

SAN MH-1
RIM: 376.50
INV. IN: 367.61
INV. OUT: 367.51

SAN MH-3
RIM: 375.90
INV. IN: 369.91
INV. OUT: 369.81

62 LF 8" PVC @ 0.5%

SAN MH-2
RIM: 376.80
INV. IN: 369.50
INV. OUT: 369.40

250 LF 8" PVC @ 0.7%

RIM=371.60
FL=364.40

SCALE: 1 INCH = 30 FEET

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SIT□ UTILITY □L□N II

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DR□WN BY	□□D
□□ROV□D BY	B□

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Drawing No.

CU102

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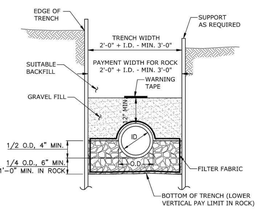
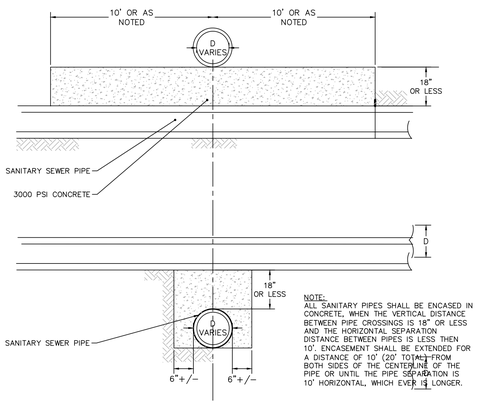


TYPICAL SANITARY SEWER TRENCH SECTION
NO SCALE

OFFICE OF THE TOWN ENGINEER TOWN OF TRUMBULL 5866 Main Street (203) 452-5050	
TYPICAL SANITARY SEWER TRENCH SECTION DETAIL TRUMBULL, CONNECTICUT	
Scale: NTS	Date: 8/15/2014
Drawn by:	Grid:
Approved by:	Sheet: SS-03

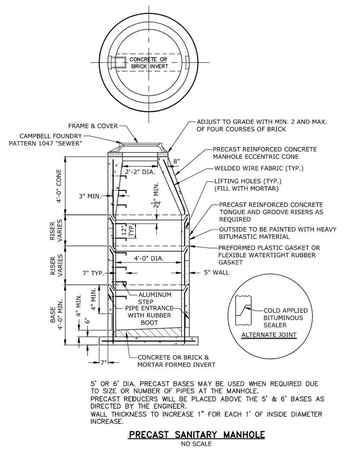
1 SANITARY TRENCH
N.T.S

DETAIL PROVIDED BY TRUMBULL ENGINEERING



NOTE:
ALL SANITARY PIPES SHALL BE ENCASED IN CONCRETE, WHEN THE VERTICAL DISTANCE BETWEEN PIPE CROSSINGS IS 18" OR LESS AND THE HORIZONTAL SEPARATION DISTANCE BETWEEN PIPES IS LESS THEN 10'. ENCASEMENT SHALL BE EXTENDED FOR A DISTANCE OF 10' (20' TOTAL) FROM BOTH SIDES OF THE CENTERLINE OF THE PIPE OR UNTIL THE PIPE SEPARATION IS 10' HORIZONTAL, WHICH EVER IS LONGER.

2 CONCRETE ENCASEMENT FOR SANITARY SEWER
N.T.S



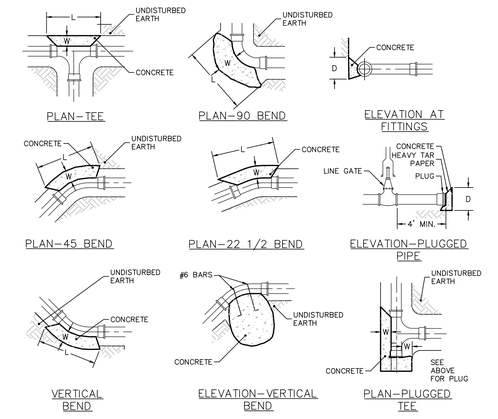
5' OR 6' DIA. PRECAST BASES MAY BE USED WHEN REQUIRED DUE TO SIZE OR NUMBER OF PIPES AT THE MANHOLE. PRECAST REDUCERS WILL BE PLACED ABOVE THE 5' & 6' BASES AS DIRECTED BY THE ENGINEER. WALL THICKNESS TO INCREASE 1" FOR EACH 1' OF INSIDE DIAMETER INCREASE.

PRECAST SANITARY MANHOLE
NO SCALE

OFFICE OF THE TOWN ENGINEER TOWN OF TRUMBULL 5866 Main Street (203) 452-5050	
PRECAST SANITARY MANHOLE DETAIL TRUMBULL, CONNECTICUT	
Scale: NTS	Date: 8/15/2014
Drawn by:	Grid:
Approved by:	Sheet: SS-05

3 SANITARY MANHOLE
N.T.S.

DETAIL PROVIDED BY TRUMBULL ENGINEERING

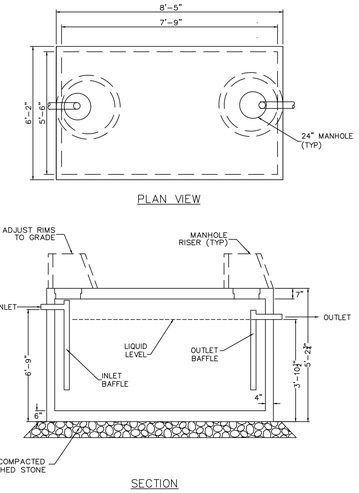


THRUST BLOCK SCHEDULE								
PIPE SIZE	TEE		22 1/2		45		90	
	L	D	L	D	L	D	L	D
6"	18"	15"	15"	12"	15"	12"	15"	15"
8"	2'	18"	18"	12"	18"	12"	2'	18"
12"	3'	2'	2'	12"	2'	12"	3'	2'
16"	4'	2.5'	2'	12"	2.33'	15"	4'	2.5'
20"	5.25'	3'	3'	18"	3'	2'	5.25'	3'
24"	7.5'	3'	3'	18"	4'	2.5'	7.5'	3'

BASIS:
2,000 LB/SQ.FT. SOIL RESISTANCE
250 PSI WATER PRESSURE
CORRECTION FACTORS FOR OTHER SOILS:
SOFT CLAY 4
SAND 2
SAND & GRAVEL 1.33
SHALE 0.4

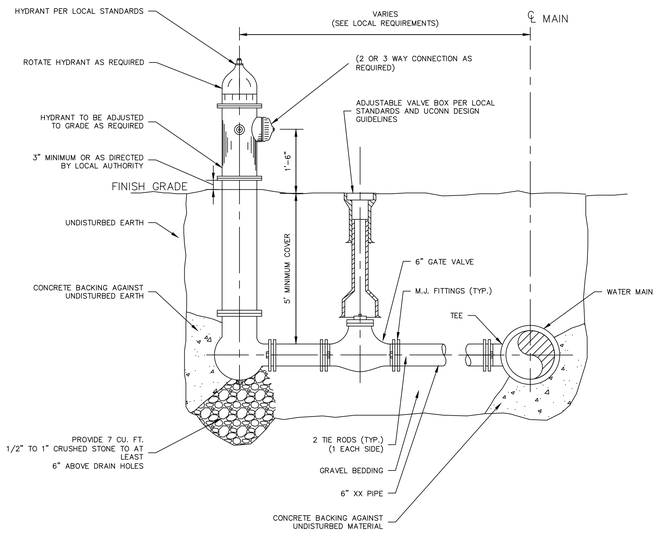
NOTE:
1. IF SOFT MATERIALS ARE ENCOUNTERED, THE THRUST BLOCKS SIZES SHALL BE ADJUSTED ACCORDINGLY.
2. CONCRETE TO BE 3000 PSI.

4 THRUST BLOCKS
N.T.S

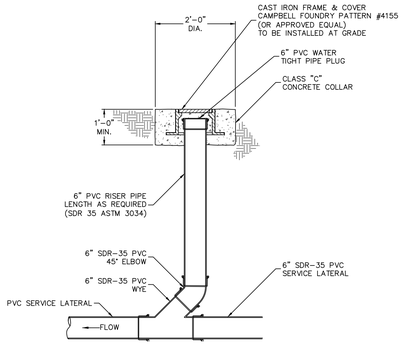


NOTES:
1. CONCRETE MINIMUM STRENGTH – 5,000 PSI AT 28 DAYS.
2. STEEL REINFORCEMENT – ASTM A-615 GR.60, A-185, OR A-497, 1" MIN COVER
3. CONSTRUCTION JOINT SEALED WITH BUTYL SEALANT.
4. DESIGN LOADING – AASHTO H520 – 44.
5. ALL TEES SHALL BE PVC AND FASTENED WITH STAINLESS STEEL HARDWARE.
6. MANHOLE COVERS SHALL BE PLACATED WITH NOTIFICATION AS TO THE DANGER OF ENTERING THE STRUCTURE DUE TO NOXIOUS GASES.
7. OUTER DIMENSIONS SHOWN ARE APPROXIMATE SIZES. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR REVIEW BY ENGINEER.

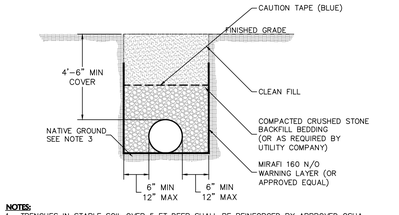
5 1,000 GALLON GREASE TRAP
N.T.S



6 FIRE HYDRANT AND VALVE
N.T.S

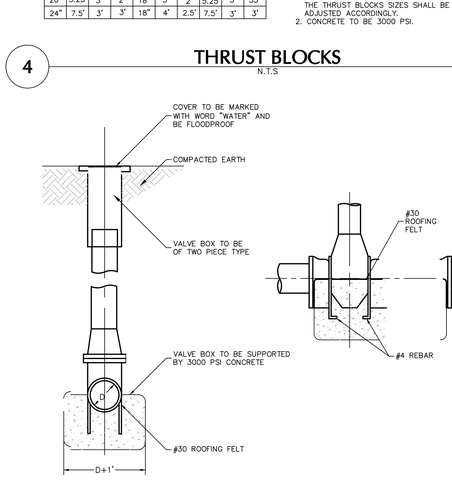


7 SANITARY CLEANOUT
N.T.S.

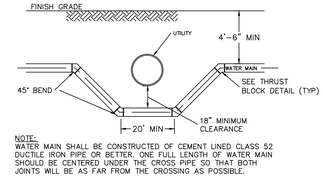


NOTES:
1. TRENCHES IN STABLE SOIL OVER 5 FT DEEP SHALL BE REINFORCED BY APPROVED OSHA METHODS.
2. TRENCHES SHALL BE COMPACTED.
3. IF NATIVE GROUND IS NOT SUITABLE, THE CONTRACTOR SHALL EXCAVATE TO AN ACCEPTABLE DEPTH AND INSTALL MATERIALS AS APPROVED BY ENGINEERS AND UTILITY COMPANY.
4. THE WARNING LAYER IS NOT REQUIRED IN AREAS OF THE SITE WHERE SOIL IS CLASSIFIED AS REGULATED MATERIAL. WHERE INSTALLED, WARNING LAYER SHALL EXTEND UP THE SIDES OF THE EXCAVATION TO MATCH WITH THE HORIZONTAL LINER.

8 WATER MAIN TRENCH
N.T.S



9 GATE VALVE
N.T.S



NOTE:
WATER MAIN SHALL BE CONSTRUCTED OF CEMENT LINED CLASS 52 DUCTILE IRON PIPE OR BETTER. ONE FULL LENGTH OF WATER MAIN SHOULD BE CENTERED UNDER THE CROSS PIPE SO THAT BOTH JOINTS WILL BE AS FAR FROM THE CROSSING AS POSSIBLE.

10 WATER MAIN DROP
N.T.S

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STATE OF CONNECTICUT ROBERT T. POWELL 29 REGISTERED ARCHITECT PROFESSIONAL

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SOIL EROSION-SEDIMENT CONTROL NOTES

PROPOSED DEVELOPMENT

1. CONSTRUCTION WILL INCLUDE EARTHWORK, CURBING, PAVING, UTILITY INSTALLATION, LANDSCAPING AND BUILDING CONSTRUCTION. ALL DEMOLITION DEBRIS AND SOIL REMOVAL RELATED TO CONSTRUCTION SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAWS GOVERNING SUCH ACTIVITIES.
2. THE DETAILED EROSION AND SEDIMENT CONTROL MEASURES ARE SHOWN WITHIN THIS PLANSET. THE PROPOSED MEASURES HAVE BEEN DESIGNED TO PREVENT THE MIGRATION OF SOIL SEDIMENT FROM THE SITE.

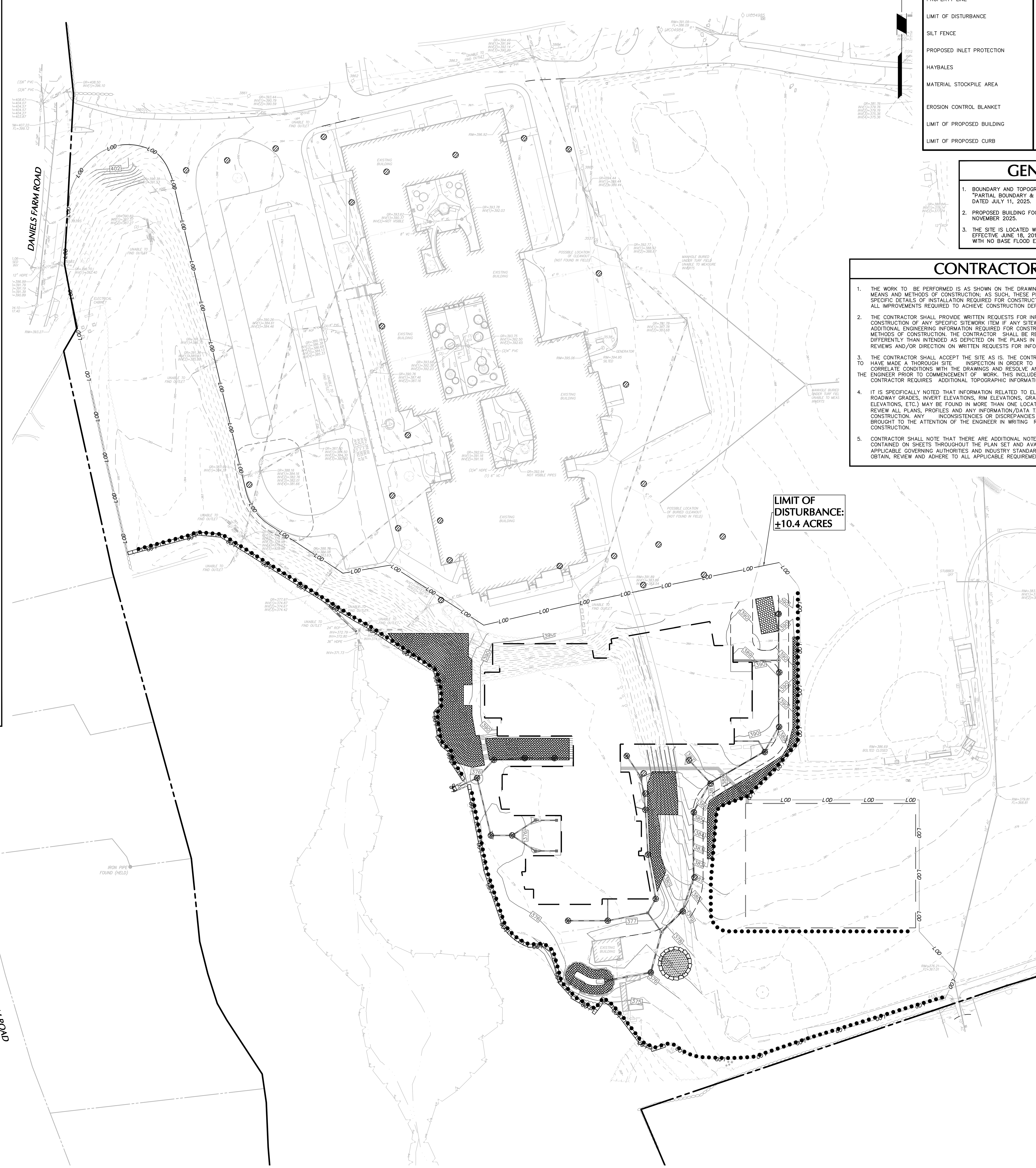
SOIL EROSION AND SEDIMENT CONTROL NOTES

1. THE SOIL AND SEDIMENT CONTROL PRACTICES MUST BE INSTALLED IN ACCORDANCE WITH THE LOCAL GOVERNING AUTHORITY AND THE CONNECTICUT COUNCIL ON SOIL AND WATER CONSERVATION AND THE 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL.
2. EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSTALLED PRIOR TO START OF DEMOLITION AND CONSTRUCTION AND DISTURBANCE OF SITE CONTRIBUTORY DRAINAGE AREAS. THE OWNER OR ITS CONTRACTOR SHALL INSPECT, REPAIR AND REMOVE ALL SEDIMENT AND EROSION CONTROL DEVICES, AS INDICATED HEREIN.
3. DISPOSAL OF COLLECTED SEDIMENT SHALL BE MADE TO AREA DESIGNATED BY THE OWNER'S SOIL ENGINEER.
4. FILTER FABRIC/SILT FENCE WILL BE INSTALLED ALONG THE TOE OF ALL CRITICAL CUT AND FILL SLOPES.
5. ALL TOPSOIL NOT TO BE USED FOR FINAL GRADING/LANDSCAPED AREAS SHALL BE REMOVED FROM THE SITE IMMEDIATELY, IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW. ALL TOPSOIL TO BE USED IN LANDSCAPED AREAS SHALL BE STORED/STOCKPILED IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW STANDARDS.
6. ALL AREAS WITHIN 500 FEET OF AN INHABITED DWELLING SHALL BE WETTED AS NECESSARY TO PROVIDE DUST CONTROL.
7. SEDIMENT DISPOSAL AREAS AND TOPSOIL STOCKPILES NOT SCHEDULED FOR CONSTRUCTION ACTIVITIES WITHIN THIRTY (30) DAYS OF DISTURBANCE SHALL BE STABILIZED AS FOLLOWS:
   - A. GROUND LIMESTONE AT A RATE OF 135 LBS. PER 1,000 SF.
   - B. FERTILIZER AT A RATE OF 14 LBS. PER 1,000 SF USING A 10–20–10 ANALYSIS OR AN EQUIVALENT.
   - C. ANNUAL RYE GRASS SEEDING APPLIED AT A RATE OF NOT LESS THAN 1 LB. PER 1,000 SF.
   - D. MULCH ALL NEWLY SEEDED AREAS WITHIN 80 LBS. OF SALT HAY OR SMALL GRAIN STRAW PER 1,000 SF.
8. BETWEEN OCTOBER 15 AND MARCH 15, WHEN DISTURBED AREAS ARE SCHEDULED FOR IMMEDIATE LANDSCAPING, THEY MAY BE MULCHED AND SEEDED PER ITEM D ABOVE.
9. PAVEMENT BASE COURSE MUST BE PLACED IN ALL NEW ROADWAY AREAS UPON COMPLETION OF FINE GRADING.
10. THE CONTRACTOR IS RESPONSIBLE FOR ALL PAVED ROADWAYS, ON AND OFF–SITE, WHICH MUST BE KEPT FREE OF SITE GENERATED SEDIMENT AT ALL TIMES. DUST SHALL BE CONTROLLED BY SPRINKLING OR OTHER APPROVED METHOD.
11. SILT FENCES AND BARRIERS MUST BE CLEANED OR REPLACED PERIODICALLY TO REMOVE BUILT–UP SILT.
12. ALL EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSPECTED ON A DAILY BASIS AND CLEANED IMMEDIATELY AFTER EACH STORM.
13. ALL EXPOSED SURFACES WILL BE TREATED WITH TOPSOIL PER THE LANDSCAPE PLANS PRIOR TO FINAL STABILIZATION.
14. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING. MULCH AS NECESSARY FOR SEED PROTECTION AND ESTABLISHMENT. LIME AND FERTILIZE PRIOR TO PERMANENT SEEDING.
15. SOIL EROSION AND SEDIMENT CONTROL SHALL INCLUDE, BUT NOT BE LIMITED TO, OMISSIONS, ERRORS, OR FIELD OPERATIONS IMMEDIATELY AND IN ACCORDANCE WITH THE ABOVE MEASURES. THE CONTRACTOR SHALL BE RESPONSIBLE TO CORRECT ANY OMISSIONS, ERRORS, OR FIELD OPERATIONS IMMEDIATELY AND IN ACCORDANCE WITH THE GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL.
16. ANY CONVEYANCE OF THIS PROJECT PRIOR TO ITS COMPLETION WILL TRANSFER FULL RESPONSIBILITY FOR COMPLIANCE WITH THE CERTIFIED PLAN TO ANY SUBSEQUENT OWNERS.
17. PERMANENT
   - A. MATERIALS SPECIFICATION: LAWN AREAS.
     - a. SOIL
       ANY SOIL HAVING A pH OF 4 OR LESS CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE INCHES OF SOIL HAVING A pH OF FIVE OR MORE PRIOR TO SEED BED PREPARATION.
     - b. LIME
       THREE TONS PER ACRE GROUND LIMESTONE INCORPORATED FOUR INCHES INTO SOIL.
     - c. FERTILIZER
       500 L.S. PER ACRES 10–20–10 INCORPORATED FOUR INCHES INTO SOIL.
     - d. SEED
       DATES 4/15–6/15 AND 9/15–10/15. 30 LBS OF KENTUCKY 31 TALL FESCUE, 30 LBS OF SPREADING FESCUE, 30 LBS OF KENTUCKY BLUEGRASS PER ACRE.
     - e. SHADE AREAS
       15 LBS OF SPREADING FESCUE, 15 LBS OF CHEWINGS RED FESCUE, 30 LBS KENTUCKY BLUEGRASS, AND 10 LBS OF PERENNIAL RYE GRASS PER ACRE. MULCH SHOULD BE APPLIED AFTER SEEDING FOR ADDED PROTECTION.
   - B. MULCHING SHALL BE DONE AT THE RATE OF SEVENTY TO NINETY POUNDS (70–90 LBS) PER 1,000 SQUARE FEET WITH UNROTTED SALT HAY.
   - C. LIQUID MULCH BINDERS MUST BE USED TO ANCHOR SALT HAY, HAY OR STRAY MULCHES.
     - a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND CATCHES THE MULCH IN VALLEYS AND AT CREATED BANKS. REMAINDER OF AREA SHOULD BE UNIFORM IN APPEARANCE.
     - b. USE ONE OF THE FOLLOWING: SYNTHETIC OR ORGANIC BINDERS, BINDERS SUCH AS CURASOL DCA–70, PETRO SET, TERRA TACH, HYDRO MULCH AND AEROSPRAY MAY BE USED AT RATES RECOMMENDED BY THE MANUFACTURER OF ANCHOR MULCH MATERIALS. BINDERS CONTAINING PETROLEUM PRODUCTS SHALL NOT BE USED.

     NOTE: ALL NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE TO THE EXCLUSION OF OTHER PRODUCTS.
   - D. FILL MATERIAL SHALL BE FREE FROM DEBRIS, PERISHABLE OR COMBUSTIBLE MATERIAL AND FROZEN OR WET EARTH OR STONES LARGER THAN THREE INCHES IN MAXIMUM DIMENSION.
   - E. CONSTRUCTION AREAS SHALL BE PERIODICALLY SPRAYED WITH WATER UNTIL THE SURFACE IS WET TO CONTROL THE GENERATION OF DUST.
   - F. ALL REVISIONS AFTER APPROVAL HAS BEEN GRANTED SHALL BE FORWARDED TO THE APPROPRIATE DISTRICT FOR REVIEW.
   - G. THE LOCAL GOVERNING AUTHORITY SHALL RECEIVE WRITTEN NOTIFICATION SEVENTY TWO HOURS BEFORE THE START OF ANY CONSTRUCTION.
   - H. SEEDED PREPARATION:
     - c. TOPSOIL SHOULD BE A MINIMUM OF SIX INCHES DEEP (COMPACTED) BEFORE SEEDING.
     - d. HAVE TOPSOIL TESTED FOR pH, ADD LIME AS NECESSARY TO ACHIEVE pH OF 6.5. APPLY FERTILIZER AT A RATE OF 300 POUNDS PER ACRE OR SEVEN POUNDS PER 4,000 SQUARE FEET USING 10–20–10 OR EQUIVALENT. IN ADDITION, 300 POUNDS 38–0–0 PER ACRE OF SLOW RELEASE NITROGEN MAY BE USED IN LIEU OF TOP DRESSING.
     - e. WORK LIME AND FERTILIZER INTO SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF FOUR INCHES WITH A DISC, SPRINGTOOTH HARROW OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE ALL CLAY OR SILTY SOIL AND COARSE SANDS SHOULD BE ROLLED TO FIRM THE SEED BED WHEREVER FEASIBLE.
     - f. REMOVE FROM THE SURFACE ALL STONES ONE INCH OR LARGER IN ANY DIMENSION. REMOVE ALL OTHER DEBRIS, SUCH AS WIRE, CABLE, TREE ROOTS, PIECES OF CONCRETE, CLODS, LUMPS, OR OTHER UNSUITABLE MATERIAL.
     - g. INSPECT SEED BED JUST BEFORE SEEDING. IF TRAFFIC HAS LEFT SOIL COMPACT, THE AREA MUST BE RETILLED AND FIRMED AS ABOVE.

CONTINGENCY SOIL EROSION AND SEDIMENT CONTROL NARRATIVE

1. THE GENERAL CONTRACTOR WILL DESIGNATE PERSONNEL FOR 24 HOUR EMERGENCY RESPONSE IN THE EVENT OF SEVERE WEATHER AND INCREASED POTENTIAL FOR SEVERE EROSION. CONTRACTOR TO PROVIDE NAME AND PHONE NUMBER OF INDIVIDUAL TO THE PLANNING AND ZONING COMMISSION PRIOR TO THE START OF CONSTRUCTION.
2. THE GENERAL CONTRACTOR IS REQUIRED TO MAINTAIN ON SITE OR HAVE THE ABILITY TO RETRIEVE WITHIN 12 HOURS THE FOLLOWING MATERIALS IN THE EVENT THAT THERE ARE DEFICIENCIES IN THE SESC MEASURES:
   - A. 25% OF THE INSTALLED LENGTH OF SILT FENCE
   - B. EQUIVALENT TONNAGE OF STONE FOR STABILIZATION OF 1 STABILIZATION ENTRANCE. STONE COULD BE USED FOR SLOPE REPAIRS, ENERGY DISSIPATER ENHANCEMENTS, ETC.
   - C. HEAVY EQUIPMENT CAPABLE OF TRENCHING/EXCAVATING LARGE AREAS TO DIVERT AND CONTROL RUNOFF IN A CONTROLLED MANNER.
   - D. HAVE DESIGNATED A HYDRO–SEED CONTRACTOR CAPABLE OF RESPONDING TO THE SITE WITHIN 12 HOURS



LEGEND

	PROPOSED
PROPERTY LINE	
LIMIT OF DISTURBANCE	LOD
SILT FENCE	
PROPOSED INLET PROTECTION	
HAYBALES	
MATERIAL STOCKPILE AREA	
EROSION CONTROL BLANKET	
LIMIT OF PROPOSED BUILDING	
LIMIT OF PROPOSED CURB	

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

CONTRACTOR NOTES

1. THE WORK TO BE PERFORMED IS AS SHOWN ON THE DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION; AS SUCH, THESE PLANS MAY NOT COMPLETELY REPRESENT ALL SPECIFIC DETAILS OF INSTALLATION REQUIRED FOR CONSTRUCTION. CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL IMPROVEMENTS REQUIRED TO ACHIEVE CONSTRUCTION DEPICTED ON THESE PLANS.
2. THE CONTRACTOR SHALL PROVIDE WRITTEN REQUESTS FOR INFORMATION TO THE ENGINEER PRIOR TO THE CONSTRUCTION OF ANY SPECIFIC SITEWORK ITEM IF ANY SITEWORK ITEM DEPICTED ON THE PLANS WARRANTS ADDITIONAL ENGINEERING INFORMATION REQUIRED FOR CONSTRUCTION AND IS NOT RELATED TO MEANS AND METHODS OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITEWORK ITEMS INSTALLED DIFFERENTLY THAN INTENDED AS DEPICTED ON THE PLANS IN THE ABSENCE OF SUBMITTING AND RECEIVING REVIEWS AND/OR DIRECTION ON WRITTEN REQUESTS FOR INFORMATION.
3. THE CONTRACTOR SHALL ACCEPT THE SITE AS IS. THE CONTRACTOR SHALL MAKE AND SHALL BE DEEMED TO HAVE MADE A THOROUGH SITE INSPECTION IN ORDER TO FIELD CHECK EXISTING SITE CONDITIONS, CORRELATE CONDITIONS WITH THE DRAWINGS AND RESOLVE ANY POSSIBLE CONSTRUCTION CONFLICTS WITH THE ENGINEER PRIOR TO COMMENCEMENT OF WORK. THIS INCLUDES A TOPOGRAPHIC SURVEY OF ANY AREAS THE CONTRACTOR REQUIRES ADDITIONAL TOPOGRAPHIC INFORMATION.
4. IT IS SPECIFICALLY NOTED THAT INFORMATION RELATED TO ELEVATIONS AND PROPOSED UTILITIES (SUCH AS ROADWAY GRADES, INVERT ELEVATIONS, RIM ELEVATIONS, GRATE ELEVATIONS, BUILDING FINISHED FLOOR ELEVATIONS, ETC.) MAY BE FOUND IN MORE THAN ONE LOCATION ON THE DRAWINGS. CONTRACTOR SHALL REVIEW ALL PLANS, PROFILES AND ANY INFORMATION/DATA TABLES FOR CONSISTENCY PRIOR TO CONSTRUCTION. ANY INCONSISTENCIES OR DISCREPANCIES THAT ARE FOUND SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING REQUESTING CLARIFICATION PRIOR TO CONSTRUCTION.
5. CONTRACTOR SHALL NOTE THAT THERE ARE ADDITIONAL NOTES, SPECIFICATIONS AND REQUIREMENTS CONTAINED ON SHEETS THROUGHOUT THE PLAN SET AND AVAILABLE REFERENCES TO SPECIFICATIONS FROM APPLICABLE GOVERNING AUTHORITIES AND INDUSTRY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN, REVIEW AND ADHERE TO ALL APPLICABLE REQUIREMENTS.

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TRUMBULL HILLCR□ST MIDDL□ SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

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ST□T□ □RO□. NO.	144-0108N
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SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

CE100

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LEGEND

	PROPOSED
PROPERTY LINE	
LIMIT OF DISTURBANCE	LOD LOD
SILT FENCE	
PROPOSED INLET PROTECTION	
HAYBALES	
MATERIAL STOCKPILE AREA	
EROSION CONTROL BLANKET	
LIMIT OF PROPOSED BUILDING	
LIMIT OF PROPOSED CURB	

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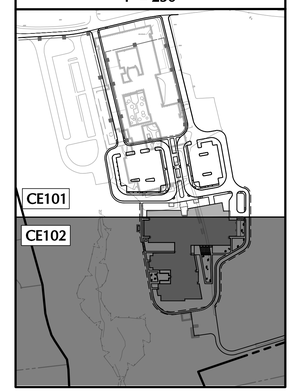
SHEET LEGEND
1" = 250'



EXISTING SCHOOL TO BE FULLY OPERATIONAL DURING PHASE 1 OF CONSTRUCTION. CONTRACTOR TO PROVIDE TEMPORARY PERIMETER FENCING AND OTHER SECURITY MEASURES AS REQUIRED BY THE OWNER.

SEE SITE LOGISTICS PLANS BY BSIMARK FOR PROJECT PHASING INFORMATION

EXISTING SCHOOL, BUILDING, UTILITY CONNECTIONS, AND EMERGENCY EGRESS ROUTES TO BE PROTECTED AND MAINTAINED IN THE FIRST PHASE OF CONSTRUCTION.

LIMIT OF DISTURBANCE: ±10.4 ACRES

SILT SOCK AND SILT FENCE (TYP.)

SLOPE STABILIZATION BLANKET

SILT FENCE (TYP.)

PROPOSED INLET PROTECTION (TYP.)

CONSTRUCTION ENTRANCE

PROPOSED LIMIT OF CURBING WITHIN PHASE 1 OF CONSTRUCTION (TYP.)

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

MATCHLINE - CE101

MATCHLINE - CE102

SCALE: 1 INCH = 30 FEET

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530 Daniels Farm Road, Trumbull, CT 06611

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DR□WN BY	□□D
□□ROV□D BY	B□

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LEGEND

	PROPOSED
PROPERTY LINE	
LIMIT OF DISTURBANCE	LOD LOD
SILT FENCE	
PROPOSED INLET PROTECTION	
HAYBALES	
MATERIAL STOCKPILE AREA	
EROSION CONTROL BLANKET	
LIMIT OF PROPOSED BUILDING	
LIMIT OF PROPOSED CURB	

MATCHLINE - CE101

MATCHLINE - CE102

CONTRACTOR TO COORDINATE INSTALLATION OF ALL PROPOSED UTILITIES SUCH THAT EXISTING SERVICES TO THE EXISTING SCHOOL ARE MAINTAINED. CONTRACTOR TO COORDINATE TEMPORARY UTILITY SHUTOFFS AS NEEDED WITH OWNER.

SLOPE STABILIZATION BLANKET

25 LF 6" HDPE FOOTING DRAIN

CONNECT BUILDING FOUNDATION DRAINAGE TO STORM NETWORK. COORDINATE WITH ARCHITECT FOR FOUNDATION DRAINAGE CONNECTION. 14 LF 6" HDPE @ MIN 0.5%

4" PERFORATED HDPE PIPE. REFER TO DETAIL CS503/6.

NYLOPLAST INLINE DRAIN FLUSH WITH BOTTOM OF PLANTER BED. REFER TO DETAIL CS505/5.

PROPOSED LIMIT OF CURBING WITHIN PHASE 1 OF CONSTRUCTION (TYP.)

SILT FENCE (TYP.)

LIMIT OF DISTURBANCE: ±10.6 ACRES

PROPOSED BUILDING AND LOADING DOCK FOOTPRINT

PROPOSED INLET PROTECTION (TYP.)

LIMIT OF GEOTHERMAL FIELD. SEE MEP PLANS FOR DETAILS (TYP.)

SILT SOCK AND SILT FENCE (TYP.)

SITE TRAILER, CONSTRUCTION LAYDOWN, ETC WITHIN LIMITS OF CONSTRUCTION FENCE (TYP.)

MATERIAL STOCKPILE AREA (TYP.)

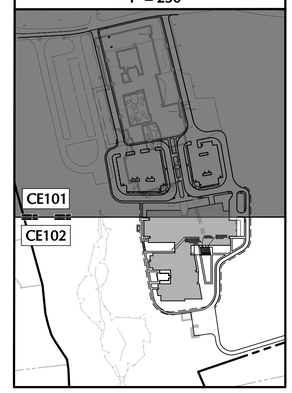
SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

RIM=376.21
FL=367.01

RIM=371.60
FL=364.40

SHEET LEGEND

1" = 250'



SCALE: 1 INCH = 30 FEET

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DR□WN BY	□□D
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5	05/19/2026	100□ CD

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SOIL EROSION-SEDIMENT CONTROL NOTES

PROPOSED DEVELOPMENT

1. CONSTRUCTION WILL INCLUDE EARTHWORK, CURBING, PAVING, UTILITY INSTALLATION, LANDSCAPING AND BUILDING CONSTRUCTION. ALL DEMOLITION DEBRIS AND SOIL REMOVAL RELATED TO CONSTRUCTION SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAWS GOVERNING SUCH ACTIVITIES.

2. THE DETAILED EROSION AND SEDIMENT CONTROL MEASURES ARE SHOWN WITHIN THIS PLANSET. THE PROPOSED MEASURES HAVE BEEN DESIGNED TO PREVENT THE MIGRATION OF SOIL SEDIMENT FROM THE SITE.

SOIL EROSION AND SEDIMENT CONTROL NOTES

1. THE SOIL AND SEDIMENT CONTROL PRACTICES MUST BE INSTALLED IN ACCORDANCE WITH THE LOCAL GOVERNING AUTHORITY AND THE CONNECTICUT COUNCIL ON SOIL AND WATER CONSERVATION AND THE 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL.

2. EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSTALLED PRIOR TO START OF DEMOLITION AND CONSTRUCTION AND DISTURBANCE OF SITE CONTRIBUTORY DRAINAGE AREAS. THE OWNER OR ITS CONTRACTOR SHALL INSPECT, REPAIR AND REMOVE ALL SEDIMENT AND EROSION CONTROL DEVICES, AS INDICATED HEREIN.

3. DISPOSAL OF COLLECTED SEDIMENT SHALL BE MADE TO AREA DESIGNATED BY THE OWNER'S SOIL ENGINEER.

4. FILTER FABRIC/SILT FENCE WILL BE INSTALLED ALONG THE TOE OF ALL CRITICAL CUT AND FILL SLOPES.

5. ALL TOPSOIL NOT TO BE USED FOR FINAL GRADING/LANDSCAPED AREAS SHALL BE REMOVED FROM THE SITE IMMEDIATELY, IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW. ALL TOPSOIL TO BE USED IN LANDSCAPED AREAS SHALL BE STORED/STOCKPILED IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW STANDARDS.

6. ALL AREAS WITHIN 500 FEET OF AN INHABITED DWELLING SHALL BE WETTED AS NECESSARY TO PROVIDE DUST CONTROL.

7. SEDIMENT DISPOSAL AREAS AND TOPSOIL STOCKPILES NOT SCHEDULED FOR CONSTRUCTION ACTIVITIES WITHIN THIRTY (30) DAYS OF DISTURBANCE SHALL BE STABILIZED AS FOLLOWS:
   A. GROUND LIMESTONE AT A RATE OF 135 LBS. PER 1,000 SF.
   B. FERTILIZER AT A RATE OF 14 LBS. PER 1,000 SF USING A 10–20–10 ANALYSIS OR AN EQUIVALENT.
   C. ANNUAL RYE GRASS SEEDING APPLIED AT A RATE OF NOT LESS THAN 1 LB. PER 1,000 SF.
   D. MULCH ALL NEWLY SEEDED AREAS WITHIN 80 LBS. OF SALT HAY OR SMALL GRAIN STRAW PER 1,000 SF.

8. BETWEEN OCTOBER 15 AND MARCH 15, WHEN DISTURBED AREAS ARE SCHEDULED FOR IMMEDIATE LANDSCAPING, THEY MAY BE MULCHED AND SEEDED PER ITEM D ABOVE.

9. PAVEMENT BASE COURSE MUST BE PLACED IN ALL NEW ROADWAY AREAS UPON COMPLETION OF FINE GRADING.

10. THE CONTRACTOR IS RESPONSIBLE FOR ALL PAVED ROADWAYS, ON AND OFF–SITE, WHICH MUST BE KEPT FREE OF SITE GENERATED SEDIMENT AT ALL TIMES. DUST SHALL BE CONTROLLED BY SPRINKLING OR OTHER APPROVED METHOD.

11. SILT FENCES AND BARRIERS MUST BE CLEANED OR REPLACED PERIODICALLY TO REMOVE BUILT–UP SILT.

12. ALL EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSPECTED ON A DAILY BASIS AND CLEANED IMMEDIATELY AFTER EACH STORM.

13. ALL EXPOSED SURFACES WILL BE TREATED WITH TOPSOIL PER THE LANDSCAPE PLANS PRIOR TO FINAL STABILIZATION.

14. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING. MULCH AS NECESSARY FOR SEED PROTECTION AND ESTABLISHMENT. LIME AND FERTILIZE PRIOR TO PERMANENT SEEDING.

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16. ANY CONVEYANCE OF THIS PROJECT PRIOR TO ITS COMPLETION WILL TRANSFER FULL RESPONSIBILITY FOR COMPLIANCE WITH THE CERTIFIED PLAN TO ANY SUBSEQUENT OWNERS.

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      b. LIME
         THREE TONS PER ACRE GROUND LIMESTONE INCORPORATED FOUR INCHES INTO SOIL.
      c. FERTILIZER
         500 L.S. PER ACRES 10–20–10 INCORPORATED FOUR INCHES INTO SOIL.
      d. SEED
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      e. SHADE AREAS
         15 LBS OF SPREADING FESCUE, 15 LBS OF CHEWINGS RED FESCUE, 30 LBS KENTUCKY BLUEGRASS, AND 10 LBS OF PERENNIAL RYE GRASS PER ACRE. MULCH SHOULD BE APPLIED AFTER SEEDING FOR ADDED PROTECTION.
   B. MULCHING SHALL BE DONE AT THE RATE OF SEVENTY TO NINETY POUNDS (70–90 LBS) PER 1,000 SQUARE FEET WITH UNROTTED SALT HAY.
   C. LIQUID MULCH BINDERS MUST BE USED TO ANCHOR SALT HAY, HAY OR STRAY MULCHES.
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      b. USE ONE OF THE FOLLOWING: SYNTHETIC OR ORGANIC BINDERS, BINDERS SUCH AS CURASOL DCA–70, PETRO SET, TERRA TACH, HYDRO MULCH AND AEROSPRAY MAY BE USED AT RATES RECOMMENDED BY THE MANUFACTURER OF ANCHOR MULCH MATERIALS. BINDERS CONTAINING PETROLEUM PRODUCTS SHALL NOT BE USED.

      NOTE: ALL NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE TO THE EXCLUSION OF OTHER PRODUCTS.
   D. FILL MATERIAL SHALL BE FREE FROM DEBRIS, PERISHABLE OR COMBUSTIBLE MATERIAL AND FROZEN OR WET EARTH OR STONES LARGER THAN THREE INCHES IN MAXIMUM DIMENSION.
   E. CONSTRUCTION AREAS SHALL BE PERIODICALLY SPRAYED WITH WATER UNTIL THE SURFACE IS WET TO CONTROL THE GENERATION OF DUST.
   F. ALL REVISIONS AFTER APPROVAL HAS BEEN GRANTED SHALL BE FORWARDED TO THE APPROPRIATE DISTRICT FOR REVIEW.
   G. THE LOCAL GOVERNING AUTHORITY SHALL RECEIVE WRITTEN NOTIFICATION SEVENTY TWO HOURS BEFORE THE START OF ANY CONSTRUCTION.
   H. SEEDED PREPARATION:
      c. TOPSOIL SHOULD BE A MINIMUM OF SIX INCHES DEEP (COMPACTED) BEFORE SEEDING.
      d. HAVE TOPSOIL TESTED FOR pH, ADD LIME AS NECESSARY TO ACHIEVE pH OF 6.5. APPLY FERTILIZER AT A RATE OF 300 POUNDS PER ACRE OR SEVEN POUNDS PER 4,000 SQUARE FEET USING 10–20–10 OR EQUIVALENT. IN ADDITION, 300 POUNDS 38–0–0 PER ACRE OF SLOW RELEASE NITROGEN MAY BE USED IN LIEU OF TOP DRESSING.
      e. WORK LIME AND FERTILIZER INTO SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF FOUR INCHES WITH A DISC, SPRINGTOOTH HARROW OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE ALL CLAY OR SILTY SOIL AND COARSE SANDS SHOULD BE ROLLED TO FIRM THE SEED BED WHEREVER FEASIBLE.
      f. REMOVE FROM THE SURFACE ALL STONES ONE INCH OR LARGER IN ANY DIMENSION. REMOVE ALL OTHER DEBRIS, SUCH AS WIRE, CABLE, TREE ROOTS, PIECES OF CONCRETE, CLODS, LUMPS, OR OTHER UNSUITABLE MATERIAL.
      g. INSPECT SEED BED JUST BEFORE SEEDING. IF TRAFFIC HAS LEFT SOIL COMPACT, THE AREA MUST BE RETILLED AND FIRMED AS ABOVE.

CONTINGENCY SOIL EROSION AND SEDIMENT CONTROL NARRATIVE

1. THE GENERAL CONTRACTOR WILL DESIGNATE PERSONNEL FOR 24 HOUR EMERGENCY RESPONSE IN THE EVENT OF SEVERE WEATHER AND INCREASED POTENTIAL FOR SEVERE EROSION. CONTRACTOR TO PROVIDE NAME AND PHONE NUMBER OF INDIVIDUAL TO THE PLANNING AND ZONING COMMISSION PRIOR TO THE START OF CONSTRUCTION.

2. THE GENERAL CONTRACTOR IS REQUIRED TO MAINTAIN ON SITE OR HAVE THE ABILITY TO RETRIEVE WITHIN 12 HOURS THE FOLLOWING MATERIALS IN THE EVENT THAT THERE ARE DEFICIENCIES IN THE SESC MEASURES:
   A. 25% OF THE INSTALLED LENGTH OF SILT FENCE
   B. EQUIVALENT TONNAGE OF STONE FOR STABILIZATION OF 1 STABILIZATION ENTRANCE. STONE COULD BE USED FOR SLOPE REPAIRS, ENERGY DISSIPATER ENHANCEMENTS, ETC.
   C. HEAVY EQUIPMENT CAPABLE OF TRENCHING/EXCAVATING LARGE AREAS TO DIVERT AND CONTROL RUNOFF IN A CONTROLLED MANNER.
   D. HAVE DESIGNATED A HYDRO–SEED CONTRACTOR CAPABLE OF RESPONDING TO THE SITE WITHIN 12 HOURS



LEGEND

	PROPOSED
PROPERTY LINE	— — — —
LIMIT OF DISTURBANCE	——LOD——LOD——
SILT FENCE	• • • • • • • •
EXISTING INLET PROTECTION	▨
PROPOSED INLET PROTECTION	⊘
HAYBALES	▭▭▭▭▭
MATERIAL STOCKPILE AREA	◎
EROSION CONTROL BLANKET	☒☒☒☒

GENERAL NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED FROM PLANS TITLED "PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN, DATED JULY 11, 2025.
2. PROPOSED BUILDING FOOTPRINT RECEIVED ELECTRONICALLY FROM TSKP IN NOVEMBER 2025.
3. THE SITE IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP 09001C0289F, EFFECTIVE JUNE 18, 2010. ZONE X IS AN AREA OF MINIMAL FLOOD HAZARD WITH NO BASE FLOOD ELEVATIONS.

CONTRACTOR NOTES

1. THE WORK TO BE PERFORMED IS AS SHOWN ON THE DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION; AS SUCH, THESE PLANS MAY NOT COMPLETELY REPRESENT ALL SPECIFIC DETAILS OF INSTALLATION REQUIRED FOR CONSTRUCTION. CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL IMPROVEMENTS REQUIRED TO ACHIEVE CONSTRUCTION DEPICTED ON THESE PLANS.
2. THE CONTRACTOR SHALL PROVIDE WRITTEN REQUESTS FOR INFORMATION TO THE ENGINEER PRIOR TO THE CONSTRUCTION OF ANY SPECIFIC SITEWORK ITEM IF ANY SITEWORK ITEM DEPICTED ON THE PLANS WARRANTS ADDITIONAL ENGINEERING INFORMATION REQUIRED FOR CONSTRUCTION AND IS NOT RELATED TO MEANS AND METHODS OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITEWORK ITEMS INSTALLED DIFFERENTLY THAN INTENDED AS DEPICTED ON THE PLANS IN THE ABSENCE OF SUBMITTING AND RECEIVING REVIEWS AND/OR DIRECTION ON WRITTEN REQUESTS FOR INFORMATION.
3. THE CONTRACTOR SHALL ACCEPT THE SITE AS IS. THE CONTRACTOR SHALL MAKE AND SHALL BE DEEMED TO HAVE MADE A THOROUGH SITE INSPECTION IN ORDER TO FIELD CHECK EXISTING SITE CONDITIONS, CORRELATE CONDITIONS WITH THE DRAWINGS AND RESOLVE ANY POSSIBLE CONSTRUCTION CONFLICTS WITH THE ENGINEER PRIOR TO COMMENCEMENT OF WORK. THIS INCLUDES A TOPOGRAPHIC SURVEY OF ANY AREAS THE CONTRACTOR REQUIRES ADDITIONAL TOPOGRAPHIC INFORMATION.
4. IT IS SPECIFICALLY NOTED THAT INFORMATION RELATED TO ELEVATIONS AND PROPOSED UTILITIES (SUCH AS ROADWAY GRADES, INVERT ELEVATIONS, RIM ELEVATIONS, GRATE ELEVATIONS, BUILDING FINISHED FLOOR ELEVATIONS, ETC.) MAY BE FOUND IN MORE THAN ONE LOCATION ON THE DRAWINGS. CONTRACTOR SHALL REVIEW ALL PLANS, PROFILES AND ANY INFORMATION/DATA TABLES FOR CONSISTENCY PRIOR TO CONSTRUCTION. ANY INCONSISTENCIES OR DISCREPANCIES THAT ARE FOUND SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING REQUESTING CLARIFICATION PRIOR TO CONSTRUCTION.
5. CONTRACTOR SHALL NOTE THAT THERE ARE ADDITIONAL NOTES, SPECIFICATIONS AND REQUIREMENTS CONTAINED ON SHEETS THROUGHOUT THE PLAN SET AND AVAILABLE REFERENCES TO SPECIFICATIONS FROM APPLICABLE GOVERNING AUTHORITIES AND INDUSTRY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN, REVIEW AND ADHERE TO ALL APPLICABLE REQUIREMENTS.

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STATE OF CONNECTICUT — CHRISTOPHER P. CAVIAN? — PEN0021996 — LICENSED — PROFESSIONAL ENGINEER

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

□H□S□ II OV□R□LL SOIL □ROSION □ S□DIM□NT CONTROL □L□N

ST□T□ □RO□. NO.	144-0108N
□RO□. NO.	250501
SC□L□	□S NOT□D
D□T□	08/15/2025
DR□WN BY	□□D
□□□ROV□D BY	B□

ISSUE DATES

NO.	DATE	PURPOSE
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4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

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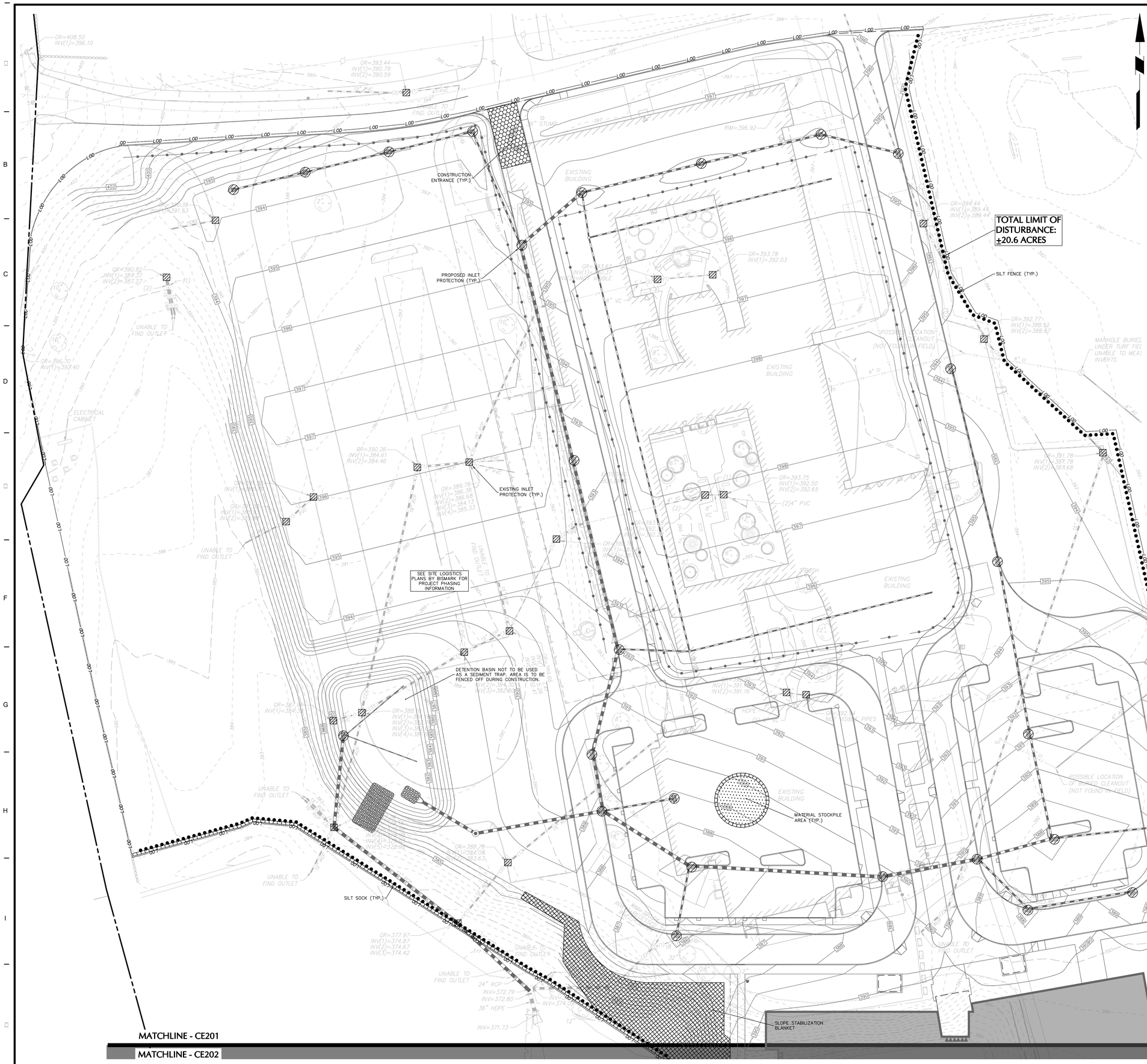

LEGEND

	PROPOSED
PROPERTY LINE	
LIMIT OF DISTURBANCE	LOD
SILT FENCE	
EXISTING INLET PROTECTION	
PROPOSED INLET PROTECTION	
HAYBALES	
MATERIAL STOCKPILE AREA	
EROSION CONTROL BLANKET	

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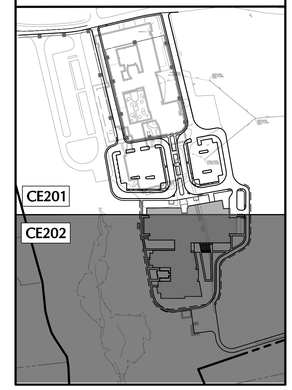
SHEET LEGEND

1" = 250'



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□H□S□ II SOIL □ROSION □ S□DIM□NT CONTROL □L□N I

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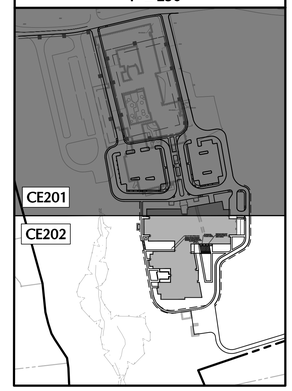
LEGEND

	PROPOSED
PROPERTY LINE	
LIMIT OF DISTURBANCE	LOD LOD
SILT FENCE	
EXISTING INLET PROTECTION	
PROPOSED INLET PROTECTION	
HAYBALES	
MATERIAL STOCKPILE AREA	
EROSION CONTROL BLANKET	

SHEET LEGEND
1" = 250'



MATCHLINE - CE201

MATCHLINE - CE202

PROPOSED BUILDING
±84,300 SF FOOTPRINT

25 LF 6" HDPE FOOTING DRAIN CONNECT BUILDING FOUNDATION DRAINAGE TO STORM NETWORK. COORDINATE WITH ARCHITECT FOR FOUNDATION DRAINAGE CONNECTION. 14 LF 6" HDPE @ MIN 0.5%

4" PERFORATED HDPE PIPE. REFER TO DETAIL CS503/6.

NYLOPLAST INLINE DRAIN FLUSH WITH BOTTOM OF PLANTER BED. REFER TO DETAIL CS505/5.

SLOPE STABILIZATION BLANKET (TYP.)

PROPOSED INLET PROTECTION (TYP.)

SILT SOCK (TYP.)

SILT FENCE (TYP.)

TOTAL LIMIT OF DISTURBANCE: ±20.6 ACRES

LIMIT OF GEOTHERMAL FIELD. SEE MEP PLANS FOR DETAILS (TYP.)

EXISTING BUILDING

DETENTION BASIN NOT TO BE USED AS A SEDIMENT TRAP. AREA IS TO BE FENCED OFF DURING CONSTRUCTION.

MATERIAL STOCKPILE AREA (TYP.)

SEE SITE LOGISTICS PLANS BY BISMARK FOR PROJECT PHASING INFORMATION

RIM=376.21
FL=367.01

RIM=371.60
FL=364.40

30 0 15 30
SCALE: 1 INCH = 30 FEET

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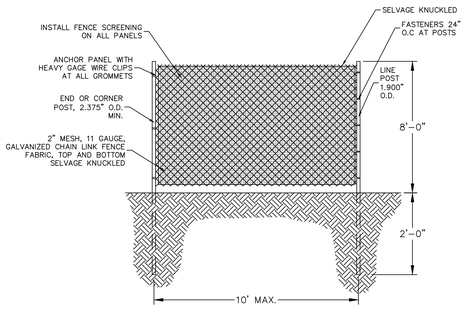
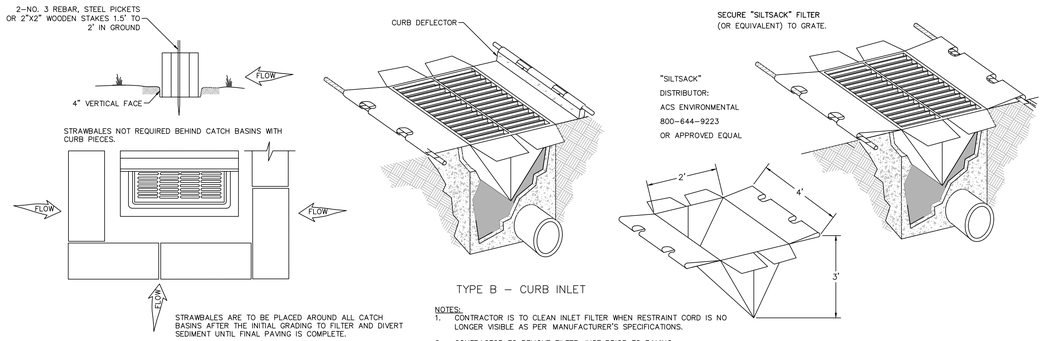


1 TEMPORARY CONSTRUCTION FENCE

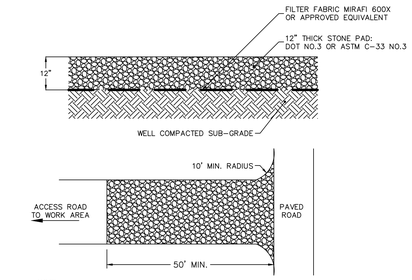
N.T.S



NOTES:
1. CONTRACTOR IS TO CLEAN INLET FILTER WHEN RESTRAINT CORD IS NO LONGER VISIBLE AS PER MANUFACTURER'S SPECIFICATIONS.
2. CONTRACTOR TO REMOVE FILTER JUST PRIOR TO PAVING.

2 INLET PROTECTION

N.T.S



NOTE:
1. CONSTRUCTION PAD LOCATION TO BE SET BY CONTRACTOR AND LOCATED AS REQUIRED FOR CONSTRUCTION SEQUENCING.
2. SEE SOIL EROSION & SEDIMENT CONTROL PLAN, CE101, FOR DIMENSIONS.

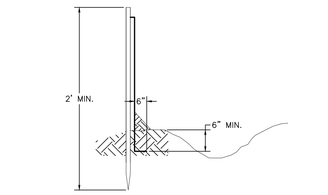
3 CONSTRUCTION ENTRANCE

N.T.S

NOTE: SEE SOIL EROSION & SEDIMENT CONTROL PLAN FOR LOCATION OF HAYBALE BARRIER

4 TEMPORARY STOCKPILE

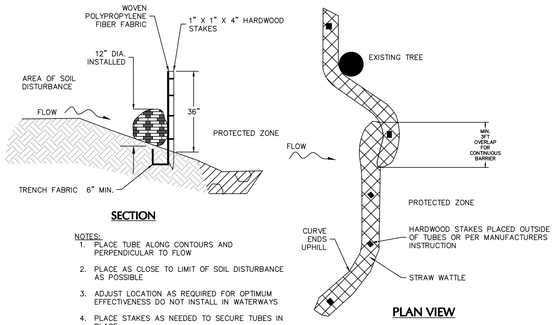
N.T.S



INSTALLATION NOTES:
1. EXCAVATE AND SECURE BOTTOM 6" OF SILT FENCE BELOW GRADE AS SHOWN.
2. EXCEPT FOR THE END POST, DRIVE ALL POSTS INTO THE GROUND AT BACK SIDE OF TRENCH SPACED A MAXIMUM OF 8 FT O. C.
3. SECURE FILTER FABRIC WITH DRAWSTRING TO POST WITH METAL FASTENERS AND REINFORCEMENT BETWEEN FASTENER AND FABRIC.

5 SILT FENCE

N.T.S



NOTES:
1. PLACE TUBE ALONG CONTOURS AND PERPENDICULAR TO FLOW
2. PLACE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE
3. ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS DO NOT INSTALL IN WATERWAYS
4. PLACE STAKES AS NEEDED TO SECURE TUBES IN PLACE

6 STAKED SILT FENCE/SILT SOCK

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Drawing No.

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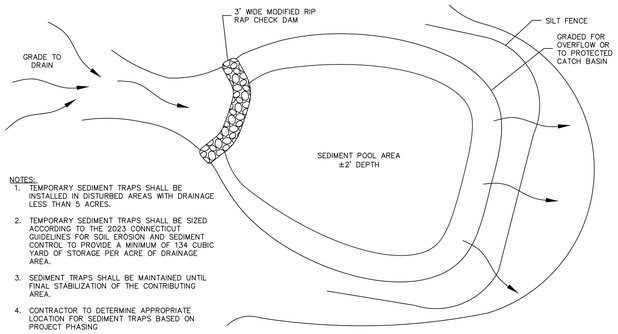
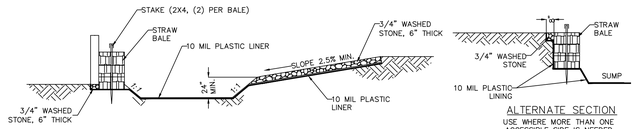


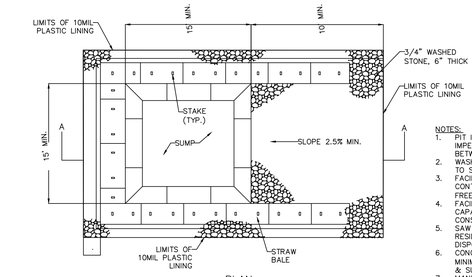
NOTES:
1. TEMPORARY SEDIMENT TRAPS SHALL BE INSTALLED IN DISTURBED AREAS WITH DRAINAGE LESS THAN 5 ACRES.
2. TEMPORARY SEDIMENT TRAPS SHALL BE SIZED ACCORDING TO THE 2023 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL TO PROVIDE A MINIMUM OF 134 CUBIC YARD OF STORAGE PER ACRE OF DRAINAGE AREA.
3. SEDIMENT TRAPS SHALL BE MAINTAINED UNTIL FINAL STABILIZATION OF THE CONTRIBUTING AREA.
4. CONTRACTOR TO DETERMINE APPROPRIATE LOCATION FOR SEDIMENT TRAPS BASED ON PROJECT PHASING

1 TEMPORARY SEDIMENT TRAP
N.T.S



SECTION A–A

ALTERNATE SECTION
USE WHERE MORE THAN ONE ACCESSIBLE SIDE IS NEEDED



PLAN



WASHOUT SIGN

NOTES:
1. PIT IS SPECIFICALLY DESIGNATED, DIKED AND IMPERVIOUS CONTAINMENT TO PREVENT CONTACT BETWEEN CONCRETE WASH AND STORMWATER. WASH WATER SHALL NOT BE ALLOWED TO FLOW TO SURFACE WATER.
2. FACILITY MUST HOLD SUFFICIENT VOLUME TO CONTAIN CONCRETE WASTE WITH A MINIMUM FREEBOARD OF 12".
3. FACILITY SHALL NOT BE FILLED BEYOND 95% CAPACITY UNLESS A NEW FACILITY IS CONSTRUCTED.
4. SAW CUT PORTLAND CEMENT CONCRETE, RESIDUE FROM SAWCUT & GRINDING TO BE DISPOSED OF IN THE PIT.
5. CONCRETE WASHOUTS SHALL BE LOCATED A MINIMUM OF 100' FROM DRAINAGE WAYS, INLETS, & SURFACE WATERS.
6. MANUFACTURING CONCRETE WASHOUT DEVICES MAY BE USED IF REMOVED FROM THE SITE WHEN 95% FULL CAPACITY.

2 CONCRETE WASHOUT AREA
N.T.S

NORTH AMERICAN GREEN
EROSION CONTROL *Products Guaranteed* SOLUTIONS
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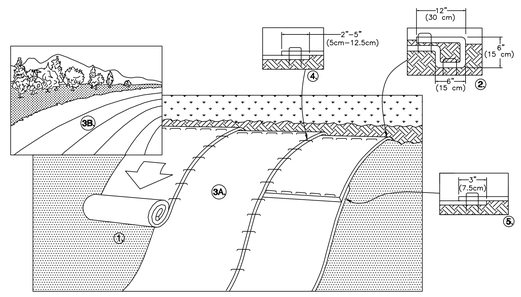
EVANSVILLE, IN 47725
800-772-2040
www.nagreen.com

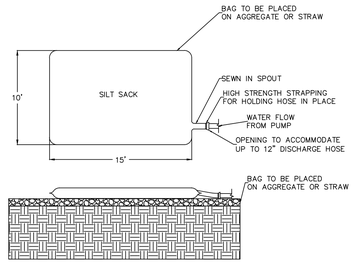
BIONET SC150BN DOUBLE NET STRAW BLANKET – BIODEGRADABLE (OR APPROVED EQUAL)
SLOPE INSTALLATION

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
   NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF RECP's EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE RECP's.
3. ROLL THE RECP's (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM™ STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 2" – 5" (5 CM – 12.5 CM) OVERLAP DEPENDING ON RECP's TYPE.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5 CM) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30 CM) APART ACROSS ENTIRE RECP's WIDTH.
   NOTE:
   •IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY SECURE THE RECP's.



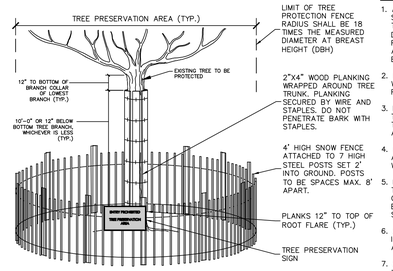
NOTE:
CONTRACTOR TO PROVIDE EROSION CONTROL BLANKET ON ALL SLOPES 3:1 OR STEEPER.

3 SLOPE STABILIZATION (SLOPES ≥3H:1V)
N.T.S



NOTE: SILT SACK TO BE BY DIRTBAG OR EQUIVALENT.

4 SILT SACK
N.T.S



TREE PROTECTION NOTES:

1. ALL EXISTING TREES WITHIN THE LIMITS OF TREE PROTECTION FENCING SHALL BE PROTECTED THROUGHOUT THE DURATION OF WORK. THE LIMIT OF TREE PROTECTION FENCE RADIUS SHALL BE 18 TIMES THE MEASURED DIAMETER-AT-BREAST-HEIGHT (DBH), UNLESS CONDITIONS WARRANT THE FENCE TO BE LOCATED CLOSER TO THE TREE. THE PROJECT LANDSCAPE ARCHITECT TO APPROVE THE LOCATION OF ALL FENCING PRIOR TO EXCAVATION.
2. TREE PROTECTION PLANKING SHALL BE INSTALLED ON ALL EXISTING TREES WHERE WORK IS TO BE DONE WITHIN THE LIMIT OF TREE PROTECTION FENCING. REFER TO DETAIL ON THIS SHEET.
3. IF TREE PROTECTION FENCING NEEDS TO BE MOVED OR BREACHED DUE TO TEMPORARY CONSTRUCTION ACTIVITY WITHIN THE TREE PROTECTION ZONE, THE FENCING WILL BE RESET TO ITS ORIGINAL LOCATION IMMEDIATELY AFTER CONSTRUCTION WITHIN THE TREE PROTECTION ZONE IS COMPLETE.
4. TREE PROTECTION FENCING SHALL BE MAINTAINED TO PROTECT TREES AT ALL TIMES. ANY DAMAGED FENCING SHALL BE IMMEDIATELY REPLACED WHEN DAMAGED.
5. DEMOLITION WORK WITHIN THE TREE PROTECTION FENCE OF PROTECTED TREES SHALL BE PERFORMED BY NON-MECHANICAL METHODS. CONTRACTOR TO PROTECT ROOT MASS AGAINST DAMAGE DURING EXCAVATION. ANY TREE ROOTS THAT ARE DISTURBED, BROKEN, OR CUT SHALL BE PRUNED BACK WITH CLEAN SHARP TOOLS.
6. ALL TEMPORARILY EXPOSED TREE ROOTS SHALL BE COVERED WITH 2 INCHES OF SHREDDED HARDWOOD MULCH AND THOROUGHLY IRRIGATED ON A DAILY BASIS AS DIRECTED BY THE PROJECT LANDSCAPE ARCHITECT.
7. ALL WORK TO BE PERFORMED UNDER THE DIRECT SUPERVISION OF EITHER THE OWNER'S REPRESENTATIVE OR THE PROJECT LANDSCAPE ARCHITECT.

5 TREE PROTECTION FENCE
N.T.S

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TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

PROJECT NORTH

DRAWING TITLE
SOIL EROSION AND SEDIMENT CONTROL DETAILS II

STATE PROJ. NO.	144-0108N
PROJ. NO.	250501
SCALE	AS NOTED
DATE	08/15/2025
DRAWN BY	JAD
APPROVED BY	BP

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.
CE502

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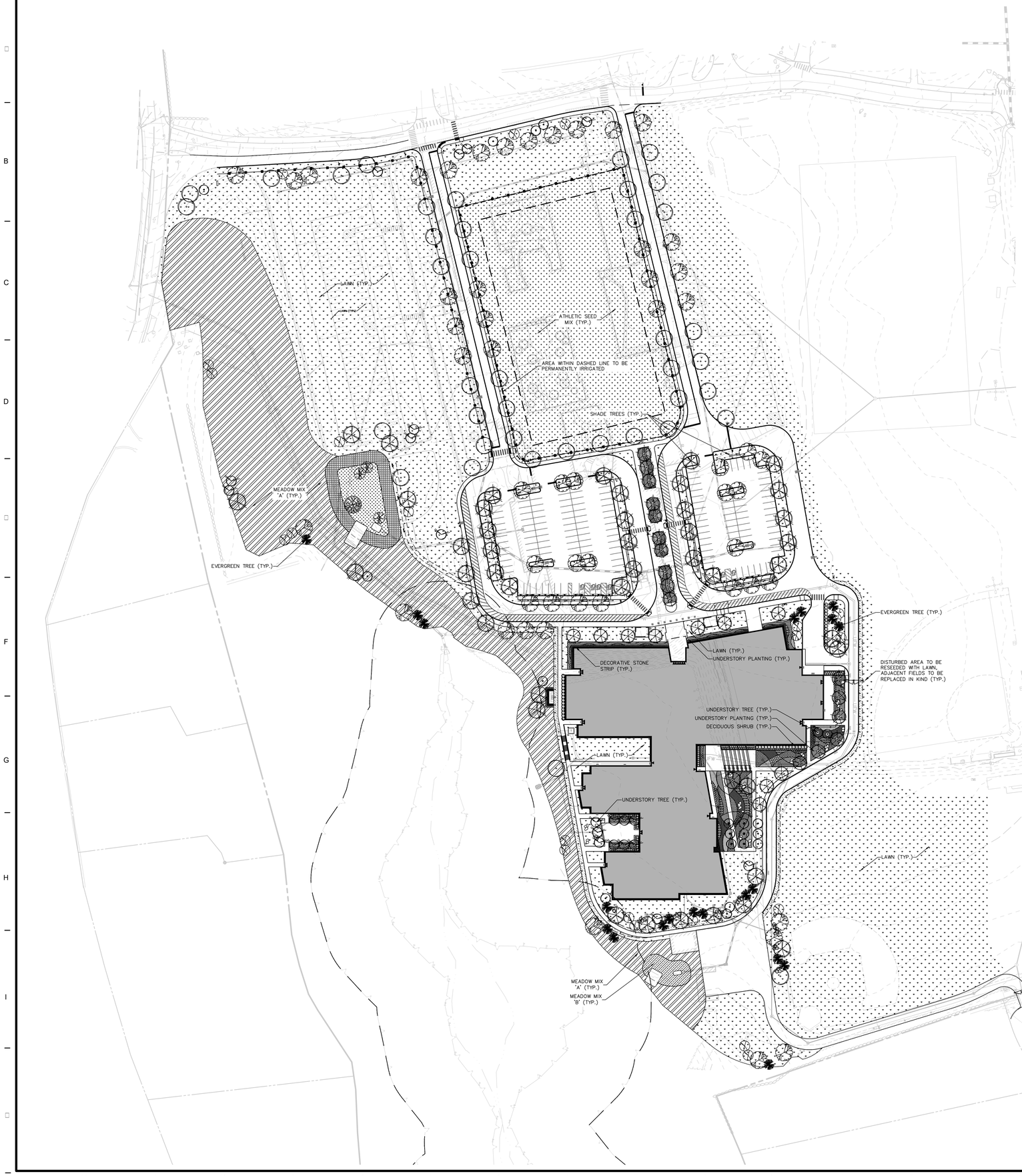

ORDINANCE COMPLIANCE CHART

SMART CODE REQUIREMENT	REQUIRED/ PERMITTED	PROVIDED/ PROPOSED	COMPLIANCE
ARTICLE IV – GARAGES. PARKING SPACES AND LOADING AREAS – 4.6.4	EACH LOT WLL BE PROVIDED WITH A LANDSCAPED AREA EXTENDING THE LENGTH OF THE STREET FRONTAGE ALONG THE INTERIOR SIDE OF THE FRONT LOT LINE, EXCEPT WHERE DRIVEWAY EXITS AND ENTRANCES ARE LOCATED. THE WIDTH OF THE FRONT LANDSCAPED AREA WILL BE NO LESS THAN 10 FEET IN THE B–C ZONE, NO LESS THAN 15 FEET IN THE I–L ZONES, AND 25 FEET OR MORE IN OTHER ZONES. THE AREA OF THE FRONT LANDSCAPED BUFFER MAY BE INCLUDED IN CALCULATIONS FOR THE MINIMUM LANDSCAPED AREA REQUIRED IN SECTION 4.6.2. THE FRONT LANDSCAPED AREA WILL BE COVERED WITH GRASS OR OTHER GROUND COVER AND WILL INCLUDE APPROPRIATE TREES AND SHRUBS. AT A MINIMUM, ONE STREET SHADE TREE HAVING A CALIPER OF AT LEAST 3 INCHES AND A HEIGHT OF AT LEAST 6 FEET AT TIME OF PLANTING WILL BE PLANTED FOR EACH 50 FEET OR FRACTION THEREOF OF LOT FRONTAGE.	LOT FRONTAGE ALONG THE INTERIOR SIDE OF THE FRONT LOT LINE, EXCEPT WHERE DRIVEWAY EXITS AND ENTRANCES ARE LOCATED IS LANDSCAPED WITH GRASS AND OTHER GROUND COVER AND INCLUDES APPROPRIATE TREES AND SHRUBS. AT LEAST ONE STREET SHADE TREE HAS BEEN PLANTED EVERY 50 FEET. 525' TOTAL FRONTAGE / 50 = 10.5 11 = TOTAL STREET TREES REQ. 11 = TOTAL STREET TREES PROPOSED	COMPLIES
ARTICLE IV – GARAGES. PARKING SPACES AND LOADING AREAS – 4.6.6 – INTERIOR PARKING LOT LANDSCAPING	ALL USES REQUIRED TO PROVIDE 20 OR MORE OFF–STREET PARKING SPACES WILL HAVE AT LEAST 20 SQUARE FEET OF INTERIOR LANDSCAPING WITHIN THE PAVED PORTION OF THE PARKING FOR EACH PARKING SPACE. ISLANDS WILL BE PROVIDED TO INDICATE AND ASSURE SAFE AND EFFICIENT CHANNELIZATION OF BOTH PEDESTRIAN AND VEHICULAR TRAFFIC AND TO SEPARATE MAJOR ACCESS WAYS THROUGH THE PARKING AREA FROM PARKING AISLES. EACH SEPARATE LANDSCAPED AREA WILL CONTAIN A MINIMUM OF ONE HUNDRED (100) SQUARE FEET, WILL HAVE A MINIMUM DIMENSION OF AT LEAST EIGHT (8) FEET, WILL BE PLANTED WITH GRASS OR SHRUBS, AND WILL INCLUDE AT LEAST ONE DECIDUOUS TREE OF NOT LESS THAN THREE (3) INCH CALIPER, AT LEAST SIX (6) FEET IN HEIGHT. INTERIOR LANDSCAPING WILL BE POSITIONED TO ENHANCE THE VISUAL QUALITIES OF THE SITE AND TO BREAK UP LARGE EXPANSES OF PARKING. A STANDARD OF ONE ISLAND FOR EVERY TEN PARKING SPACES SHOULD BE USED FOR DESIGN PURPOSES. NO MORE THAN FIFTEEN (15) SPACES IN A ROW OR FOUR ROWS ACROSS WILL BE PERMITTED WITHOUT AN INTERVENING INTERIOR LANDSCAPE AREA. A LANDSCAPED AREA WILL BE PROVIDED ALONG THE PERIMETER OF ANY PARKING AREA EXCEPT WHERE THE PARKING AREA IS FUNCTIONALLY INTEGRATED WITH AN ADJOINING PARKING AREA ON AN ABUTTING LOT. THE LANDSCAPED AREA WILL HAVE A MINIMUM DIMENSION OF FIVE (5) FEET, WILL BE PLANTED WITH GRASS OR SHRUBS, AND WILL INCLUDE AT LEAST ONE DECIDUOUS TREE OF NOT LESS THAN THREE (3) INCH CALIPER, AT LEAST SIX (6) FEET IN HEIGHT FOR EVERY FIFTY (50) FEET ALONG THE PERIMETER OF THE PARKING AREA. WHERE APPROPRIATELY LOCATED, THE REQUIRED FRONT LANDSCAPED AREAS AND PERIMETER BUFFERS MAY BE USED TO SATISFY THIS REQUIREMENT.	LANDSCAPE ISLANDS ARE A MINIMUM OF ONE HUNDRED (100) SQUARE FEET, AND ARE PLANTED WITH GRASS/SHRUBS, AND INCLUDE AT LEAST ONE DECIDUOUS TREE. A LANDSCAPED AREA HAS BEEN PROVIDED ALONG THE PERIMETER OF PARKING AREA AND CONTAINS AT LEAST ONE DECIDUOUS TREE EVERY FIFTY (50) FEET ALONG THE PERIMETER OF THE PARKING AREA. ALL PROPOSED DECIDUOUS SHADE TREES ARE 3–3 1/2" CALIPER.	COMPLIES

PLANT SCHEDULE

KEY	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	REMARKS
SHADE TREE(S)						
ASB	53	ACER SACCHARUM BONFIRE	BONFIRE SUGAR MAPLE	3–3 1/2" CAL.	B+B	–
CXO	40	CELTIS X OCCIDENTALIS	HACKBERRY	3–3 1/2" CAL.	B+B	–
NS	45	NYSSA SYLVATICA	SOURGUM OR TUPELO	3–3 1/2" CAL.	B+B	–
SE	1	SALIX X ELEGANTISSIMA	WEEPING WILLOW	3–3 1/2" CAL.	B+B	–
TXAR	26	TILIA X AMERICANA 'REDMOND'	REDMOND LINDEN	3–3 1/2" CAL.	B+B	–
ORNAMENTAL TREE(S)						
BND	3	BETULA NIGRA 'DURA HEAT'	DURA HEAT RIVER BIRCH	10–12'	B+B	–
CC	20	CERCIS CANADENSIS	EASTERN REDBUD	10–12'	B+B	–
CF	20	CORNUS FLORIDA	WHITE FLOWERING DOGWOOD	10–12'	B+B	–
EVERGREEN TREE(S)						
IO	21	ILEX OPACA	AMERICAN HOLLY	8–10'	B+B	–
PGL	20	PICEA GLAUCA	WHITE SPRUCE	8–10'	B+B	–
EVERGREEN SHRUB(S)						
IGS	126	ILEX GLABRA 'SHAMROCK'	SHAMROCK INKBERRY HOLLY	24–30"	CONTAINER	–
DECIDUOUS SHRUB(S)						
CMP	728	COMPTONIA PEREGRINA	SWEET FERN	2 GAL.	CONTAINER	spaced @ 24" o.c.
CSF	72	CORNUS SERICEA 'FLAVIRAMEA'	YELLOW TWG DOGWOOD	24–30"	CONTAINER	–
HYPM	77	HYPERICUM PROLIFICUM	SHRUBBY ST. JOHNS–WORT	2 GAL.	CONTAINER	–
VD	78	VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	24–30"	CONTAINER	–
PERENNIAL(S)						
ALPS	514	ALLIUM 'PURPLE SENSATION'	'PURPLE SENSATION' ORNAMENTAL ONION	1 GAL.	CONTAINER	spaced @ 18" o.c.
COR	591	COREOPSIS GRANDIFLORA 'EARLY SUNRISE'	TICKSEED	1 GAL.	CONTAINER	spaced @ 24" o.c.
ORNAMENTAL GRASS(ES)						
CXA	1419	CAREX APPALACHICA	APPALACHIAN SEDGE	2 GAL.	CONTAINER	spaced @ 18" o.c.
JE	6029	JUNCUS EFFUSUS	SOFT RUSH	1" PLUG	CONTAINER	spaced @ 12" o.c.
PVS	539	PANICUM VIRGATUM 'SHENANDOAH'	SHENANDOAH SWITCH GRASS	2 GAL.	CONTAINER	spaced @ 24" o.c.
SSCO	736	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	2 GAL.	CONTAINER	spaced @ 24" o.c.
RAIN GARDEN PLANTING						
	850	ACORUS CALAMUS	SWEET FLAG	1" PLUG	CONTAINER	spaced @ 12" o.c.
	85	ARONIA MELANOCARPA	BLACK CHOKEBERRY	3–4'	CONTAINER	10 FEET
	85	CORNUS AMOMUM	SILKY DOGWOOD	3–4'	CONTAINER	10 FEET
	85	CORNUS RACEMOSA	GRAY DOGWOOD	3–4'	CONTAINER	10 FEET
	85	HAMAMELIS VIRGINIANA	COMMON WITCH–HAZEL	3–4'	CONTAINER	10 FEET
	170	IRIS VERSICOLOR	BLUE FLAG IRIS	1 GAL.	CONTAINER	5 FEET

NOTE: IF ANY DISCREPANCIES OCCUR BETWEEN AMOUNTS SHOWN IN THE PLAN AND THE PLANT LIST, THE PLAN SHALL DICTATE.

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TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

OV□R□LL □L□NTING □L□N

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	
D□T□	08/15/2025
DR□WN BY	VGC
□□ROV□D BY	□□

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD □
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□1
5	05/19/2026	100□ CD

Drawing No.

LP100

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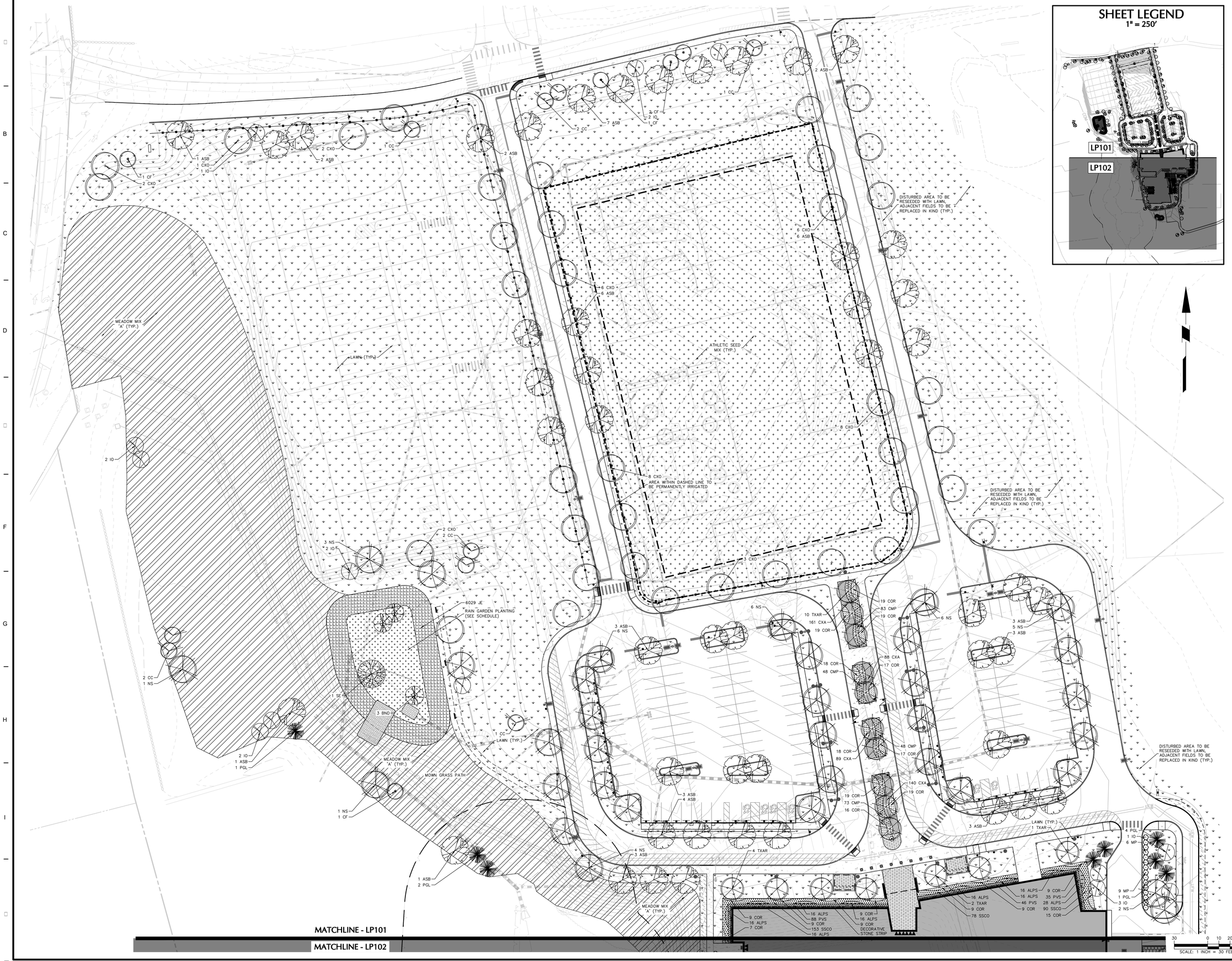
Date: 5/19/2026 Time: 11:18 User: bwillsey Style Table: Langan.stb Layout: L□100 Document Code: 140325901-0101-L□101-0101



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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

PROJECT NORTH

DRAWING TITLE

LANDSCAPE PLAN I

STATE PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	
DATE	08/15/2025
DRAWN BY	
APPROVED BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

Drawing No.

LP101

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Date: 5/19/2026 Time: 11:19 User: bwillser Style Table: Langan.stb Layout: L-101 Document Code: 140325901-0101-L-101-0102

MATCHLINE - LP101

MATCHLINE - LP102

15 VD

1 CF
2 NS

MEADOW MIX 'A' (TYP.)

LAWN (TYP.)

1 CXO

20 IGS
9 CC
35 CXA
28 SSCO
30 CMP

30 CMP

28 SSCO
35 CXA
20 IGS
DECORATIVE STONE STRIP (TYP.)

2 IO

1 CF
1 PGL
3 MP
2 IO

1 CC
4 PGL

2 PGL
4 MP
4 MP
1 IO

LAWN (TYP.)

4 MP

1 ASB
2 PGL

MEADOW MIX 'A' (TYP.)

DISTURBED AREA TO BE RESEEDED WITH MEADOW MIX 'A', V.I.F. (TYP.)

MEADOW MIX 'B' (TYP.)

DISTURBED AREA TO BE RESEEDED WITH, V.I.F. (TYP.)

DECORATIVE STONE STRIP (TYP.)
16 CSF
13 HYPM
10 IGS
56 CXA
52 SSCO
34 PVS

56 PVS
25 IGS
17 VD
73 CMP

14 HYPM
83 CMP
38 ALPS
18 CSF

18 IGS

3 TXAR
44 CMP

50 SSCO
163 CXA
17 CSF

55 COR
2 CF

115 PVS
60 ALPS
50 SSCO
125 CXA
24 HYPM

2 TXAR
66 CMP

4 TXAR
100 CXA
60 SSCO

88 CXA
47 COR
33 IGS
69 SSCO
76 CXA

28 COR

165 ALPS
84 PVS
63 SSCO
69 ALPS

42 CMP
2 NS
78 COR
21 CSF

40 SSCO
61 CXA
33 CXA
26 HYPM
42 ALPS

185 COR
9 CF
45 COR

94 PVS
80 CMP
72 COR

38 CMP

1 CC
6 NS

1 IO
1 MP

2 ASB
5 MP

3 MP
1 NS
2 PGL

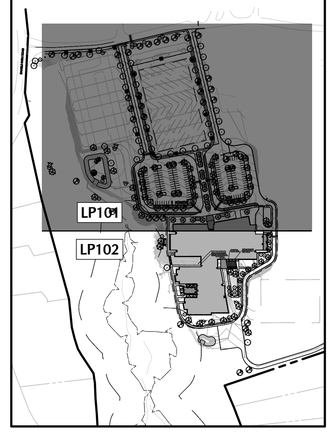
3 MP
1 CXO

DISTURBED AREA TO BE RESEEDED WITH LAWN, ADJACENT FIELDS TO BE REPLACED IN KIND (TYP.)

DISTURBED AREA TO BE RESEEDED WITH LAWN, ADJACENT FIELDS TO BE REPLACED IN KIND (TYP.)

DISTURBED AREA TO BE RESEEDED WITH LAWN, ADJACENT FIELDS TO BE REPLACED IN KIND (TYP.)

SHEET LEGEND
1" = 250'



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SCALE: 1 INCH = 30 FEET

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TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

□L□NTING □L□N II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	
D□T□	08/15/2025
DR□WN BY	VGC
□□ROV□D BY	□□

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

LP102

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9/2/2025 4:30:02 □M □utodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-□rch_BIM360-R26.rvt

Date: 5/19/2026 Time: 11:20 User: bwillsey Style Table: Langan.stb Layout: L□102 Document Code: 140325901-0101-L□101-0103

ADD/ALTERNATE C1:
MILL AND OVERLAY, RESTRIPE

CONTRACTOR TO BORE EXISTING PAVEMENT TO DETERMINE THICKNESS OF BOTH PAVEMENT AND GRAVEL BASE. REPORT FINDINGS TO CIVIL ENGINEER PRIOR TO CONSTRUCTION. IF THE EXISTING PAVEMENT DOES NOT MEET PROJECT REQUIREMENTS, PROVIDE FULL DEPTH HEAVY DUTY BITUMINOUS CONCRETE PAVEMENT SECTION.

ADD/ALTERNATE C2:
44 ADDITIONAL PARKING SPACES

ADD/ALTERNATE C3:
ADDITIONAL ATHLETIC FIELD AND UNDERDRAINAGE

ADD/ALTERNATE C2:
10 ADDITIONAL ELECTRIC VEHICLE CHARGING SPACES

AREA WITHIN DASHED LINE TO BE PERMANENTLY IRRIGATED

DISTURBED AREA TO BE RESEEDED WITH LAWN, ADJACENT FIELDS TO BE REPLACED IN KIND (TYP.)

ATHLETIC SEED MIX (TYP.)

ALL PURPOSE ATHLETIC FIELD

MEADOW MIX 'A' (TYP.)

MOWN GRASS PATH

RAIN GARDEN PLANTING (SEE SCHEDULE)

SWING CAPS

LAWN (TYP.)

340'-0"

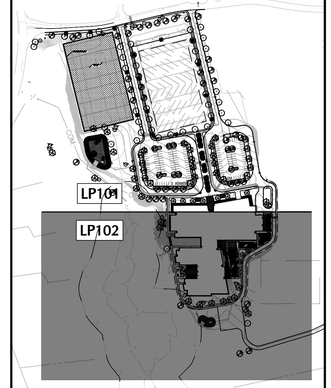
200'-0"

STOP

MATCHLINE - LP101

MATCHLINE - LP102

SHEET LEGEND
1" = 250'



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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

PROJECT NORTH

DRAWING TITLE

PLANTING PLAN - ALTERNATES

STATE PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	
DATE	08/15/2025
DRAWN BY	EC
APPROVED BY	KM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

Drawing No.

LP201

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Date: 5/19/2026 Time: 11:20 User: bwillser Style Table: Langan.stb Layout: L-101 Document Code: 140325901-0101-L-101-0104

GENERAL LANDSCAPE PLANTING NOTES:

PLANTING MATERIALS

1. NAMES OF PLANTS AS DESCRIBED ON THIS PLAN CONFORM TO THOSE GIVEN IN "STANDARDIZED PLANT NAMES", 1942 EDITION PREPARED BY THE AMERICAN JOINT COMMITTEE ON HORTICULTURAL NOMENCLATURE. NAMES OF PLANT VARIETIES NOT INCLUDED THEREIN CONFORM TO NAMES GENERALLY ACCEPTED IN NURSERY TRADE.
2. STANDARDS FOR TYPE, SPREAD, HEIGHT, ROOT BALL AND QUALITY OF NEW PLANT MATERIAL SHALL BE IN ACCORDANCE WITH GUIDELINES AS SET FORTH IN THE "AMERICAN STANDARD FOR NURSERY STOCK", PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN. PLANT MATERIAL SHALL HAVE NORMAL HABIT OF GROWTH AND BE HEALTHY, VIGOROUS, AND FREE FROM DISEASES AND INSECT INFESTATION.
3. NEW PLANT MATERIAL SHALL BE NURSERY GROWN UNLESS SPECIFIED OTHERWISE. ALL PLANTS SHALL BE SET PLUMB AND SHALL BEAR THE SAME RELATIONSHIP TO FINISHED GRADE AS THE PLANT'S ORIGINAL GRADE BEFORE DIGGING. PLANT MATERIAL OF THE SAME SPECIES AND SPECIFIED AS THE SAME SIZE SHOULD BE SIMILAR IN SHAPE, COLOR AND HABIT. THE LANDSCAPE ARCHITECT HAS THE RIGHT TO REJECT PLANT MATERIAL THAT DOES NOT CONFORM TO THE TYPICAL OR SPECIFIED HABIT OF THAT SPECIES.
4. THE CONTRACTOR SHALL NOT MAKE SUBSTITUTIONS. IF THE SPECIFIED LANDSCAPE MATERIAL IS NOT OBTAINABLE, THE CONTRACTOR SHALL SUBMIT PROOF OF NON-AVAILABILITY TO THE LANDSCAPE ARCHITECT AND OWNER TOGETHER WITH A WRITTEN PROPOSAL FOR USE OF AN EQUIVALENT MATERIAL.

DELIVERY, STORAGE, AND HANDLING

1. PACKAGED MATERIALS: PACKAGED MATERIALS SHALL BE DELIVERED IN CONTAINERS SHOWING WEIGHT, ANALYSIS, AND NAME OF MANUFACTURER. MATERIALS SHALL BE PROTECTED FROM DETERIORATION DURING DELIVERY, AND WHILE STORED AT SITE.
2. TREES AND SHRUBS: THE CONTRACTOR SHALL PROVIDE TREES AND SHRUBS DUG FOR THE GROWING SEASON FOR WHICH THEY WILL BE PLANTED. DO NOT PRUNE PRIOR TO DELIVERY UNLESS OTHERWISE DIRECTED BY THE LANDSCAPE ARCHITECT. DO NOT BEND OR BIND-TIE TREES OR SHRUBS IN SUCH A MANNER AS TO DAMAGE BARK, BREAK BRANCHES, OR DESTROY NATURAL SHAPE. PROVIDE PROTECTIVE COVERING DURING TRANSIT. DO NOT DROP OR BREAK BALLED STOCK DURING DELIVERY OR HANDLING.
3. ALL PLANTS SHALL BE BALLED AND BURLAPPED OR CONTAINER GROWN AS SPECIFIED. NO CONTAINER GROWN STOCK WILL BE ACCEPTED IF IT IS ROOT BOUND. ALL ROOT BALL WRAPPING AND BINDING MATERIAL MADE OF SYNTHETICS OR PLASTICS SHALL BE REMOVED FROM THE TOP OF THE BALL AT THE TIME OF PLANTING, IF THE PLANT IS SHIPPED WITH A WIRE BASKET AROUND THE ROOT BALL, THE WIRE BASKET SHALL BE CUT AND FOLDED DOWN 8" INTO THE PLANTING HOLE. WITH CONTAINER-GROWN STOCK, THE CONTAINER SHALL BE REMOVED AND THE ROOT BALL SHALL BE CUT THROUGH THE SURFACE IN TWO LOCATIONS.
4. THE CONTRACTOR SHALL HAVE TREES AND SHRUBS DELIVERED TO SITE AFTER PREPARATIONS FOR PLANTING HAVE BEEN COMPLETED AND PLANT IMMEDIATELY. IF PLANTING IS DELAYED MORE THAN 6 HOURS AFTER DELIVERY, THE CONTRACTOR SHALL SET TREES AND SHRUBS IN SHADE, PROTECT FROM WEATHER AND MECHANICAL DAMAGE AND KEEP ROOTS MOIST BY COVERING WITH MULCH, BURLAP OR OTHER ACCEPTABLE MEANS OF RETAINING MOISTURE.

INSTALLATION

1. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITY AND SEWER LINES PRIOR TO THE START OF EXCAVATION ACTIVITIES. NOTIFY THE PROJECT ENGINEER AND OWNER IMMEDIATELY OF ANY CONFLICTS WITH PROPOSED PLANTING LOCATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE.
2. THE CONTRACTOR TO STAKE OUT PLANTING LOCATIONS, FOR REVIEW AND APPROVAL BY THE LANDSCAPE ARCHITECT AND/OR OWNER BEFORE PLANTING WORK BEGINS. THE LANDSCAPE ARCHITECT AND/OR OWNER SHALL DIRECT THE CONTRACTOR IN THE FINAL PLACEMENT OF ALL PLANT MATERIAL AND LOCATION OF PLANTING BEDS TO ENSURE COMPLIANCE WITH DESIGN INTENT UNLESS OTHERWISE INSTRUCTED.
3. NO PLANTING SHALL BE INSTALLED BEFORE ACCEPTANCE OF FINAL GRADING.
4. COMPLETE QUANTITIES OF PLANTS FOR EACH AREA TO BE AVAILABLE ON SITE AT THE TIME OF PLANTING FOR FIELD LAYOUT BY OWNER'S REPRESENTATIVE. NO PARTIAL LAYOUT AND PLANTING OF AREAS WILL BE ACCEPTABLE,
5. INSTALL PLANTS WITH ROOT FLARES FLUSH WITH GRADE. IMMEDIATELY REPLANT PLANTS WHICH SETTLE OUT OF PLUMB OR BELOW FINISH GRADE.
6. NO PLANT SHALL BE PUT INTO THE GROUND BEFORE ROUGH GRADING HAS BEEN COMPLETED AND APPROVED BY THE PROJECT LANDSCAPE ARCHITECT OR PROJECT ENGINEER.
7. ALL LANDSCAPED AREAS TO BE CLEARED OF ROCKS, STUMPS, TRASH AND OTHER UNSIGHTLY DEBRIS. ALL FINE GRADED AREAS SHOULD BE HAND RAKED SMOOTH ELIMINATING ANY CLUMPS AND UNEVEN SURFACES PRIOR TO PLANTING OR MULCHING.
8. ALL PLANT MATERIAL SHALL BE INSTALLED AS PER DETAILS, NOTES AND CONTRACT SPECIFICATIONS. THE LANDSCAPE ARCHITECT MAY REVIEW INSTALLATION AND MAINTENANCE PROCEDURES.
9. PLANT UNDER FULL SUPERVISION OF CERTIFIED ARBORIST, NURSERYMAN, OR LICENSED LANDSCAPE ARCHITECT. PROVIDE WRITTEN VERIFICATION OF CERTIFICATION AND/OR LICENSE FOR OWNER'S REPRESENTATIVE'S APPROVAL.
10. THE CONTRACTOR SHALL KEEP AREA CLEAN DURING DELIVERY AND INSTALLATION OF PLANT MATERIALS. REMOVE AND DISPOSE OF OFF-SITE ANY ACCUMULATED DEBRIS OR UNUSED MATERIALS. REPAIR DAMAGE TO ADJACENT AREAS CAUSED BY LANDSCAPE INSTALLATION OPERATIONS.
11. LOOSE OR CRACKED ROOTBALLS ARE UNACCEPTABLE.
12. DO NOT USE TREE WRAP.
13. AFTER PLANT IS PLACED IN TREE PIT LOCATION, ALL TWINE HOLDING ROOT BALL TOGETHER SHOULD BE COMPLETELY REMOVED. REMOVE TOP 2/3 OF WIRE BASKETS. REMOVE TOP 1/3 OF BURLAP. SYNTHETIC BURLAP WILL NOT BE ACCEPTED. FOR CONTAINER PLANTS, REMOVE CONTAINER AND SCARIFY EDGES OF ROOTBALL 1/2" DEEP IN A MINIMUM OF FOUR LOCATIONS.
14. MULCH SHOULD NOT BE PILED UP AROUND THE TRUNK OF ANY PLANT MATERIAL. NO MULCH OR TOPSOIL SHOULD BE TOUCHING THE BASE OF THE TRUNK ABOVE THE ROOT COLLAR.
15. ALL PLANTS SHALL BE WATERED THOROUGHLY TWICE DURING THE FIRST 24-HOUR PERIOD AFTER PLANTING. ALL PLANTS SHALL THEN BE WATERED WEEKLY OR AS REQUIRED BY SITE AND WEATHER CONDITIONS TO MAINTAIN VIGOROUS AND HEALTHY PLANT GROWTH.
16. RAISE AND REPLANT PLANTS THAT SETTLE AFTER PLANTING AND WATERING.
17. AFTER COMPLETION OF A PROJECT, ALL EXPOSED GROUND SURFACES THAT ARE NOT PAVED WITHIN THE CONTRACT LIMIT LINE, AND THAT ARE NOT COVERED BY LANDSCAPE PLANTING OR SEEDING AS SPECIFIED, SHALL BE COVERED BY A SHREDDED HARDWOOD BARK OR APPROVED EQUAL MULCH THAT WILL PREVENT SOIL EROSION AND THE EMANATION OF DUST.

GUARANTEE

1. NEW PLANT MATERIAL SHALL BE GUARANTEED TO BE ALIVE AND IN VIGOROUS GROWING CONDITION FOR A PERIOD OF 18 MONTHS FOLLOWING ACCEPTANCE BY THE OWNER. PLANT MATERIAL FOUND TO BE UNHEALTHY, DYING OR DEAD DURING THIS PERIOD, SHALL BE REMOVED AND REPLACED IN KIND BY THE CONTRACTOR AT NO EXPENSE TO THE OWNER.

LAWN SEED NOTES:

1. LAWN SEED MIX: LESCO GRASS SEED – ALL PRO TRANSITION MIX (3 TURF-TYPE TALL-FESCUE GRASSES)

NOTES:
A) SEED RATE:
1) NEW ESTABLISHMENT: SEED AT A RATE OF 6-8 LBS/1000 SQ FT
2) RENOVATION: 20-50% EXISTING COVER: 5-7 LBS/1000 SQ FT
50-75% EXISTING COVER: 4-6 LBS/1000 SQ FT

2. GENERAL SEED NOTES:

A) FINAL SEED MIXTURES, RATES, AND SPECIES TO BE DETERMINED BASED ON PROJECT LANDSCAPE ARCHITECT REVIEW.
B) SEEDING SHALL TAKE PLACE IN THE SPRING (APRIL 1 TO JUNE 15) OR THE FALL (SEPTEMBER 1 TO OCTOBER 15).
C) ELIMINATE UNWANTED VEGETATION PRIOR TO SEEDING USING A NON-SELECTIVE HERBICIDE PER MANUFACTURER'S SPECIFICATIONS.
D) IT IS RECOMMENDED THAT CONTRACTOR INSTALL SEED MIXTURE USING A NO-TILL TRUAX-TYPE DRILL SEEDER WHERE APPLICABLE.
E) THERE MUST BE CONTINUOUS SOIL MOISTURE FOR 4-6 WEEKS TO ALLOW FOR PROPER GERMINATION.

MEADOW SEED NOTES

1. MEADOW MIX 'A' – ERNMX-181 (NATIVE STEEP SLOPE MIX WITH ANNUAL RYEGRASS**)

29.% ANDROPOGON GERARDII, 'BISON'	BIG BLUESTEM, BISON
20.0% LOLIUM MULTIFLORUM	ANNUAL RYEGRASS
15.5% SORGHASTRUM NUTANS, 'NEBRASKA 54'	INDIANGRASS, NEBRASKA 54
13.4% ELYMUS VIRGINICUS, 'MADISON'	VIRGINIA WILDRYE, MADISON
10.0% ELYMUS CANADENSIS	CANADA WILDRYE
4.0% AGROSTIS PERENNANS, ALBANY PINE BUSH	AUTUMN BENTGRASS, ALBANY PINE BUSH
4.0% PANICUM VIRGATUM, 'HABITAT'	SWITCHGRASS, NJ ECOTYPE
3.0% PANICUM CLANDESTINUM, TIOGA	DEERTONGUE, TIOGA

NOTES:
SEED AT A RATE OF 60 LBS/ACRE OF 100% PURE LIVE SEED.
SEED VARIETIES WITH RATES UNDER 1.0% NOT INCLUDED ABOVE, REFER TO ERNST SEED MIX FOR COMPLETE BLEND.
**RECOMMENDED COVER CROP MAY VARY BASED ON TIME OF SEEDING. PRIOR TO INSTALLATION, CONTRACTOR TO SUBMIT FINAL COVER CROP FOR REVIEW BY PROJECT LANDSCAPE ARCHITECT.

2. MEADOW MIX 'B' – ERNST SEED MIX ERNMX-183 (NATIVE DETENTION AREA MIX)

26.0% PANICUM CLANDESTINUM, 'TIOGA'	DEERTONGUE, 'TIOGA'
25.0% PANICUM VIRGATUM, 'SHAWNEE'	SWITCHGRASS, 'SHAWNEE'
21% ELYMUS VIRGINICUS 'MADISON	VIRGINIA WILDRYE 'MADISON'
20% CAREX VULPINOIDEA	FOX SEDGE
4.0% AGROSTIS PERENNANS, PIEDMONT	WINTER BENTGRASS, PIEDMONT
2% JUNCUS EFFUSUS	SOFT RUSH
1% PANICUM RIGIDULUM	REDTOP PANICGRASS
1% JUNCUS TENUIS	PATH RUSH

NOTES:
SEED AT A RATE OF 20 LBS/ACRE OF 100% PURE LIVE SEED.

3. ATHLETIC FIELD MIX

30.0% FESTUCA ARUNDINACEA	FAWN TALL FESCUE, FAWN
30.0% LOLIUM PERENNE	CONFETTI III' PERENNIAL RYEGRASS, CONFETTI III (TURF TYPE)
15.0% POA PRATENSIS	'MERIT' KENTUCKY BLUEGRASS, MERIT
15.0% POA PRATENSIS	'KELLY' KENTUCKY BLUEGRASS, KELLY
10.0% LOLIUM MULTIFLORUM	ANNUAL RYEGRASS'

A) SEED PER SUPPLIER'S RECOMMENDATIONS.

GENERAL SEEDING NOTES:

1. SEEDING SHALL TAKE PLACE IN THE SPRING (APRIL 1 TO JUNE 15) OR THE FALL (SEPTEMBER 1 TO OCTOBER 15).
2. ELIMINATE UNWANTED VEGETATION PRIOR TO SEEDING USING A GLYPHOSATE-BASED HERBICIDE PER MANUFACTURER'S SPECIFICATIONS. CONTRACTOR TO ENSURE HERBICIDE IS INDICATED FOR USE AROUND WATER BODIES.
3. IT IS RECOMMENDED THAT CONTRACTOR INSTALL SEED MIXTURE USING A NO-TILL TRUAX-TYPE DRILL WHERE APPLICABLE.
4. THERE MUST BE CONTINUOUS SOIL MOISTURE FOR 4-6 WEEKS TO ALLOW PROPER GERMINATION.

WEED CONTROL / MAINTENANCE

1. DURING THE ESTABLISHMENT YEAR, CONTRACTOR SHALL MOW SEEDING IF WEED HEIGHT EXCEEDS MEADOW MIX HEIGHT. MOW AT A HEIGHT OF 8"-10". DO NOT MOW CLOSE, AS SOME OF THE MEADOW MIX MAY BE DAMAGED.
2. AFTER THE FIRST GROWING SEASON, AND IF MEADOW MIX IS WELL ESTABLISHED, THE MEADOW MIX SHALL BE MOWED ONLY ONCE ANNUALLY. ANNUAL MAINTENANCE MOWING SHALL BE DONE IN LATE WINTER DURING THE MONTH OF MARCH.
3. MOW IN DETENTION BASIN AND WETLAND TRANSITION AREAS DURING DRIER SITE CONDITIONS WHEN SOIL DISTURBANCE WILL NOT OCCUR. MAINTENANCE FOR DETENTION BASIN AND WETLAND TRANSITION AREAS SHALL OCCUR DURING LATE SUMMER (JULY 15 – AUGUST 15) WHEN THE WATER TABLE IS USUALLY AT ITS LOWEST POINT OF THE YEAR. DO NOT MOW IN DETENTION BASIN, WETLAND OR WETLAND TRANSITION AREAS AFTER ESTABLISHMENT OF MEADOW MIX.

BIORETENTION SOIL MIX:

BIORETENTION SOIL MIX
a. BIORETENTION SOIL MIX IS TO BE USED IN ALL DETENTION BASINS AND RAIN GARDENS.
b. MIX TO CONSIST OF 60% COARSE SAND, 40% SUBMITTED TOPSOIL/HORTICULTURAL SOIL MIX
c. TOPSOIL/HORTICULTURAL SOIL MIX: REFER TO SPECIFICATIONS LISTED IN SECTION ABOVE

d. COARSE SAND

1) PARTICLE SIZE ANALYSIS

SIEVE	PERCENT PASSING
3/8 INCH (9.5 MM)	100
NO 4 (4.75 MM)	95-100
NO 8 (2.36 MM)	80-100
NO 16 (1.18 MM)	50-85
NO 30 (.60 MM)	25-60
NO 50 (.30 MM)	10-30
NO 100 (.15 MM)	2-10
NO 200 (0.75 MM	2-5

2) CHEMICAL ANALYSIS
PH: LOWER THAN 7.0
TOXIC SUBSTANCE ANALYSIS

e. FINAL BIORETENTION MIX

1) PARTICLE SIZE ANALYSIS
a) SAND – 80-85%
b) SILT – 10-15%
c) CLAY – 2-5%

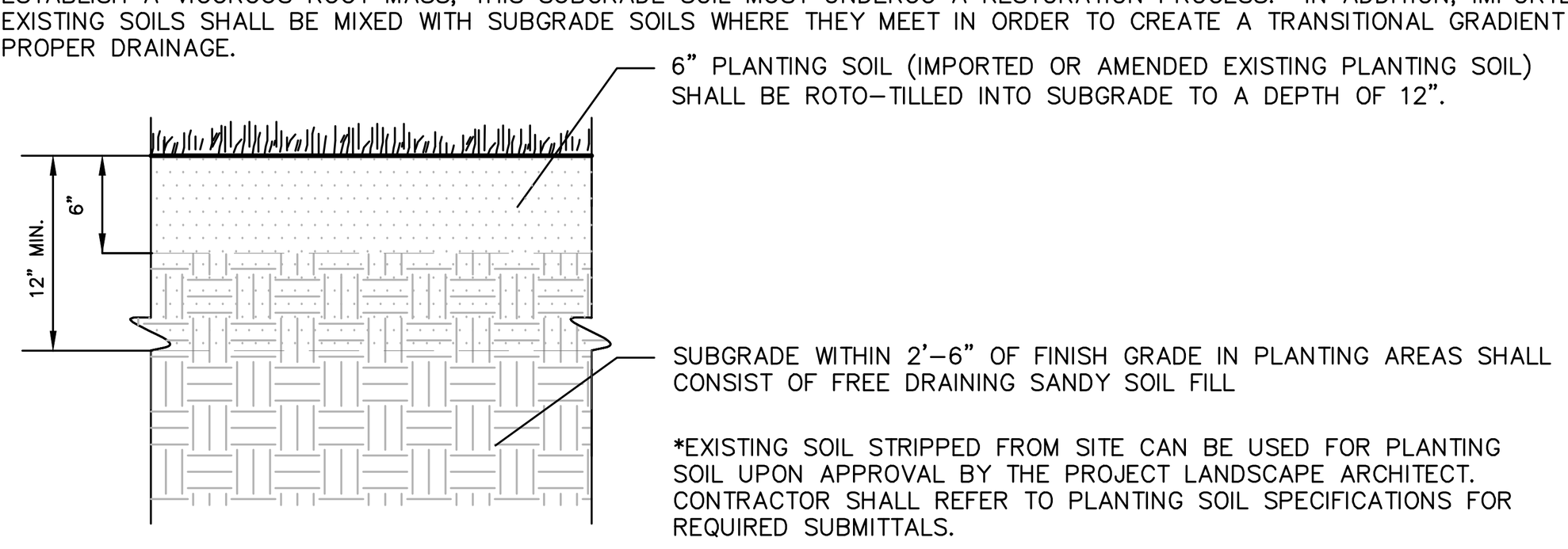
NOT MORE THAN 1% OF MATERIAL TO BE RETAINED BY A #4 SIEVE

2) CHEMICAL ANALYSIS
a) PH – 5.5-6.5
b) SOLUBLE SALTS: LESS THAN 2 MMHO/CM

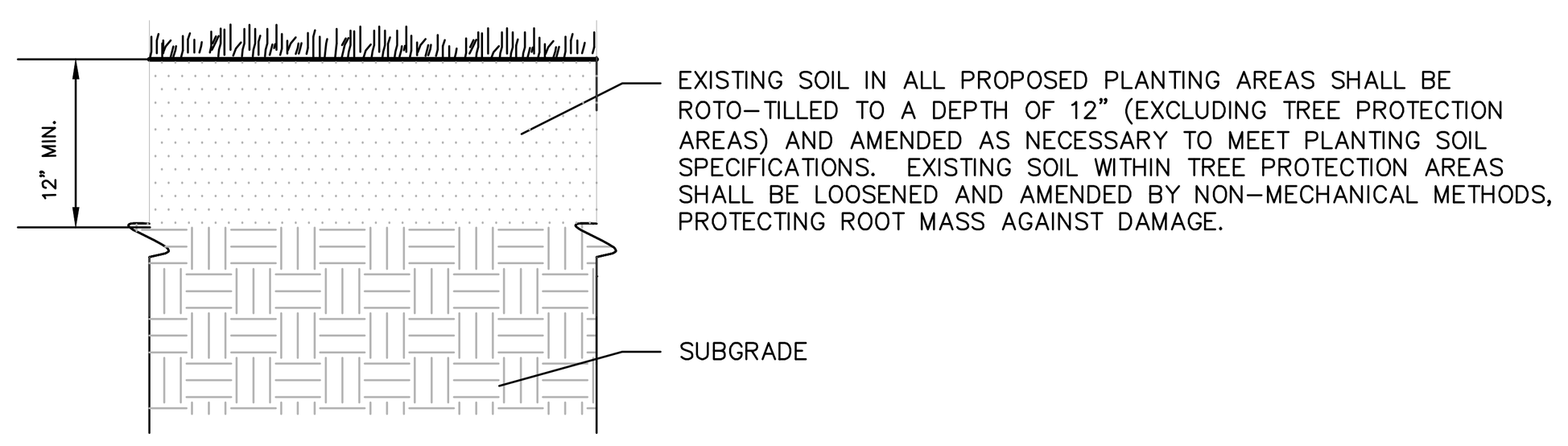
3) CONTRACTOR TO SUBMIT TOXIC SUBSTANCE ANALYSIS AND MATERIAL DRAINAGE RATE IN ADDITION TO INFORMATION LISTED ABOVE. DRAINAGE RATE OF MATERIAL TO EXCEED 1 INCH/HOUR

GENERAL NOTE:

DUE TO GENERAL CONSTRUCTION ACTIVITIES AND ADJACENT SITE COMPACTION REQUIREMENTS, SUBGRADE SOILS WITHIN PROPOSED PLANTING AREAS TEND TO BECOME HIGHLY COMPACTED. IN ORDER TO CREATE A HEALTHY GROWTH MEDIUM TO ALLOW PROPOSED PLANTINGS TO ESTABLISH A VIGOROUS ROOT MASS, THIS SUBGRADE SOIL MUST UNDERGO A RESTORATION PROCESS. IN ADDITION, IMPORTED OR AMENDED EXISTING SOILS SHALL BE MIXED WITH SUBGRADE SOILS WHERE THEY MEET IN ORDER TO CREATE A TRANSITIONAL GRADIENT TO ALLOW FOR PROPER DRAINAGE.



PLANTING SOIL WITHIN AREAS OF CUT OR RAISED GRADE

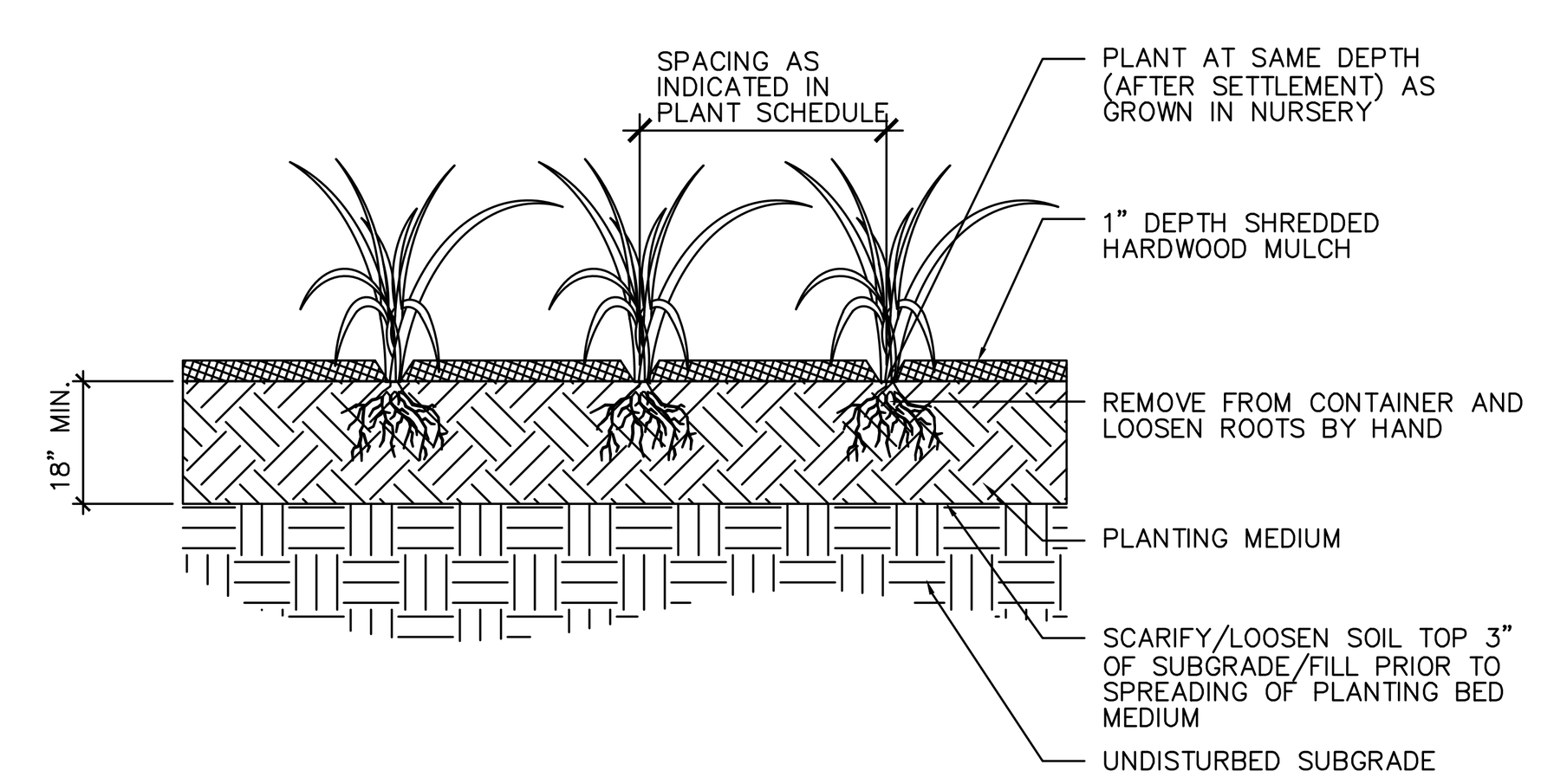


PLANTING SOIL WITHIN AREAS OF UNCHANGED GRADE

NOTES:

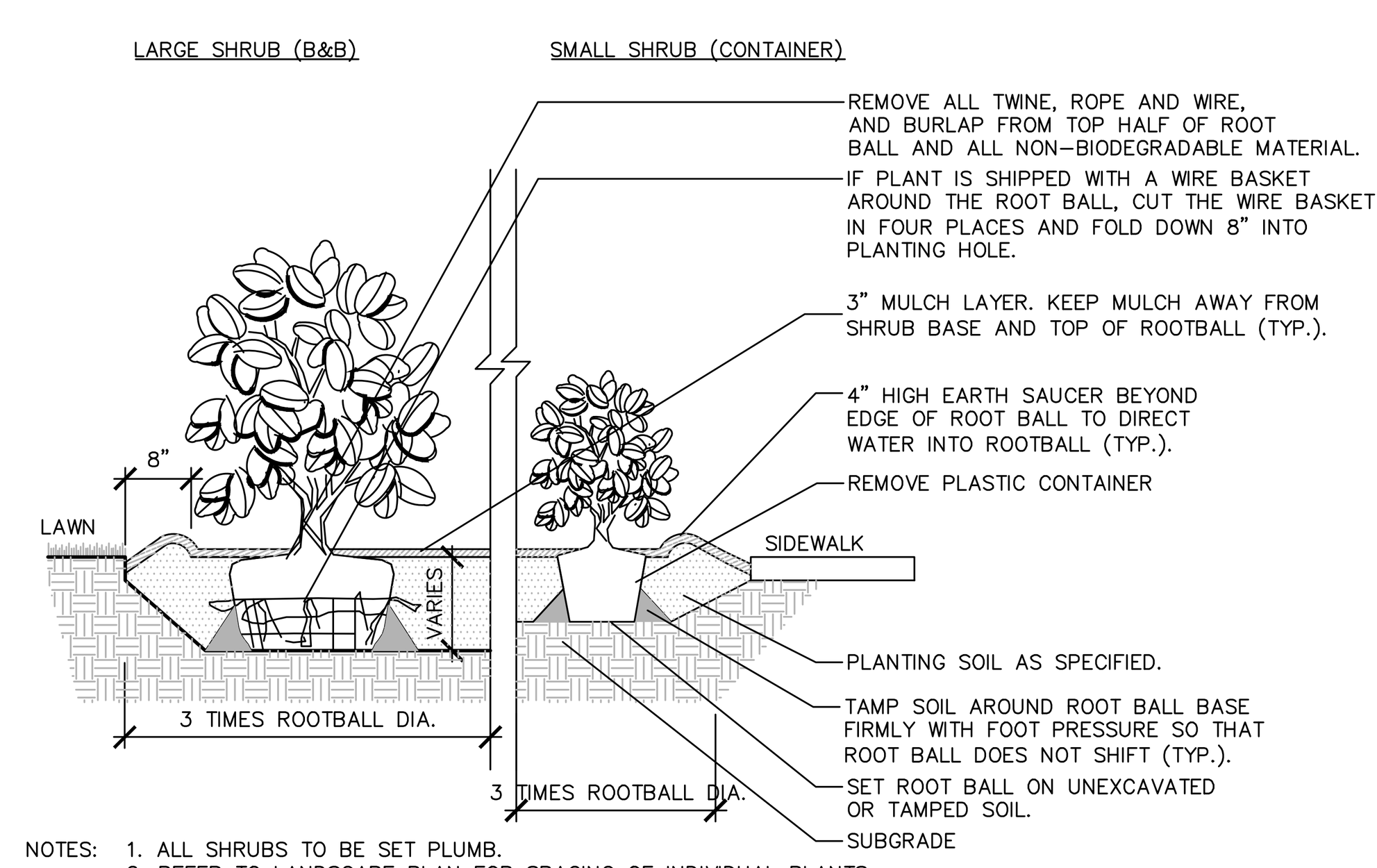
1. CONTRACTOR IS RESPONSIBLE TO SEND SAMPLES OF EXISTING SOILS INTENDED FOR USE IN PLANTING AREAS (1 PER 500 CY.) TO TESTING LABORATORY OR UNIVERSITY COOPERATIVE EXTENSION FOR TESTING. ALL TESTING COSTS ARE AT THE CONTRACTOR'S EXPENSE.
2. RECYCLED CRUSHED CONCRETE AND ASPHALT MILLINGS SHALL NOT BE PLACED WITHIN 2'-6" OF FINISH GRADE IN PROPOSED LANDSCAPE AREAS.
3. IMPORTED FILL SHALL CONTAIN NO CONTAMINATION IN EXCEEDENCE OF THE APPLICABLE STATE ENVIRONMENTAL STANDARDS AND MEET THE ENVIRONMENTAL REQUIREMENTS FOR THE PROJECT. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION OF COMPLIANCE PRIOR TO DELIVERY OF ANY FILL TO THE SITE.
4. CONTRACTOR TO LIGHTLY COMPACT ALL PLACED PLANTING SOILS AND RAISE GRADES ACCORDINGLY TO ALLOW FOR FUTURE SETTLEMENT OF PLANTING SOILS (TYP.)
5. NO STONES, WOOD CHIPS, OR DEBRIS LARGER THAN 1/2" SHALL BE ACCEPTABLE WITHIN PLANTING AREAS.

1 PLANTING SOIL
N.T.S



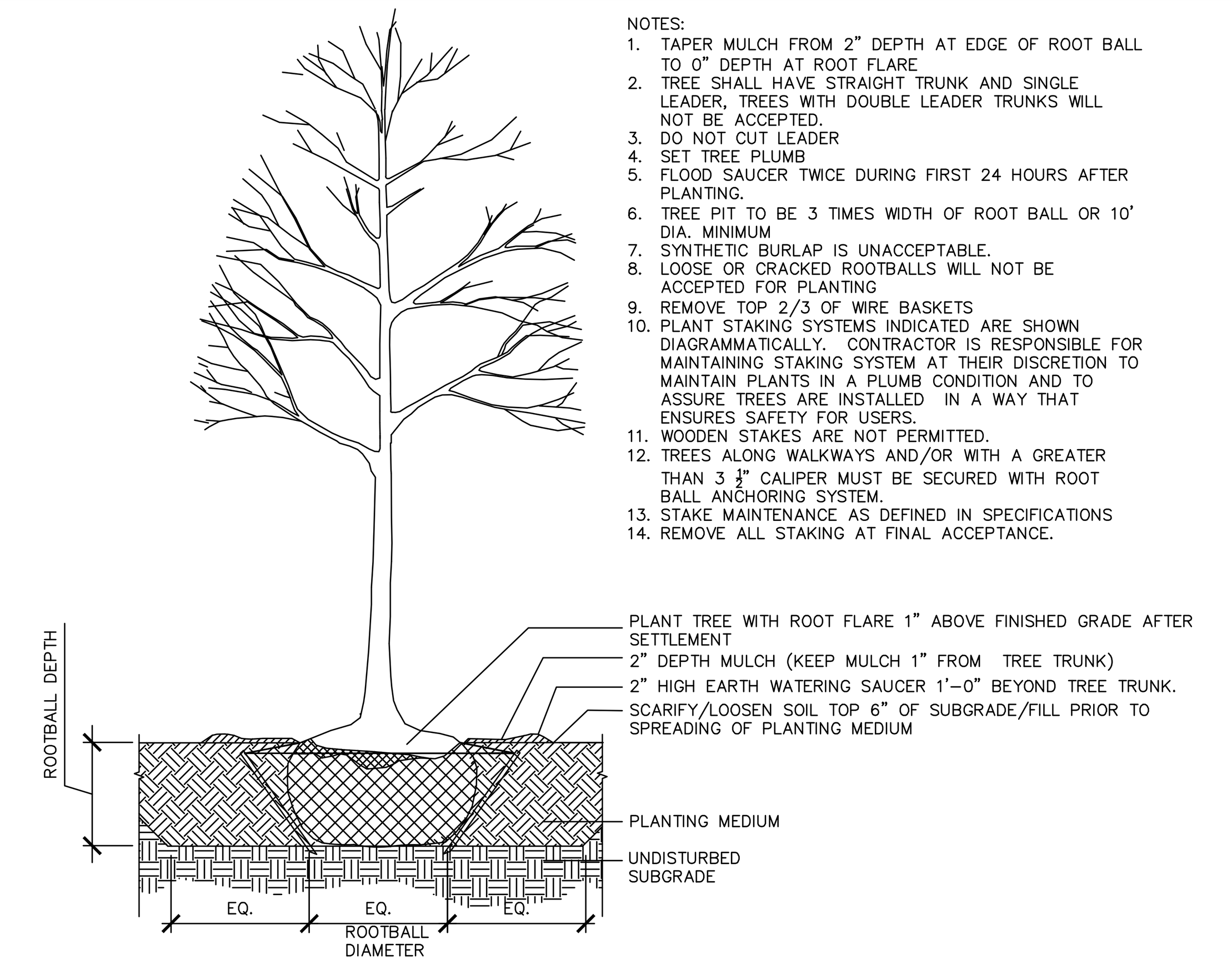
NOTES
1. LOOSE OR CRACKED ROOT BALLS ARE UNACCEPTABLE
2. EXCAVATE TO REQUIRED DEPTH AND DO NOT EXCAVATE BELOW ROOT BALL DEPTH
3. FLOOD WATERING SAUCER TWICE IN FIRST 24 HOURS AFTER PLANTING.
4. RAISE AND REPLANT ANY SHRUBS THAT SETTLE AFTER PLANTING & WATERING.
5. REMOVE 1/3 BURLAP PRIOR TO BACKFILL. SYNTHETIC BURLAP UNACCEPTABLE
6. FOR CONTAINERIZED PLANTS: REMOVE CONTAINER PRIOR TO PLANTING, SCARIFY ROOT BALL BELOW EDGE 1/2" DEEP IN FOUR LOCATIONS

2 ORNAMENTAL GRASS PLANTING
N.T.S



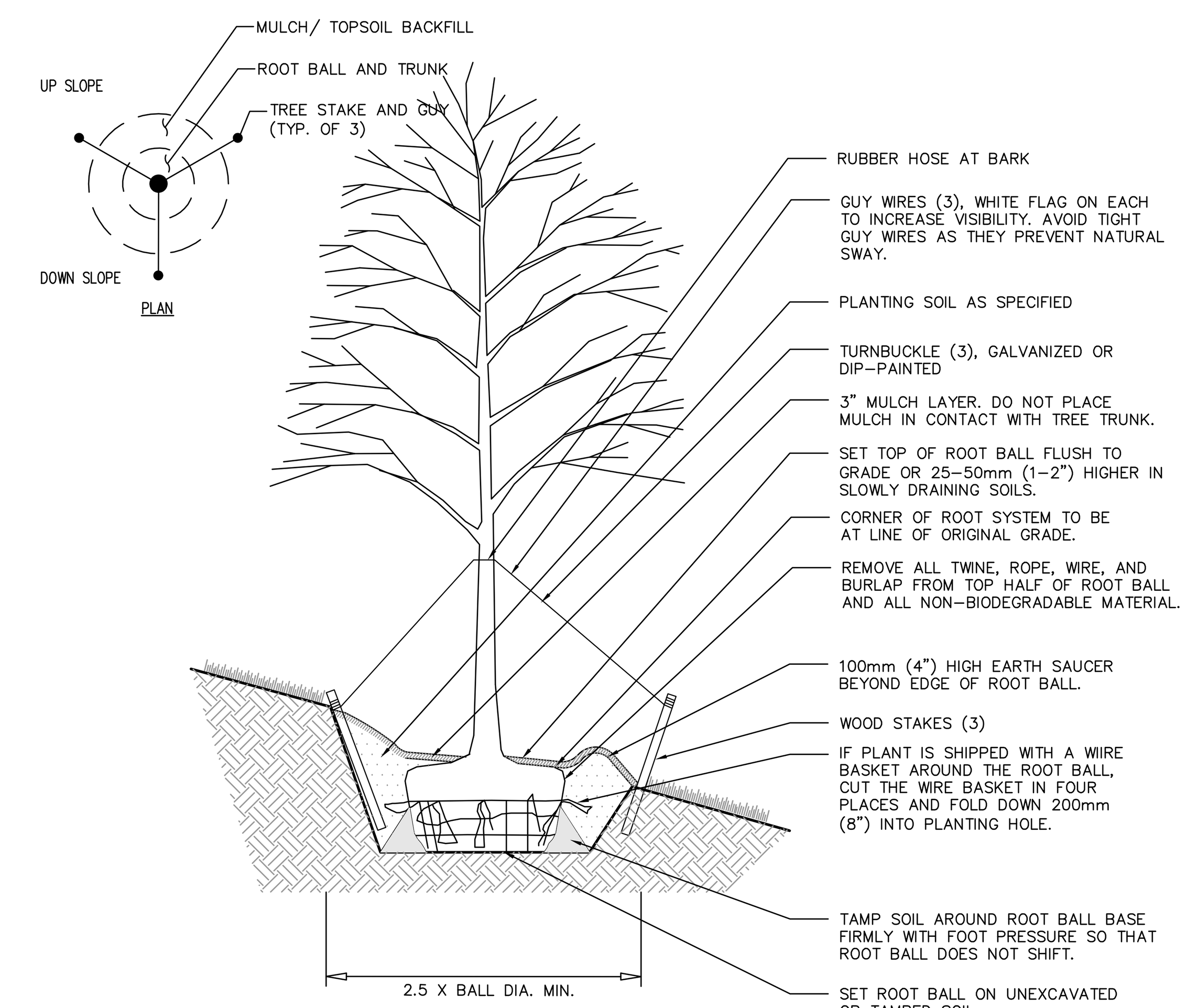
NOTES:
1. ALL SHRUBS TO BE SET PLUMB.
2. REFER TO LANDSCAPE PLAN FOR SPACING OF INDIVIDUAL PLANTS.
3. REMOVE ALL WIRE, PLASTIC, TAGS OR SYNTHETIC MATERIAL FROM PLANTS PRIOR TO PLANTING.

3 SHRUB PLANTING
N.T.S



NOTES:
1. TAPER MULCH FROM 2" DEPTH AT EDGE OF ROOT BALL TO 0" DEPTH AT ROOT FLARE
2. TREE SHALL HAVE STRAIGHT TRUNK AND SINGLE LEADER, TREES WITH DOUBLE LEADER TRUNKS WILL NOT BE ACCEPTED.
3. DO NOT CUT LEADER
4. SET TREE PLUMB
5. FLOOD SAUCER TWICE DURING FIRST 24 HOURS AFTER PLANTING.
6. TREE PIT TO BE 3 TIMES WIDTH OF ROOT BALL OR 10' DIA. MINIMUM
7. SYNTHETIC BURLAP IS UNACCEPTABLE.
8. LOOSE OR CRACKED ROOTBALLS WILL NOT BE ACCEPTED FOR PLANTING
9. REMOVE TOP 2/3 OF WIRE BASKETS
10. PLANT STAKING SYSTEMS INDICATED ARE SHOWN DIAGRAMMATICALLY. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING STAKING SYSTEM AT THEIR DISCRETION TO MAINTAIN PLANTS IN A PLUMB CONDITION AND TO ASSURE TREES ARE INSTALLED IN A WAY THAT ENSURES SAFETY FOR USERS.
11. WOODEN STAKES ARE NOT PERMITTED.
12. TREES ALONG WALKWAYS AND/OR WITH A GREATER THAN 3 ½" CALIPER MUST BE SECURED WITH ROOT BALL ANCHORING SYSTEM.
13. STAKE MAINTENANCE AS DEFINED IN SPECIFICATIONS
14. REMOVE ALL STAKING AT FINAL ACCEPTANCE.

4 TREE PLANTING
N.T.S



5 TREE PLANTING ON SLOPE
N.T.S

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STATE OF CONNECTICUT – KRISTEN MITCHELL – NO. 1659 – LICENSED LANDSCAPE ARCHITECT

TRUMBULL HILLCR ST MIDDL SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

ro ect Status

K Y L N

PROJECT NORTH

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ST T RO . NO.	144-0108N
RO . NO.	250501
SC L	
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ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD ricing Set
3	03/16/2026	50 CD
4	03/26/2026	H S 1
5	05/19/2026	100 CD

Drawing No.

LP501

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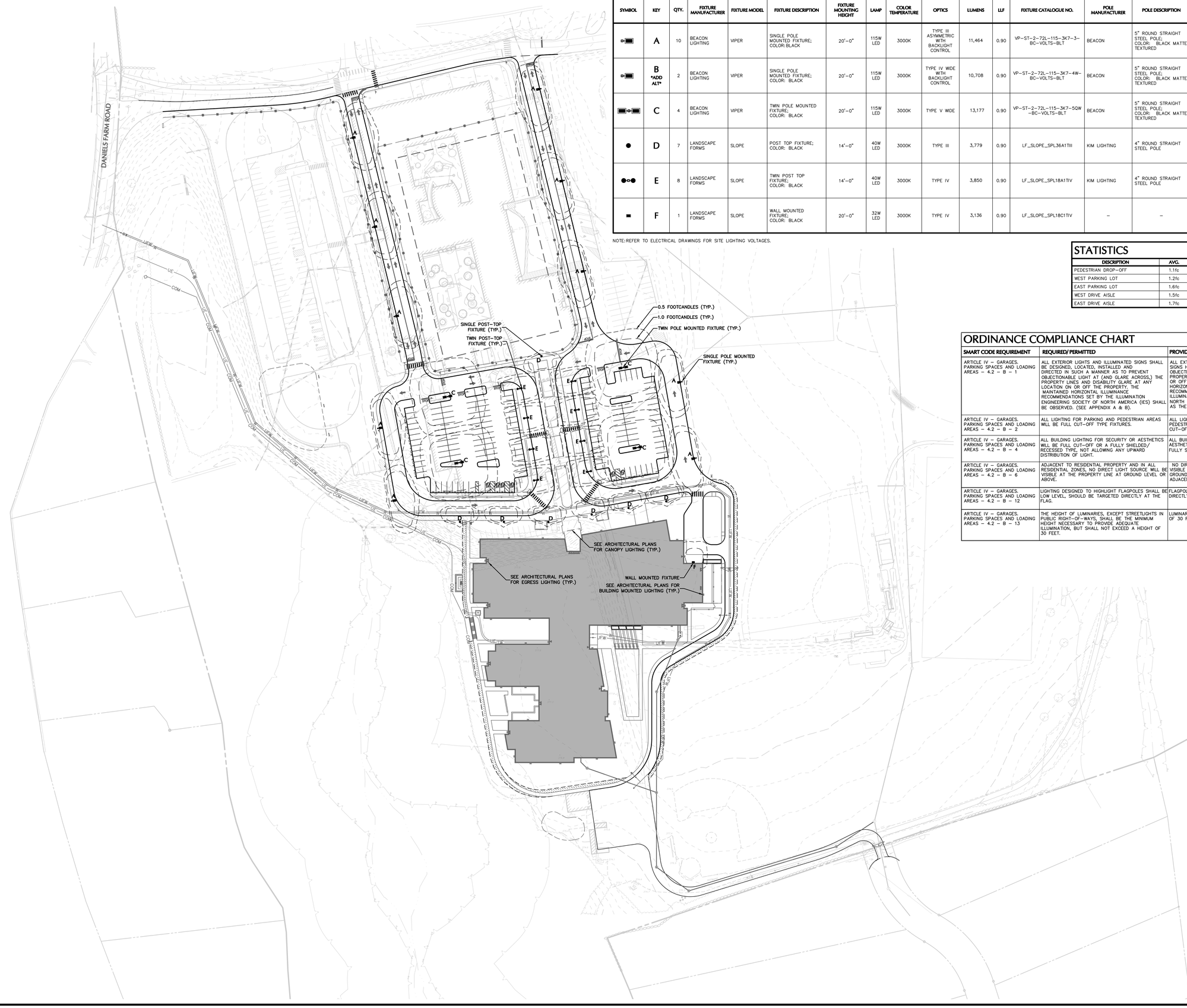

SITE LIGHTING SCHEDULE

SYMBOL	KEY	QTY.	FIXTURE MANUFACTURER	FIXTURE MODEL	FIXTURE DESCRIPTION	FIXTURE MOUNTING HEIGHT	LAMP	COLOR TEMPERATURE	OPTICS	LUMENS	LLF	FIXTURE CATALOGUE NO.	POLE MANUFACTURER	POLE DESCRIPTION	POLE LENGTH	POLE CATALOGUE NO.	REMARKS
▫■	A	10	BEACON LIGHTING	VIPER	SINGLE POLE MOUNTED FIXTURE; COLOR: BLACK	20'-0"	115W LED	3000K	TYPE III ASYMMETRIC WITH BACKLIGHT CONTROL	11,464	0.90	VP-ST-2-72L-115-3K7-3-BC-VOLTS-BLT	BEACON	5" ROUND STRAIGHT STEEL POLE; COLOR: BLACK MATTE TEXTURED	20'-0"	RSAB-S20-50B-1-BLT	STEEL POLE TO BE MOUNTED ON FLUSH CONCRETE BASE
▫■	B "ADD ALT"	2	BEACON LIGHTING	VIPER	SINGLE POLE MOUNTED FIXTURE; COLOR: BLACK	20'-0"	115W LED	3000K	TYPE IV WIDE WITH BACKLIGHT CONTROL	10,708	0.90	VP-ST-2-72L-115-3K7-4W-BC-VOLTS-BLT	BEACON	5" ROUND STRAIGHT STEEL POLE; COLOR: BLACK MATTE TEXTURED	20'-0"	RSAB-S20-50B-1-BLT	ADD ALTERNATE: STEEL POLE TO BE MOUNTED ON FLUSH CONCRETE BASE
■▫■	C	4	BEACON LIGHTING	VIPER	TWIN POLE MOUNTED FIXTURE; COLOR: BLACK	20'-0"	115W LED	3000K	TYPE V WIDE	13,177	0.90	VP-ST-2-72L-115-3K7-5QW-BC-VOLTS-BLT	BEACON	5" ROUND STRAIGHT STEEL POLE; COLOR: BLACK MATTE TEXTURED	20'-0"	RSAB-S20-50B-2-BLT	STEEL POLE TO BE MOUNTED ON FLUSH CONCRETE BASE
●	D	7	LANDSCAPE FORMS	SLOPE	POST TOP FIXTURE; COLOR: BLACK	14'-0"	40W LED	3000K	TYPE III	3,779	0.90	LF_SLOPE_SPL36A1TIII	KIM LIGHTING	4" ROUND STRAIGHT STEEL POLE	12'-0"	KRS12-4120-PT-BLT	STEEL POLE TO BE MOUNTED ON FLUSH CONCRETE BASE
●▫●	E	8	LANDSCAPE FORMS	SLOPE	TWIN POST TOP FIXTURE; COLOR: BLACK	14'-0"	40W LED	3000K	TYPE IV	3,850	0.90	LF_SLOPE_SPL18A1TIV	KIM LIGHTING	4" ROUND STRAIGHT STEEL POLE	12'-0"	KRS12-4120-PT-BLT	STEEL POLE TO BE MOUNTED ON FLUSH CONCRETE BASE
■	F	1	LANDSCAPE FORMS	SLOPE	WALL MOUNTED FIXTURE; COLOR: BLACK	20'-0"	32W LED	3000K	TYPE IV	3,136	0.90	LF_SLOPE_SPL18C1TIV	–	–	–	–	–

NOTE: REFER TO ELECTRICAL DRAWINGS FOR SITE LIGHTING VOLTAGES.

STATISTICS

DESCRIPTION	AVG.	MAX.	MIN.	MAX./MIN.	AVG./MIN.
PEDESTRIAN DROP-OFF	1.1fc	5.2fc	0.2fc	26.0:1	5.8:1
WEST PARKING LOT	1.2fc	5.5fc	0.2fc	27.5:1	6.5:1
EAST PARKING LOT	1.6fc	5.5fc	0.7fc	7.8:1	2.3:1
WEST DRIVE AISLE	1.5fc	7.1fc	0.2fc	35.5:1	7.7:1
EAST DRIVE AISLE	1.7fc	7.1fc	0.2fc	35.5:1	8.4:1

ORDINANCE COMPLIANCE CHART

SMART CODE REQUIREMENT	REQUIRED/ PERMITTED	PROVIDED/ PROPOSED	COMPLIANCE
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 1	ALL EXTERIOR LIGHTS AND ILLUMINATED SIGNS SHALL BE DESIGNED, LOCATED, INSTALLED AND DIRECTED IN SUCH A MANNER AS TO PREVENT OBJECTIONABLE LIGHT AT (AND GLARE ACROSS,) THE PROPERTY LINES AND DISABILITY GLARE AT ANY LOCATION ON OR OFF THE PROPERTY. THE MAINTAINED HORIZONTAL ILLUMINANCE RECOMMENDATIONS SET BY THE ILLUMINATION ENGINEERING SOCIETY OF NORTH AMERICA (IES) SHALL BE OBSERVED. (SEE APPENDIX A & B).	ALL EXTERIOR LIGHTS AND ILLUMINATED SIGNS HAVE BEEN LOCATED TO DIRECT OBJECTIONABLE LIGHT AWAY FROM PROPERTY LINES AND ANY LOCATION ON OR OFF THE PROPERTY. THE MAINTAINED HORIZONTAL ILLUMINANCE RECOMMENDATIONS SET BY THE ILLUMINATION ENGINEERING SOCIETY OF NORTH AMERICA (IES) HAVE BEEN USED AS THE BASIS OF DESIGN.	COMPLIES TO EXTENT PRACTICABLE
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 2	ALL LIGHTING FOR PARKING AND PEDESTRIAN AREAS WILL BE FULL CUT-OFF TYPE FIXTURES.	ALL LIGHTING FOR PARKING AND PEDESTRIAN AREAS WILL BE FULL CUT-OFF TYPE FIXTURES.	COMPLIES
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 4	ALL BUILDING LIGHTING FOR SECURITY OR AESTHETICS WILL BE FULL CUT-OFF OR A FULLY SHIELDED/ RECESSED TYPE, NOT ALLOWING ANY UPWARD DISTRIBUTION OF LIGHT.	ALL BUILDING LIGHTING FOR SECURITY OR AESTHETICS ARE FULL CUT-OFF OR ARE FULLY SHIELDED/ RECESSED	COMPLIES
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 6	ADJACENT TO RESIDENTIAL PROPERTY AND IN ALL RESIDENTIAL ZONES, NO DIRECT LIGHT SOURCE WILL BE VISIBLE AT THE PROPERTY LINE AT GROUND LEVEL OR ABOVE.	NO DIRECT LIGHT SOURCE SHOULD BE VISIBLE AT THE PROPERTY LINE AT GROUND LEVEL OR ABOVE IN LOCATIONS ADJACENT TO RESIDENTIAL ZONES.	COMPLIES
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 12	LIGHTING DESIGNED TO HIGHLIGHT FLAGPOLES SHALL BE LOW LEVEL, SHOULD BE TARGETED DIRECTLY AT THE FLAG.	FLAGPOLE UPLIGHTS ARE TARGETED DIRECTLY AT THE FLAG.	COMPLIES
ARTICLE IV – GARAGES, PARKING SPACES AND LOADING AREAS – 4.2 – B – 13	THE HEIGHT OF LUMINARIES, EXCEPT STREETLIGHTS IN PUBLIC RIGHT-OF-WAYS, SHALL BE THE MINIMUM HEIGHT NECESSARY TO PROVIDE ADEQUATE ILLUMINATION, BUT SHALL NOT EXCEED A HEIGHT OF 30 FEET.	LUMINARIES DO NOT EXCEED A HEIGHT OF 30 FEET.	COMPLIES

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TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

STATE OF CONNECTICUT · KRISTEN MITCHELL · REGISTERED ARCHITECT · NO. 10

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

OV□R□LL SIT□ LIGHTING □L□N

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	
D□T□	08/15/2025
DR□WN BY	
□□ROV□D BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

LL100

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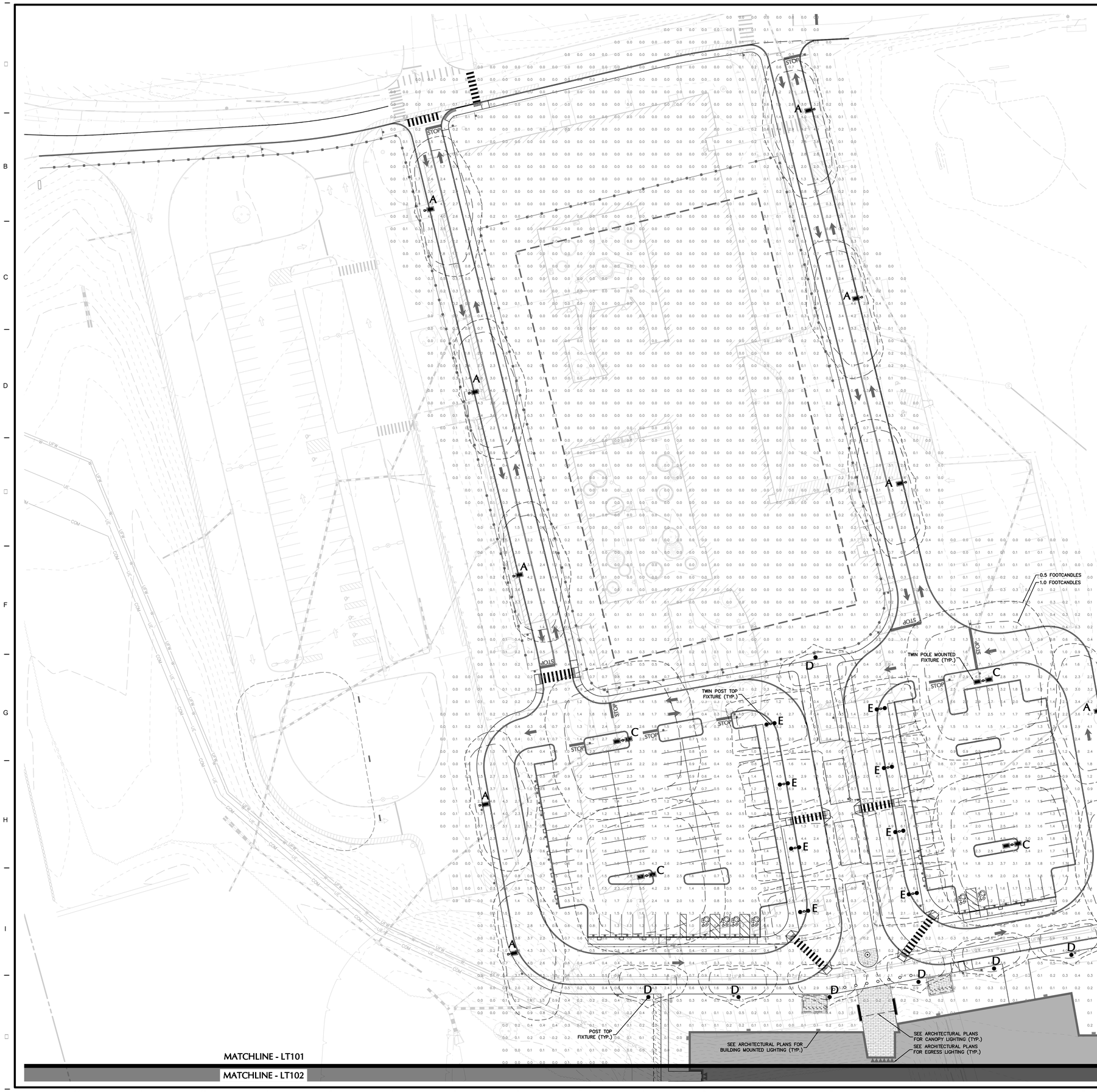
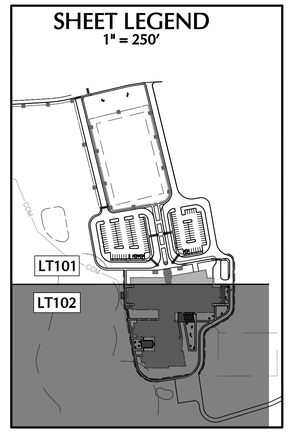
Date: 5/19/2026 Time: 11:21 User: bwillsey_c^yle Table: Langan.stb Layout: LL100 Document Code: 140325901-0101-LL101-0101



SHEET LEGEND
1" = 250'



SCALE: 1 INCH = 30 FEET

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ARCHITECTURE | PLANNING | INTERIORS

STATE OF CONNECTICUT · KRISTEN MITCHELL · REGISTERED ARCHITECT · NO. 22,000

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

SIT□ LIGHTING
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ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
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D□T□	08/15/2025
DR□WN BY	
□□ROV□D BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□1
5	05/19/2026	100□ CD

Drawing No.

LL101

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MATCHLINE - LT101

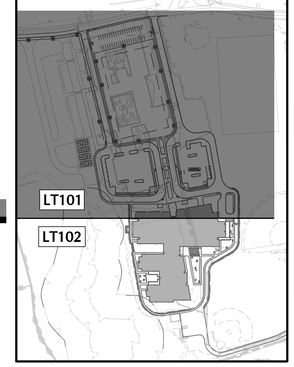
MATCHLINE - LT102

WALL MOUNTED FIXTURE (TYP.)

SEE ARCHITECTURAL PLANS FOR EGRESS LIGHTING (TYP.)

SEE ARCHITECTURAL PLANS FOR BUILDING-MOUNTED LIGHTING (TYP.)

SHEET LEGEND
1" = 250'



SCALE: 1 INCH = 30 FEET

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ARCHITECTURE | PLANNING | INTERIORS

STATE OF CONNECTICUT · KRISTEN MITCHELL · REGISTERED ARCHITECT

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N

PROJECT NORTH

DR□WING TITL□

SIT□ LIGHTING □L□N II

ST□T□ □RO□ NO.	144-0108N
□RO□ NO.	250501
SC□L□	
D□T□	08/15/2025
DR□WN BY	
□□□ROV□D BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

LL102

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Date: 5/19/2026 Time: 11:22 User: bwillsey_□^yle Table: Langan.stb Layout: LL102 Document Code: 140325901-0101-LL101-0103

ADD/ALTERNATE

CONTRACTOR TO BORE EXISTING PAVEMENT TO DETERMINE THICKNESS OF BOTH PAVEMENT AND GRAVEL BASE. REPORT FINDINGS TO CIVIL ENGINEER PRIOR TO CONSTRUCTION. IF THE EXISTING PAVEMENT DOES NOT MEET PROJECT REQUIREMENTS, PROVIDE FULL DEPTH HEAVY DUTY BITUMINOUS CONCRETE PAVEMENT SECTION.

ADD/ALTERNATE C2:
44 ADDITIONAL PARKING SPACES

ADD/ALTERNATE C3:
ADDITIONAL ATHLETIC FIELD AND UNDERDRAINAGE

ALL PURPOSE ATHLETIC FIELD

340.0'

200.0'

SWING GATE

TWIN POST TOP FIXTURE (TYP.)

TWIN POLE MOUNTED FIXTURE (TYP.)

SINGLE POLE MOUNTED FIXTURE (TYP.)

POST TOP FIXTURE (TYP.)

SEE ARCHITECTURAL PLANS FOR BUILDING MOUNTED LIGHTING (TYP.)

SEE ARCHITECTURAL PLANS FOR CANOPY LIGHTING (TYP.)

SEE ARCHITECTURAL PLANS FOR EGRESS LIGHTING (TYP.)

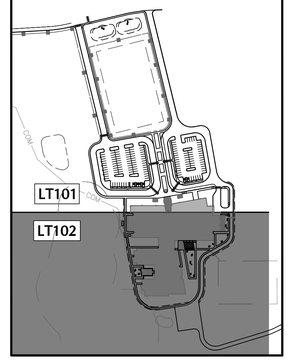
0.5 FOOTCANDLES

1.0 FOOTCANDLES

MATCHLINE - LT101

MATCHLINE - LT102

SHEET LEGEND
1" = 250'



SCALE: 1 INCH = 30 FEET

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ARCHITECTURE | PLANNING | INTERIORS

STATE OF CONNECTICUT · KRISTEN MITCHELL · LICENSED LANDSCAPE ARCHITECT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

PROJECT NORTH

DRAWING TITLE

SITE LIGHTING
PLAN - LIGHTING

STATE PROJECT NO.	144-0108N
PROJECT NO.	250501
SCALE	
DATE	08/15/2025
DRAWN BY	
APPROVED BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	CHANGE 1
5	05/19/2026	100% CD

Drawing No.

LL201

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Date: 5/19/2026 Time: 11:23 User: bwillse Style Table: Langan.stb Layout: LL101 Document Code: 140325901-0101-LL101-0104

LIGHTING NOTES:

GENERAL

1. POINT–BY–POINT CALCULATIONS PROVIDED WITHIN HAVE BEEN PREPARED IN ACCORDANCE TO IESNA STANDARDS AND IN CONSIDERATION OF THE VARIABLES WITHIN THESE NOTES AND SITE LIGHTING SCHEDULE. THE VALUES SHOWN ON THE PLANS ARE NOT AN INDICATION OF THE INITIAL LIGHT INTENSITIES OF THE LAMPS. THESE VALUES ARE AN APPROXIMATION OF THE MAINTAINED INTENSITIES DELIVERED TO THE GROUND PLANE USING INDUSTRY STANDARD LIGHT LOSS FACTORS (LLF) WHICH COVER LAMP DEGRADATION AND NATURAL BUILDUP/ DIRT DEGRADATION ON THE FIXTURE LENS. THE LIGHTING PLAN IS DESIGNED WITH AN INDUSTRY STANDARD LLF IN ACCORDANCE WITH GUIDANCE AS PROVIDED BY IESNA. MINOR VARIATIONS IN TOPOGRAPHY, PHYSICAL OBSTRUCTIONS, AMBIENT OR ADJACENT LIGHT SOURCES AND/OR OTHER POTENTIAL IMPACTS HAVE NOT BEEN INCLUDED IN THESE CALCULATIONS. THEREFORE, AS–BUILT LIGHT INTENSITIES MAY VARY, IN EITHER DIRECTION, FROM WHAT IS EXPLICITLY PORTRAYED WITHIN THESE DRAWINGS.NO GUARANTEE OF LIGHT LEVELS IS EXPRESSED OR IMPLIED BY THE POINT BY POINT CALCULATIONS SHOWN ON THESE PLANS.
2. LIGHT LEVEL POINT SPACING IS 10 FT. LEFT TO RIGHT AND 10 FT. TOP TO BOTTOM. POINT BY POINT CALCULATIONS ARE BASED ON THE LIGHT LOSS FACTOR AS STATED IN THE LIGHTING SCHEDULE.

COMPLIANCE

3. ALL SITE LIGHTING RELATED WORK AND MATERIALS SHALL COMPLY WITH CITY, COUNTY, AND OTHER APPLICABLE GOVERNING AUTHORITY REQUIREMENTS.
4. LIGHTING LAYOUT COMPLIES WITH THE ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA) SAFETY STANDARDS FOR LIGHT LEVELS.

COORDINATION

5. CONTRACTOR TO COORDINATE POWER SOURCE WITH LIGHT FIXTURES TO ENSURE ALL SITE LIGHTING IS OPERATING EFFECTIVELY, EFFICIENTLY AND SAFELY.
6. REFER TO ELECTRIFICATION PLAN FOR PROVIDING ADEQUATE POWER FOR SITE LIGHTING.
7. CONTRACTOR TO COORDINATE LOCATION OF EASEMENTS, UNDERGROUND UTILITIES AND DRAINAGE BEFORE DRILLING POLE BASES.
8. INSTALLATION OF ALL LIGHTING FIXTURES, POLES, FOOTINGS, AND FEEDER CABLE TO BE COORDINATED WITH ALL SITE WORK TRADES TO AVOID CONFLICT WITH FINISHED AND PROPOSED WORK.
9. CONTRACTOR TO COORDINATE INSTALLATION OF UNDERGROUND FEEDER CABLE FOR EXTERIOR LIGHTING WITH EXISTING AND PROPOSED UTILITIES, SITE DRAINAGE SYSTEMS, AND PAVING. CONTRACTOR SHALL PROMPTLY NOTIFY THE OWNER'S REPRESENTATIVE SHOULD ANY UTILITIES, NOT SHOWN ON THE PLANS, BE FOUND DURING EXCAVATIONS.

POLES AND FOOTINGS

10. PROVIDE A CONCRETE BASE FOR EACH LIGHT POLE AT THE LOCATIONS INDICATED ON THE CONSTRUCTION DRAWINGS AND/OR IN ACCORDANCE WITH PROJECT PLANS AND SPECIFICATIONS RELATING DIRECTLY TO CAST–IN–PLACE CONCRETE. THE USE OF ALTERNATE LIGHTING FOUNDATIONS, SUCH AS PRECAST, MAY CHANGE THE SIZING AND REINFORCEMENT REQUIREMENTS FROM THOSE SHOWN ON THESE PLANS. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO ORDERING ANY SUBSTITUTED PRODUCTS.
11. CONTRACTOR SHALL EXAMINE AND VERIFY THAT SOIL CONDITIONS ARE SUITABLE TO SUPPORT LOADS EXERTED UPON THE FOUNDATIONS DURING EXCAVATION. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY UNSATISFACTORY CONDITIONS.
12. POLE FOUNDATIONS SHALL NOT BE POURED IF FREE STANDING WATER IS PRESENT IN EXCAVATED AREA.
13. ALL POLES 25 FT OR GREATER SHALL BE EQUIPPED WITH FACTORY INSTALLED VIBRATION DAMPENERS.

WALL MOUNTED FIXTURES

14. CONTRACTOR TO COORDINATE INSTALLATION OF ALL THE WALL MOUNTED FIXTURES AND ELECTRICAL CONNECTIONS TO SITE STRUCTURE(S) WITH BUILDING MEP, ARCHITECT, AND/OR OWNER.
15. INSTALLATION AND ELECTRICAL CONNECTIONS FOR WALL MOUNTED FIXTURES TO BE COORDINATED WITH ARCHITECTURAL, STRUCTURAL, UTILITY AND SITE PLANS AND TO BE IN ACCORDANCE WITH ALL APPLICABLE CODES.

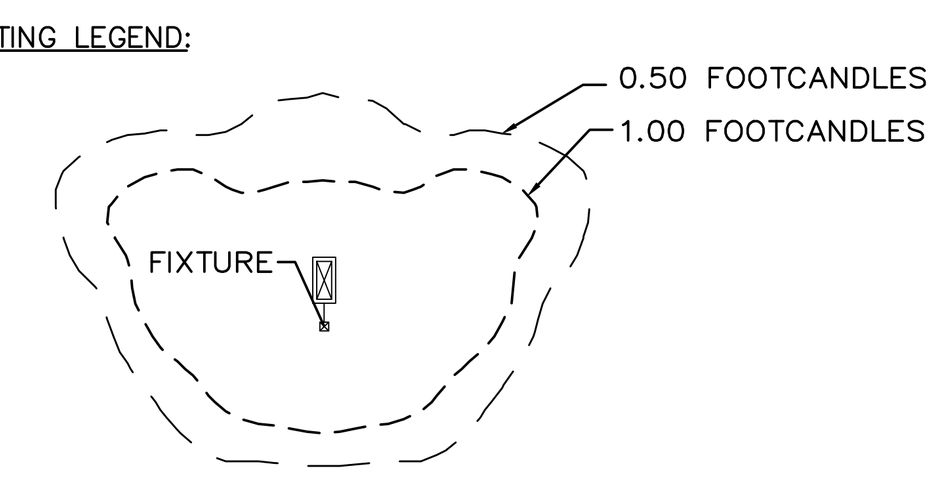
ADJUSTMENT AND INSPECTION

16. CONTRACTOR TO OPERATE EACH LUMINAIRE AFTER INSTALLATION AND CONNECTION. INSPECT FOR IMPROPER CONNECTIONS AND OPERATION.
17. CONTRACTOR TO AIM AND ADJUST ALL LUMINAIRES TO PROVIDE ILLUMINATION LEVELS AND DISTRIBUTION AS INDICATED ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE LANDSCAPE ARCHITECT AND/OR OWNER.
18. CONTRACTOR TO CONFIRM THAT LIGHT FIXTURES, TILT ANGLE AND AIMING MATCH SPECIFICATIONS ON THE PLANS.

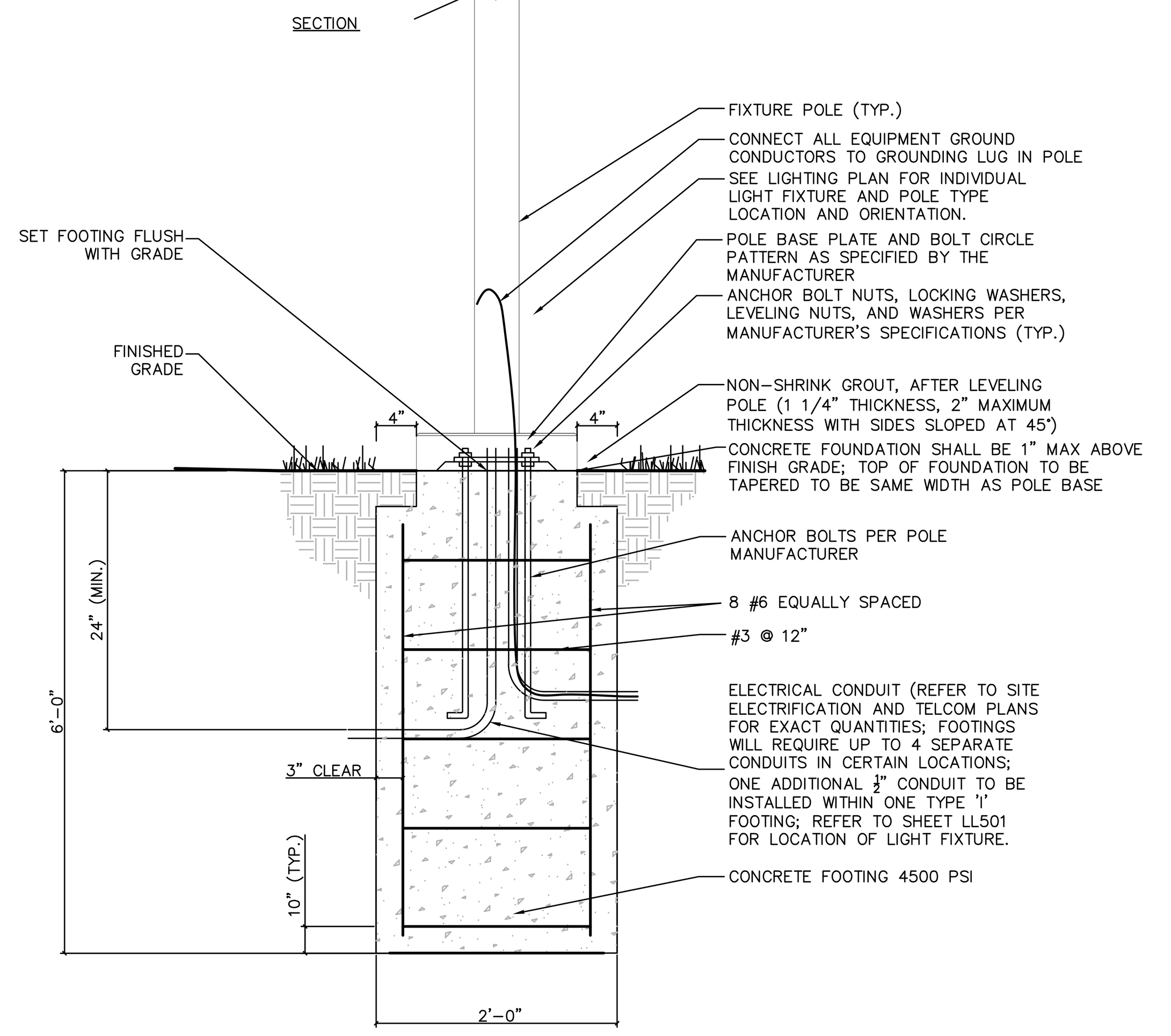
REQUIREMENTS FOR ALTERNATES

19. ALL LIGHTING SUBSTITUTIONS MUST BE MADE WITHIN 14 DAYS PRIOR TO THE BID DATE TO PROVIDE AMPLE TIME FOR REVIEW AND TO ISSUE AN ADDENDUM INCORPORATING THE SUBSTITUTION WITH THE FOLLOWING REQUIREMENTS:
    A. ANY SUBSTITUTION TO LIGHTING FIXTURES, POLES, ETC. MUST BE APPROVED BY THE OWNER, ENGINEER AND TENANTS. ANY COST ASSOCIATED WITH REVIEW AND/OR APPROVAL OF THE SUBSTITUTIONS SHALL BE ENTIRELY BORNE BY THE CONTRACTOR
    B. COMPUTER PREPARED PHOTOMETRIC LAYOUT OF THE PROPOSED LIGHTED AREA WHICH INDICATES, BY ISOFOOTCANDLE, THE SYSTEM'S PERFORMANCE.
    C. A PHOTOMETRIC REPORT FROM A NATIONAL INDEPENDENT TESTING LABORATORY WITH REPORT NUMBER, DATE, FIXTURE CATALOG NUMBER, LUMINAIRE AND LAMP SPECIFICATIONS; IES CALCULATIONS, POINT BY POINT FOOT CANDLE PLAN, STATISTIC ZONES SHOWING AVERAGE, MAXIMUM, MINIMUM AND UNIFORMITY RATIOS, SUMMARY, ISOLUX PLOT, AND CATALOGUE CUTS. CATALOGUE CUTS MUST IDENTIFY OPTICS, LAMP TYPE, DISTRIBUTION TYPE, REFLECTOR, LENS, BALLASTS, WATTAGE, VOLTAGE, FINISH HOUSING DESCRIPTION AND ALL OTHER PERTINENT INFORMATION.
    D. POLE MANUFACTURER AASHTO CALCULATIONS INDICATING THE POLE AND ANCHOR BOLTS BEING SUBMITTED ARE CAPABLE OF SUPPORTING THE POLE AND FIXTURE SYSTEMS BEING UTILIZED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
    E. THE UNDERWRITERS LABORATORY LISTING AND FILE NUMBER FOR THE SPECIFIC FIXTURE(S) TO BE UTILIZED.
    F. A COLOR PHOTOGRAPH THAT CLEARLY SHOWS THE REPLACEMENT FIXTURE POLE MOUNTED, THE FIXTURE'S COLOR, FINISH, AND PHYSICAL CHARACTERISTICS.

PHOTOMETRIC LIGHTING LEGEND:



NOTE: THE PHOTOMETRIC TEMPLATE REPRESENTS LIGHT THROW FOR EACH INDIVIDUAL FIXTURE AND DOES NOT REPRESENT LIGHT COMING FROM OTHER SOURCES.

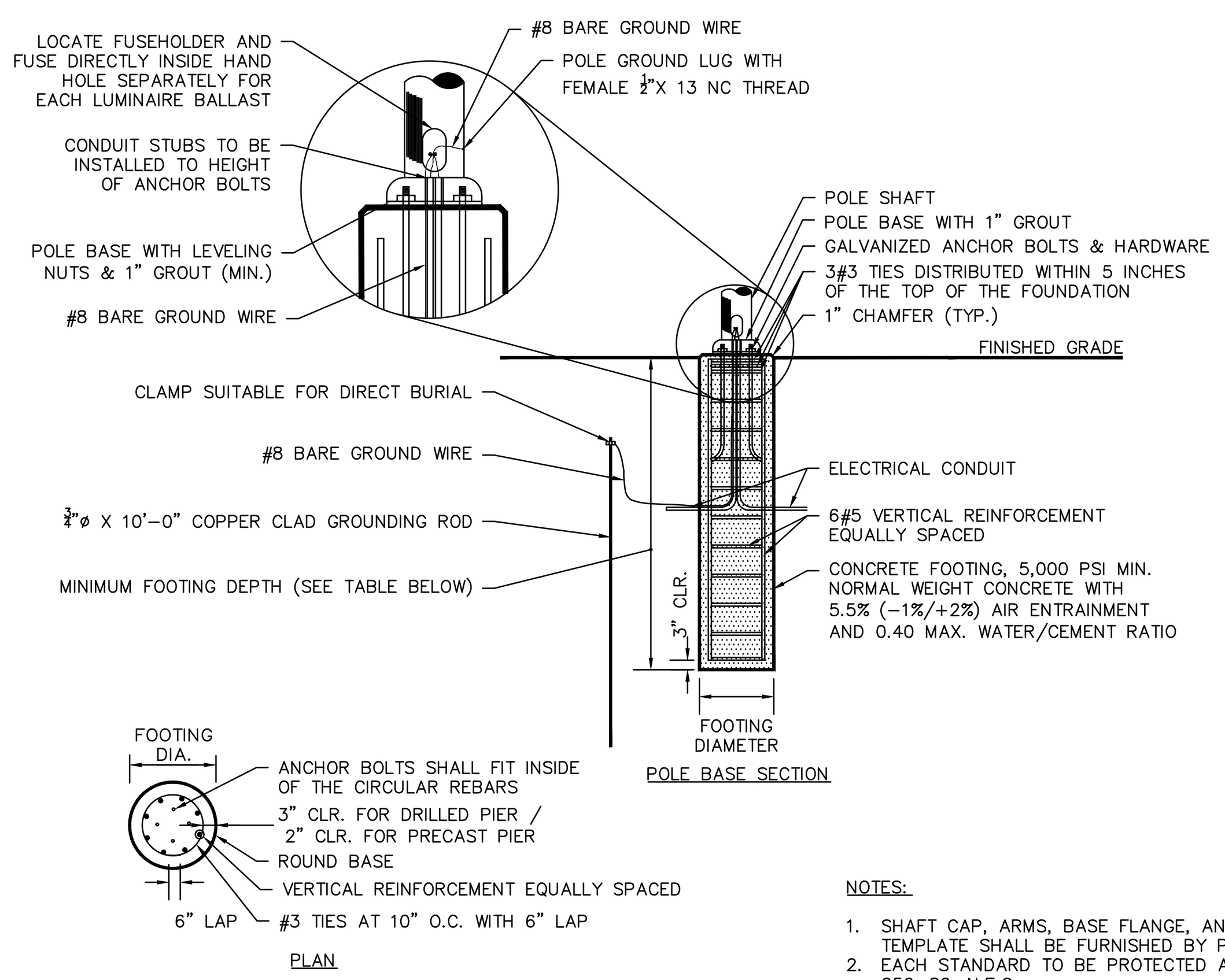


NOTES:

1. SHAFT CAP, ARMS, BASE FLANGE, ANCHOR BOLTS, LEVELING NUTS, CONNECTION HARDWARE, BOLT COVERS, HANDHOLE COVER, AND BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY POLE MANUFACTURER.
2. EACH STANDARD TO BE PROTECTED AGAINST LIGHTNING WITH AN INTERCONNECTED GROUND ROD. THIS ROD SHALL BE BONDED PER SECTION NUMBER 250–86, N.E.C.
3. CONTRACTOR TO ENSURE CONCRETE POLE BASES ARE POURED / PLACED ABSOLUTELY VERTICAL & LEVEL.
4. POLE BASE SHALL BE ONE CONTINUOUS POUR. EXPOSED PORTION OF BASE SHALL BE HAND–RUBBED SMOOTH.
5. CONTRACTOR TO COMPACT SUBGRADE AROUND POLE BASE.
6. THE INFORMATION ILLUSTRATED IN THE LIGHT POLE FOUNDATION DETAIL HAS BEEN PROVIDED FOR GENERAL REFERENCE AND PRELIMINARY COST ESTIMATE PURPOSES. LIGHT POLE FOUNDATIONS SHOULD BE DESIGNED AND DETAILED BY A LICENSED STRUCTURAL ENGINEER BASED ON EXISTING SOIL CONDITIONS, LOCAL DESIGN STANDARDS AND MANUFACTURERS RECOMMENDATIONS.

1 POST TOP FIXTURE

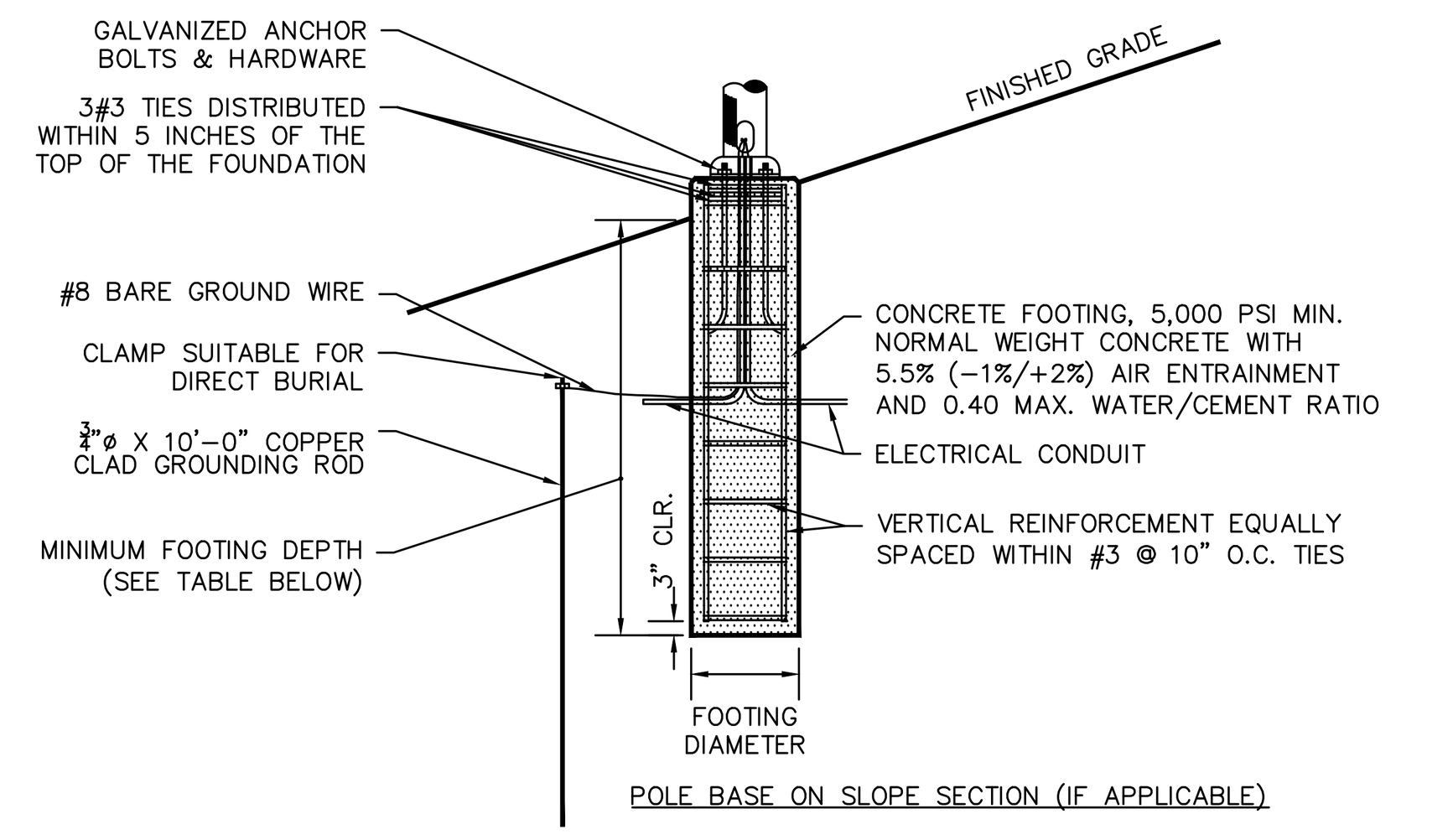
NTS



MOUNTING HEIGHT	FOOTING DEPTH	FOOTING DIAMETER	EXPOSED HEIGHT "H"	VERTICAL REINFORCEMENT
20'–0"	6'–6"	2'–0"	1" MAX	6#5 BARS

NOTES:

EXPOSED HEIGHT OF POLE BASE (H) SHALL BE MEASURED ON THE UPHILL SIDE OF A SLOPE. FOOTING DEPTH (D) SHALL BE MEASURED ON THE DOWNHILL SIDE OF A SLOPE. AN ADDITIONAL VARIABLE HEIGHT (V) WILL BE BASED ON THE SLOPE ON WHICH THE POLE BASE IS LOCATED. CONTRACTOR TO CALCULATE FULL LENGTH OF EACH POLE BASE REQUIRED ON SLOPES (H+D+V = TOTAL BASE LENGTH)



NOTES:

1. SHAFT CAP, ARMS, BASE FLANGE, ANCHOR BOLTS, LEVELING NUTS, CONNECTION HARDWARE, BOLT COVERS, HANDHOLE COVER, AND BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY POLE MANUFACTURER.
2. EACH STANDARD TO BE PROTECTED AGAINST LIGHTNING WITH AN INTERCONNECTED GROUND ROD. THIS ROD SHALL BE BONDED PER SECTION NUMBER 250–86, N.E.C.
3. CONCRETE WORK SHALL COMPLY WITH THE REQUIREMENT OF ACI 318. CAST–IN–PLACE SHALL HAVE UNCONFINED COMPRESSIVE STRENGTH OF AT LEAST 5,000 PSI AT 28–DAYS. DEFORMED REINFORCEMENT BARS SHALL CONFORM TO ASTM A615, GRADE 60.
4. CONTRACTOR TO ENSURE CONCRETE POLE BASES ARE POURED / PLACED ABSOLUTELY VERTICAL & LEVEL.
5. IF POLE BASE IS CAST–IN–PLACE, POLE BASE SHALL BE ONE CONTINUOUS POUR. EXPOSED PORTION OF BASE SHALL BE HAND–RUBBED SMOOTH.
6. CONTRACTOR TO COMPACT SUBGRADE AROUND POLE BASE PER EARTHWORK SPECIFICATIONS / GEOTECH REPORT.
7. THE INFORMATION ILLUSTRATED IN THE LIGHT POLE FOUNDATION DETAIL HAS BEEN PROVIDED FOR GENERAL REFERENCE AND PRELIMINARY COST ESTIMATE PURPOSES. LIGHT POLE FOUNDATIONS SHOULD BE DESIGNED AND DETAILED BY A LICENSED STRUCTURAL ENGINEER BASED ON EXISTING SOIL CONDITIONS, LOCAL DESIGN STANDARDS AND MANUFACTURERS RECOMMENDATIONS.
8. CONTRACTOR TO CONFIRM GROUNDING DESIGN WITH MEP.

2 POST TOP FIXTURE BASE IN LANDSCAPE

NTS

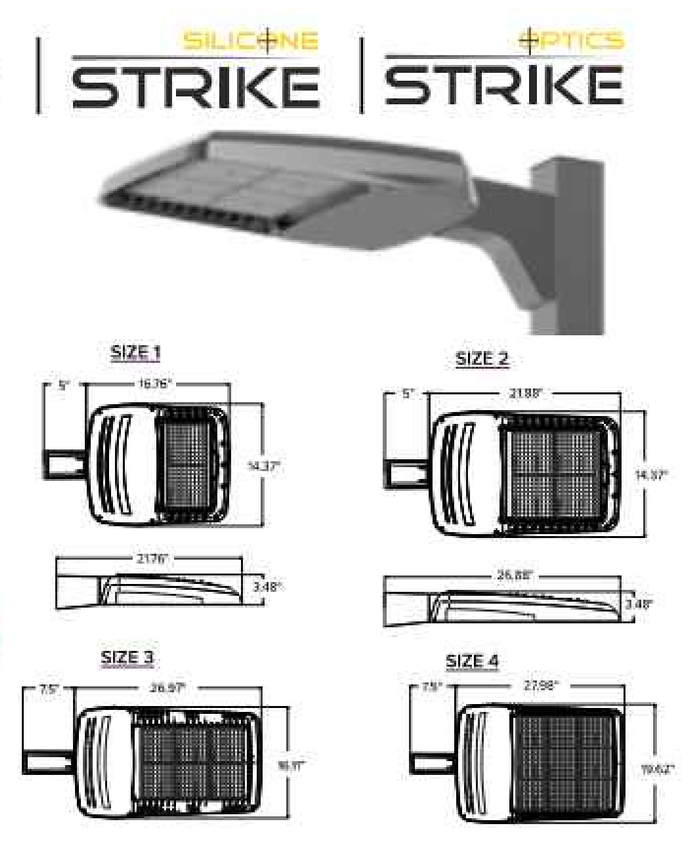
BEACON design . performance . technology

DATE: | LOCATION:
TYPE: | PROJECT:
CATALOG #:

VIPER Area/Site

VIPER LUMINAIRE

MICROSTRIKE | SILICONE STRIKE | OPTICS STRIKE



FEATURES

- Low profile LED area/site luminaire with a variety of IES distributions for lighting applications such as auto dealership, retail, commercial, and campus parking lots
- Featuring three different optical technologies, Strike, Micro Strike and Silicone Strike Optics, which provide the best distribution patterns for retrofit or new construction
- Rated for high vibration applications including bridges and overpasses. All sizes are rated for 1.5G
- Control options including photo control, occupancy sensing, NX Lighting Controls™, LightGRID+ and 7-Pin with networked controls
- New customizable lumen output feature allows for the wattage and lumen output to be customized in the factory to meet whatever specification requirements may entail
- Field interchangeable mounting provides additional flexibility after the fixture has shipped

cULus IP65 IP66 DLC LISTED DLC LISTED PREMIUM ida BAA TAA

CONTROL TECHNOLOGY — NX CONNECT, NX WIRED, NX WIRELESS, LIGHTGRID

SERVICE PROGRAMS — STOCK, QS10

SPECIFICATIONS

CONSTRUCTION
- Die-cast housing with hidden vertical heat fins are optimal for heat dissipation while keeping a clean smooth outer surface
- Corrosion resistant, die-cast aluminum housing with 1000 hour powder coat paint finish
- External hardware is corrosion resistant

OPTICS
- Micro Strike Optics (160, 320, 480, or 720 LED counts) maximize uniformity in applications and come standard with mid-power LEDs which evenly illuminate the entire luminous surface area to provide a low glare appearance. Catalog logic found on page 2
- Strike Optics (36, 72, 108, or 162 LED counts) provide best in class distributions and maximum pole spacing in new applications with high powered LEDs. Strike optics are held in place with a polycarbonate bezel to mimic the appearance of the Micro Strike Optics so both solutions can be combined on the same application. Catalog logic found on page 3
- Silicone Strike Optics (40, 80, 120, or 180 LED counts) maximize uniformity in applications and provides the highest LPW. These include an integral gasket allowing for IP66 rating. Catalog logic found on page 4.
- All optics maximize target zone illumination with minimal losses at the house-side, reducing light trespass issues. Additional backlight control shields and house side shields can be added for further reduction of illumination behind the pole
- One-piece silicone gasket ensures a weatherproof seal
- Zero up-light at 0 degrees of tilt
- Field rotatable optics

INSTALLATION
- Mounting patterns for each arm can be found on page 11
- Optional universal mounting block for ease of installation during retrofit applications. Available as an option (ASQU) or accessory for square and round poles
- All mounting hardware included

INSTALLATION (CONTINUED)
- Knuckle arm fitter option available for 2-3/8" OD tenon
- For products with EPA less than 1 mounted to a pole greater that 20ft, a vibration damper is recommended

ELECTRICAL
- Universal 120-277 VAC or 347-480 VAC input voltage, 50/60 Hz
- Ambient operating temperature -40°C to 40°C
- Drivers have greater than 90% power factor and less than 20% THD
- LED drivers have output power over-voltage, over-current protection and short circuit protection with auto recovery
- Field replaceable surge protection device provides 20kA protection meeting ANSI/ IEEE C62.41.2 Category C High and Surge Location Category C3; Automatically takes fixture off-line for protection when device is compromised
- Dual Driver option provides 2 drivers within luminaire but only one set of leads exiting the luminaire, where Dual Power Feed provides two drivers which can be wired independently as two sets of leads are extended from the luminaire. Both options cannot be combined

CONTROLS
- Photo control, occupancy sensor programmable controls, and Zigbee wireless controls available for complete on/off and dimming control
- Please consult brand or sales representative when combining control and electrical options as some combinations may not operate as anticipated depending on your application
- 7-pin ANSI C136.41-2013 photocontrol receptacle option available for twist lock photocontrols or wireless control modules (control accessories sold separately)
- 0-10V Dimming Drivers are standard. Select CD option to have dimming leads extended outside the luminaire. Must specify if wiring leads are to be greater than the 6" standard.

	EPA				
	VP1 (Size 1)	VP2 (Size 2)	VP3 (Size 3)	VP4 (Size 4)	Config
Single Fixture	0.454	0.555	0.655	0.698	
Two at 180	0.908	1.110	1.310	1.396	
Two at 90	0.583	0.711	0.857	0.948	
Three at 90	1.037	1.266	1.512	1.646	
Three at 120	0.943	1.155	1.392	1.680	
Four at 90	1.166	1.422	1.714	1.896	

CONTROLS (CONTINUED)
- NX Lighting Controls™ available with in fixture wireless control module, features dimming and occupancy sensor
- LightGRID+ available with in fixture wireless control module, features dimming and occupancy sensor. Also available in 7-pin configuration

CERTIFICATIONS
- DLC® (DesignLights Consortium Qualified), with some Premium Qualified configurations. Not all product variations listed in this document are DLC® qualified. Refer to http://www.designlights.org for the most up-to-date list.
- Listed to UL1598 and CSA C22.2#250.0-24 for wet locations and 40°C ambient temperatures
- 1.5 G rated for ANSI C136.31 high vibration applications
- Fixture is IP65 rated with Strike and Microstrike optics. Fixture is IP66 rated with Silicone Strike optics.
- Meets IDA recommendations using 3K CCT configuration at 0 degrees of tilt
- This product meets federal procurement law requirements under the Buy American Act (FAR 52.225-9) and Trade Agreements Act (FAR 52.225-11). See Buy America(n) Solutions (link to https://www.currentlighting.com/resources/america-solutions).
- FCC CFR Title 47 Part 15, Class A

WARRANTY
- 5 year warranty

Current | currentlighting.com/beacon | Page 1 of 19 | Rev 09/24/25 | BEA_VIPERSPEC_SILICONE_R02

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3 POLE MOUNTED FIXTURES A, B, & C

NTS

BEACON design . performance . technology

DATE: | LOCATION:
TYPE: | PROJECT:
CATALOG #:

RSAB-S Series Poles

ROUND STRAIGHT ALUMINUM

ORDERING INFORMATION — Example: RSAB-S14-40A-TA-BLT

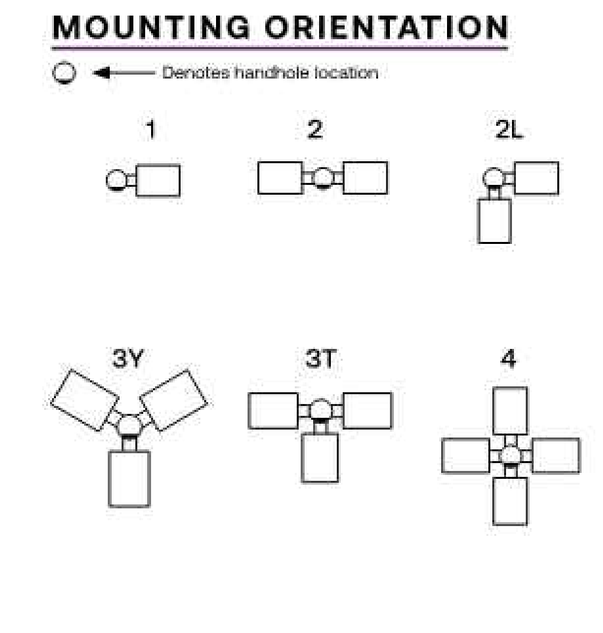
Series	Height	Shaft	Thickness	Mounting	Drill Pattern	Finish	Options
RSAB-S Round Straight Aluminum Pole Beacon	Reference page 3 Ordering matrix	Reference page 3 Ordering matrix	Reference page 3 Ordering matrix A - .125" Wall B - .188" Wall C - .250" Wall	1 Single arm mount 2 Two fixtures at 180° 2L Two fixtures at 90° 3T Three fixtures at 90° 3Y Three fixtures at 120° 4 Four fixtures at 90° TA Tenon (2.375" OD) TB Tenon (2.875" OD) TN3 Tenon (3.00" x 3.00") TN4 Tenon (3.00" x 4.00") OT No drilling (includes pole cap)	B1 Cruzer, "AM" arm B3 2 bolt (2-1/2" spacing), Viper "A" arm S2 2 bolt (3-1/2" spacing), Viper "AD" arm UDP Universal Drill Pattern	BLT Black Matte Textured BLS Black Gloss Smooth DBT Dark Bronze Matte Textured DBS Dark Bronze Gloss Smooth GTT Graphite Matte Textured LGT Light Grey Matte Textured LGS Light Grey Gloss Smooth PSS Platinum Silver Smooth WHT White Matte Textured WHS White Gloss Smooth VGT Verde Green Textured Color Option CC Custom Color[1]	GFI[2] 20 Amp GFCI Receptacle and Cover EHH[2] Extra Handhole C05[2] .5" Coupling C07[2] .75" Coupling C20[2] 2" Coupling VM2[3] 2nd Mode Vibration Dampener LAB Less Anchor Bolts UL UL Certified

1 Custom colors available; RAL number preferable
2 Specify option location using logic found on page 3 (Option Orientation).
3 There will be a weld witness mark on the side of the pole with the Factory installed VM2

Accessories (Order Separately)

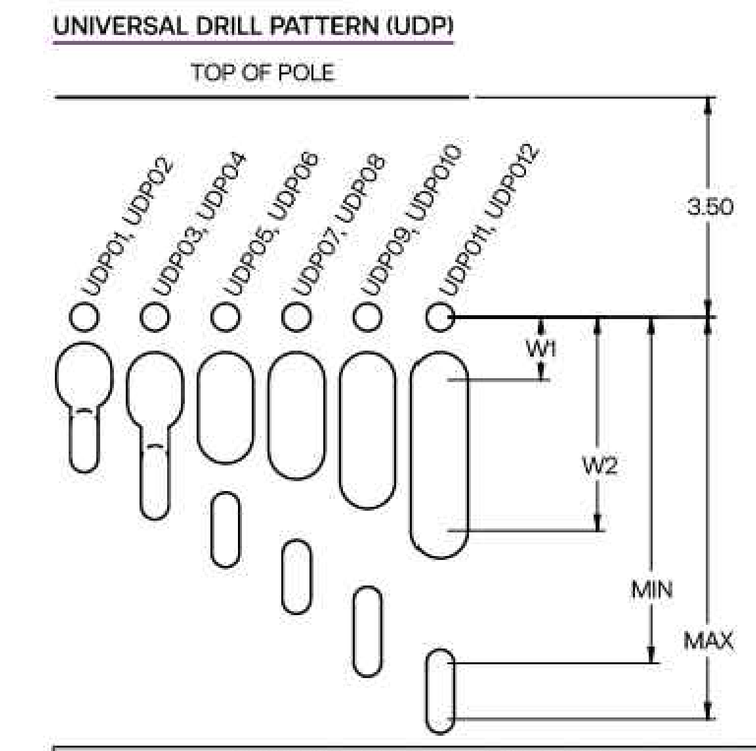
- VM2S08 Field-installed 2nd mode vibration dampener - 8 ft
- VM2S12 Field-installed 2nd mode vibration dampener - 12 ft
- VM2S16 Field-installed 2nd mode vibration dampener - 16 ft
- VM2S20 Field-installed 2nd mode vibration dampener - 20 ft
- VM2S25 Field-installed 2nd mode vibration dampener - 25 ft

MOUNTING ORIENTATION



DRILL PATTERNS

UNIVERSAL DRILL PATTERN (UDP)



Two Bolt Mounting with Center Wireway						
Mounting Hardware	Universal Mounting Patterns					
⅜" or less	UDP01	UDP03	UDP05	UDP07	UDP09	UDP011
7/16" to ½"	UDP02	UDP04	UDP06	UDP08	UDP010	UDP012
"Min" Attachment Dimension	1.69	2.25	3.00	3.76	4.50	5.50
"Max" Attachment Dimension	2.24	2.99	3.75	4.49	5.49	6.00
W1 (Wireway min)	0.85	1.00	1.00	1.00	1.00	1.00
W2 (Wireway max)	1.05	1.36	1.88	2.13	2.60	3.00

Current | currentlighting.com/beacon | Page 2 of 5 | (Rev 06/20/25) | BEA_RSA-B-S-Poles_spec_R04

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4 FIXTURES A, B, & C POLE

NTS

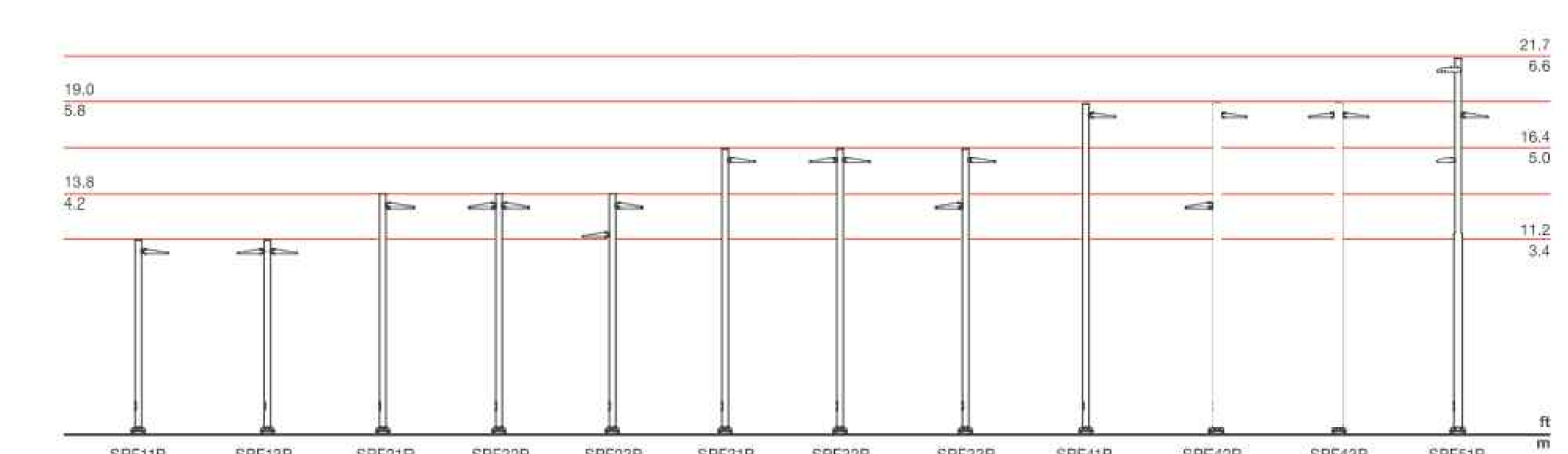
Slope

Product Data Sheet | SPL

landscapeforms



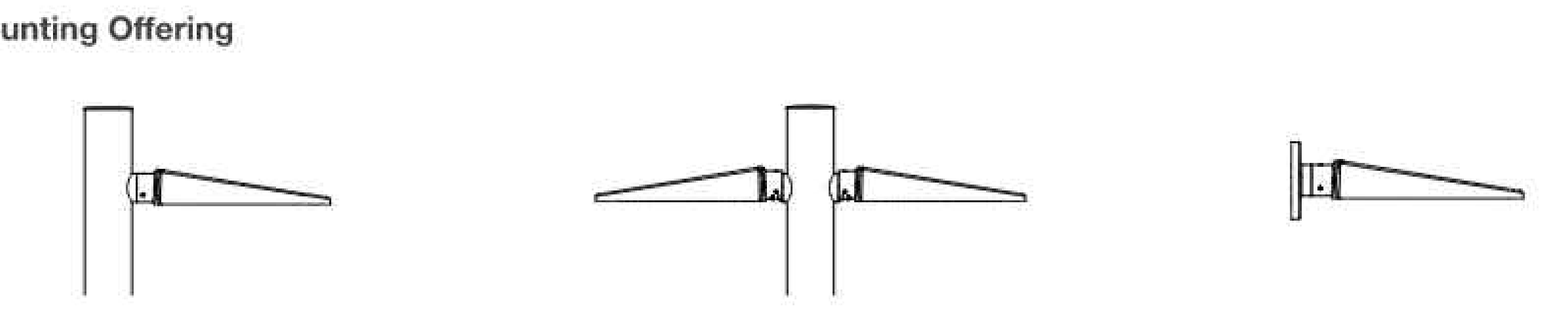
Line Drawings



Pole Description

Round pole is 4.5" and manufactured from seamless 6061 aluminum tubing and heat treated to produce a T6 temper. Nominal wall thickness is 0.125". Flush mounted hand hole cover includes two magni-coated fasteners.

Mounting Offering



2 Revised May 19, 2023 | Landscape Forms Inc. | 800.521.2546 | F 269.381.3455 | 7800 E. Michigan Ave., Kalamazoo, MI 49048

5 FIXTURES D, E, & F POLE

NTS

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One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970

ARCHITECTURE | PLANNING | INTERIORS

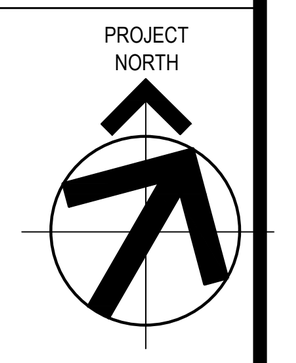
STATE OF CONNECTICUT KRISTEN MITCHELL LICENSED ARCHITECT NO. 1659

TRUMBULL HILLCR□ST MIDDL□ SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

□ro□ect Status

K□Y □L□N



DR□WING TITL□

SIT□ LIGHTING NOT□S □ND D□T□ILS

ST□T□ □RO□. NO.	144-0108N
□RO□. NO.	250501
SC□L□	
D□T□	08/15/2025
DR□WN BY	
□□□ROV□D BY	

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD □ricing Set
3	03/16/2026	50□ CD
4	03/26/2026	□H□S□ 1
5	05/19/2026	100□ CD

Drawing No.

LL501

0

9/2/2025 4:30:02 □M □utodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-□rch BIM360-R26.rvt

GENERAL NOTES:

1. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR IS R S ONSIBL FOR TH V RIFIC TION OF LL ISTING CONDITIONS, U NTITI S, ND FOR NOTIFYING TH CONSULT NT OF NY DISCR NCI S RIOR TO FIN LI ING BID.

2. B T M NT ND R M DI TION IN LL R S WILL ST RT WITH S L CTIV D MOLITION ND R MOVING M T RI LS T TH C ILING L V L ND ND WITH TH M T RI LS T TH FLOORING L V L TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL COORDIN T ND RFORM NOUGH S L CTIV D MOLITIOND MOLITION TO ID NTIFYLOC T ND CC SS LL M T RI LS TO B R MOV D/ B T D/R M DI T D.TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL O N/U W LLS, ND C ILINGS TO CH CK FOR HIDD N I ING.DUCT, TC S W LL S D MOLISHING MILLWORK; C BIN TRY, NON-MOV BL OB CTS, L Y R S OF FLOORING, W LLs, M T RI LS TT CH D TO W LLS, TC TO LOC T KNOWN ND OT NTI L SB STOS ND SSUM D CB CONT INING M T RI LS INT RIOR ND T RIOR S L CTIV D MOLITIOND MOLITION ND ROBING MUST OCCUR THROUGHOUT TH WORK R S B FOR CONT INM NT CONSTRUCTION ND B T M NT C N ST RT. SSUM TH B T M NT WORK WILL INCLUD FUG CONT INM NTS THROUGHOUT TH NTIR INT RIOR OF TH BUILDING. T RIOR B T M NT/R M DI TION WILL B TH R RFORM D IN CONT INM NT INT RIOR OR TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL INST LL OLY THYL N SH TING ON TH INT RIOR OF TH BUILDING ND R MOV M T RI LS FROM TH T RIOR LL GROUND SURF C S MUST LSO B ROT CT D WITH T R S, LYWOOD ND TWO L Y RS OF 16-MIL R INFORC D OLY THYL N SH TING. THIS GROUND ROT CTION MUST T ND T L ST 20 F T W Y FROM TH BUILDING FOUND TION OR F RTH R- NOUGH TO R V NT BUILDING M T RI LS FROM TOUCHING UN ROT CT D GROUND ND FLOOR SURF C S. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL Y FOR LL CONT MIN TION/R M DI TION/ B T M NT OF INT RIOR ND T RIOR SURF C S, INCLUDING GROUND SURF C S IF L NG N D MS TH Y H V CONT MIN T D TH S SURF C S. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL SU LY LIFTS, SC FFOLDING, ST GING, TC TO L NG N/N R S OF R M DI TION/ B T M NT/NTIL LL VISU L INS CTIONS H V SS D. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL ROVID T M OR RY SHORING IN R S TH T R UIR IT.

3. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR/D MOLITION CONTR CTOR SH LL ONLY US H VY UI M NT-O R TORS TH T H V RO R SB STOS ND/OR H WO R TR INING WH N DISTURBING/R MOVING/MOVING ND LO DING SB STOS L D, ND CB CONT INING M T RI LS. CC T BL TR INING FOR SB STOS C N B 32 OR 40 HOUR SB STOS WORK R/SU RVISOR WITH NNU L R FR SH R TR INING. 40 HOUR H WO R TR INING ND NNU L R FR SH R TR INING IS R UIR D FOR O R TORS H NDLING L D ND/OR CB CONT INING/CONT MIN T D M T RI LS. LL O R TORS MUST LSO H V. CURR NT M DIC L, FIT T ST D T ND W. R R S IR TORS DURING WORK. LL CONTR CTORS MUST COM LY WITH LL LIC BL OSH L D R GUL TIONS ND THIS WORK ND LL CORR S ONDING OSH R GUL TION COM LI NC IS INCLUD D IN TH B S BID.

4. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR, TH IR SUBCONTR CTORS, W ST TR NS ORT RS MUST SUBMIT L NDFILL INFORM TION TO L NG N ND TH OWN R RIOR TO TH SHI M NT OF NY W ST TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR S /H UL R S C NNOT SHI W ST UNTIL L NG N ND TH OWN R H V ROV D TH L NDFILL TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR H UL R S/ S RO OSING TO SHI TH W ST TO LL CB TCL S M LING OF TH W ST MUST B RFORM D BY TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR IF T STING IS ROV D BY L NG N ND TH OWN R WITH L NG N R S NT ND TH R SULTS M D V IL BL TO L NG N ND TH OWN R RIOR TO W ST SHI M NT. L NG M M Y RFORM DDITION L TCL S M LING TO CONFIRM TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR S R SULTS L NG N WILL RFORM TH L D TCL S M LING FOR CL SSIFIC TION OF TH D MOLITION ND B T M NT W ST . L S S TH SB STOS, CB, ND L D-B S D INT S CIFIC TIONS FOR DDITION L R UIR M NTS ND CONTR CTORS LI BILITY.

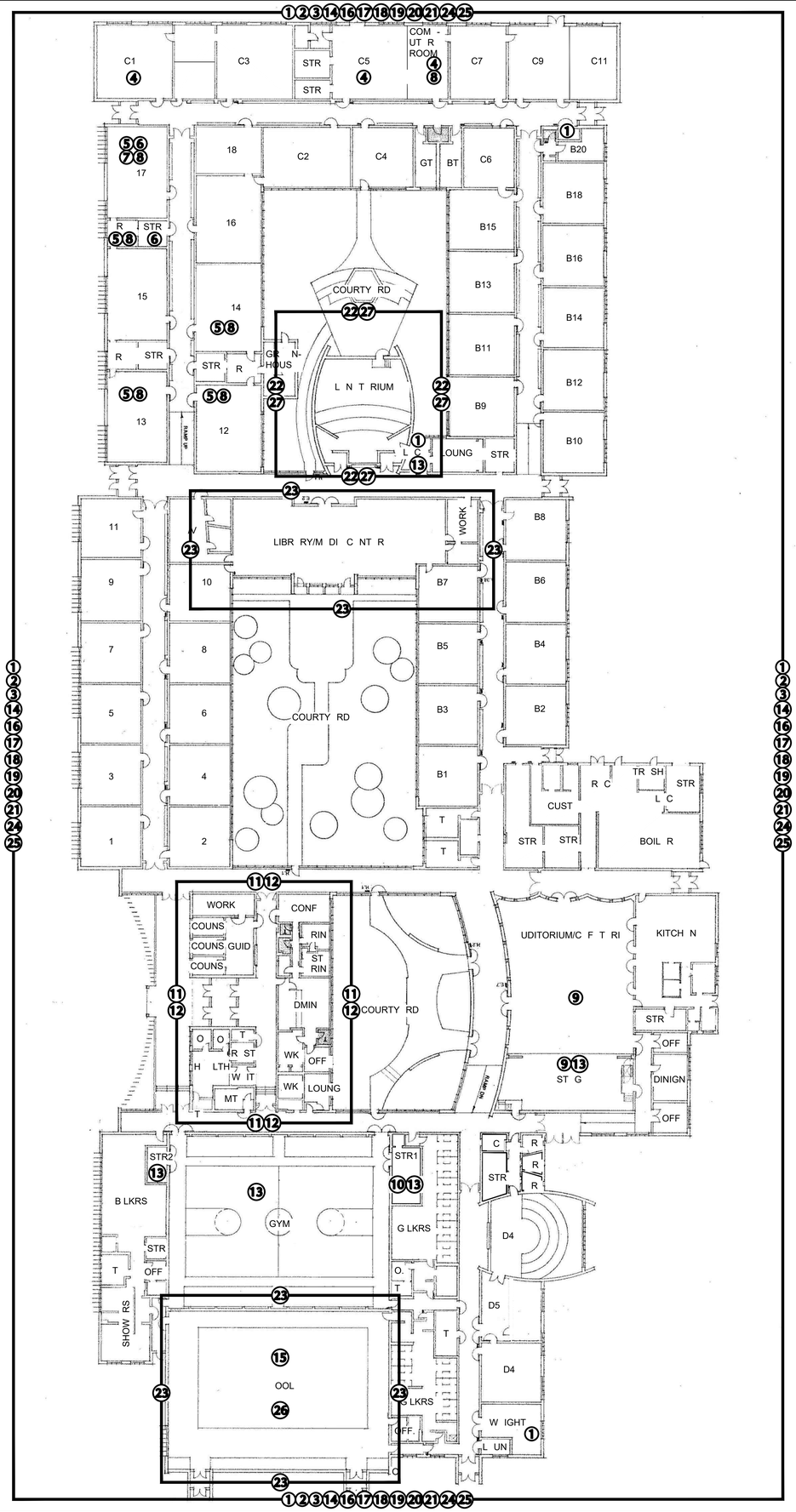
5. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR, TH IR SUBCONTR CTORS, W ST TR NS ORT RS ND/OR L NDFILL S DO NOT H V RMISSION TO T K / N LY BUILDING M T RI LS FOR CB CONT NT/ CONC NTR TIONS WITHOUT WRITT N RMISSION FROM TH BUILDING OWN R RIOR TO SUCH S M LING. SHOULD TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR OR OTH R RTI S LIST D BOV T K / N LY CB S M L S WITHOUT TH OWN RS RMISSION ND CBS R FOUND TO B T M, TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL B R S ONSIBL FOR LL COSTS SSOCI T D WITH TH B T M NT/ R M DI TION/R L C M NT OF LL TH INT RIOR/ T RIOR BUILDING M T RI LS ND D C NT SURF C S, INCLUDING SOLI S H LTI CONCR T / TC S W LL S LL COSTS SSOCI T D WITH RO CT D L YS, TTORN Y F S FOR LL RTI S FF CT D ND LL COSTS R SULTING FROM CT D / R UIR M NTS TH T M Y OCCUR S R SULT.

6. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL B R S ONSIBL FOR HIRING N NGIN R ND OTH R RO RI T RSONN L TO NSUR TH T LL R UIR D S L CTIV D MOLITION ND D MOLITION CTIVITI S R S F TO RFORM FOR LL RSONN L ON SIT . TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR S WILL B FIN NN NCI LLY R S ONSIBL FOR NY D M G TH T M Y OCCUR TO TH SIT . ON-SIT RSONN L, FIN S, N LTI S, TO TH Y WILL LSO B R S ONSIBL FOR YING/R IMBURSING LL L G L F S/COSTS FOR LL RTI S INVOLV D WITH TH RO CT SHOULD S L CTIV D MOLITION OR D MOLITION CTIVITI S C US IN URY OR D TH TO NY RSONS ON SIT .

7. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR IS R S ONSIBL FOR ROVIDING T M OR RY W T R, OW R, ND H T S N D D T TH SIT 24 HOURS D Y. T M OR RY LIGHTING WITHIN TH WORK R S MUST B CONN CT D TO GROUND F ULT CIRCUIT INT RRU T R GFCI OW R N LS INST LL D BY ST T OF CONN CTICUT LIC NS D L CTRICI N ND LOC T D OUTSID OF TH WORK R S TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL B R S ONSIBL FOR YING FOR TH US OF OW R ND W T R UNL SS TH OWN R GR S IN WRITING TO Y FOR TH S UTILITI S IT SH LL LSO B TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR S R S ONSIBILITY TO ROVID LL FI D ND T M OR RY CONN CTIONS ND HOOK-U S W LL S OBT INING RMITS ND YING LL F S FOR M KING SUCH S RVIC S V IL BL FOR HIS WORK S IS N C SS RY. LL OW R ND W T R MUST B SU LI D 24 HOURS D Y THROUGHOUT TH B T M NT RO CT, CT D H WILL B NOTIFI D IMM DI T LY IF CTIV CONT INM NTS DO NOT H V SUFFICI NT N G TIV R SSUR THROUGHOUT TH B T M NT ROC SS UNTIL CC T BL R OCCU NCY IR R SULTS R R C IV D. TH US OF ORT BL G N R TORS WILL R UIR 24 HOURS D Y, 7 D YS W K CONTINUOUS O R TION F N G TIV IR M CHIN S IN CONT INM NTS R OW R D BY TH M. THIS CONTINUOUS O R TION MUST R M IN IN L C FROM TH TIM TH R - B T M NT VISU L IS COM L T D U UNTIL CL R NC R -OCCU NCY S M LING R SULTS H V SS D. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR WILL Y TH OWN R 2,500 N LTY SHOULD TH OW R B FOUND TO NOT B RUNNING TH N G TIV IR M CHIN S IN CTIV B T M NT CONT INM NTS. THIS N LTY WILL LY D ILY ND TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR IS LSO R S ONSIBL FOR YING LL CT D H FIN S TH T M Y B IM OS D ON TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR ND OWN R.

HAZARDOUS BUILDING MATERIALS ABATEMENT NOTES (SEE ASBESTOS ABATEMENT SPECIFICATION, PCB REMEDIATION SPECIFICATIONS AND EPA COMPLIANT PCB PERFORMANCE BASED PLAN FOR ADDITIONAL INFORMATION NOT INCLUDED ON DRAWINGS)

1. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING FLOOR TIL S ND/OR BL CK M STIC S CM.
2. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING I FITTING, I H NG R ND ROOF DR IN INSUL TION S CM.
3. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING CLOCKS K R T R S CM.
4. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING TR NSIT T BL TO S ND DH SIV S S CM.
5. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING L BOR TORY SINK C ULKING COM OUND S CM.
6. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING TR NSIT L BOR TORY HOOD ND BO S CM.
7. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING L BOR TORY T ST TUB R CK ND DH SIV S CM.
8. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING L BOR TORY COUNT RTO S ND DH SIV S S CM.
9. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING L CTRIC L INSUL TION S CM.
10. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING LIGHT B CKING R S CM.
11. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING BL CK T R ON CONCR T BLOCK/W LL M T RI LS S CM.
12. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING BL CK DUCT R/T R S CM.
13. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING DUCT INSUL TION IN DH SIV S CM.
14. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING D RK R D FIR N TR TION S L NT S CM.
15. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING C R MIC W LL ND FLOOR TIL GROUTS ND MUD B DS S CM.
16. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING ROCK W LL D M - ROOFING T R/ R S CM.
17. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING D M - ROOFING T R/ R B HIND BRICK W LLS/W LLS INCLUDING T FOUND TION S CM.
18. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING TR NSIT BO RD ND D M - ROOFING T R/ R B HIND STON W LL/WINDOW N LING S CM.
19. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS ND SSUM D CB 50 M CONT INING INT RIOR DIS L Y C S W LL C ILING, C R MIC W LL DOOR, DOOR/WINDOW W LL, DOOR WINDOW, WINDOW C ULKING ND GL ING COM OUNDS S CM ND CB BULK RODUCT W ST .
20. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS ND SSUM D CB 50 M CONT INING T RIOR WINDOW, SILL INCLUDING UND RN TH SILLS , W LL, FOUND TION, DOOR, DOOR WINDOW, DOOR/WINDOW W LL, V NT, ROCK W LL, W LL NSION ND OTH R C ULKING ND GL ING COM OUNDS S CM ND CB BULK RODUCT W ST .
21. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING CONDUIT L CTRIC L ND OTH R UTTY S CM.
22. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING ROOF DOM BL CK R M T RI L UND RN TH M T L/OUT R ROOFING S CM.
23. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING ROOF FI LD ND FL SHING M T RI LS CURV D ROOFS S CM.
24. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SB STOS CONT INING ROOF N TR TION FL SHING M T RI LS S CM.
25. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SSUM D CB 50 M CONT INING L BOR TORY SINK, DIS L Y C S , UNIT V NTIL TOR C ULKING COM OUNDS S CB BULK RODUCT W ST .
26. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SSUM D CB 50 M CONT INING OOL RIM T R C ULKING COM OUNDS INSID ND OUTSID OOL S CB BULK RODUCT W ST .
27. TH H RDOUS BUILDING M T RI LS B T M NT CONTR CTOR SH LL R MOV ND DIS OS OF SSUM D CB 50 M CONT INING ROOF DOM C LKING COM OUND S CB BULK RODUCT W ST .



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Langan CT, Inc.
555 Long Wharf Drive, 9th Floor
New Haven, CT 06511

T: 203.562.5771 F: 203.789.6142 www.langan.com

ROF SSION L S L

TRUMBULL HILLCR ST MIDDL SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

ro ect Status

K Y L N

N

DR WING TITL

H RDOUS BUILDING
M T RI LS B T M NT L N

ST T RO . NO.	144-0108N
OFFIC RO . NO.	250501
SC L	1
D T	08/15/2025
DR WN BY	F
ROV D BY	MM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

HBM-01

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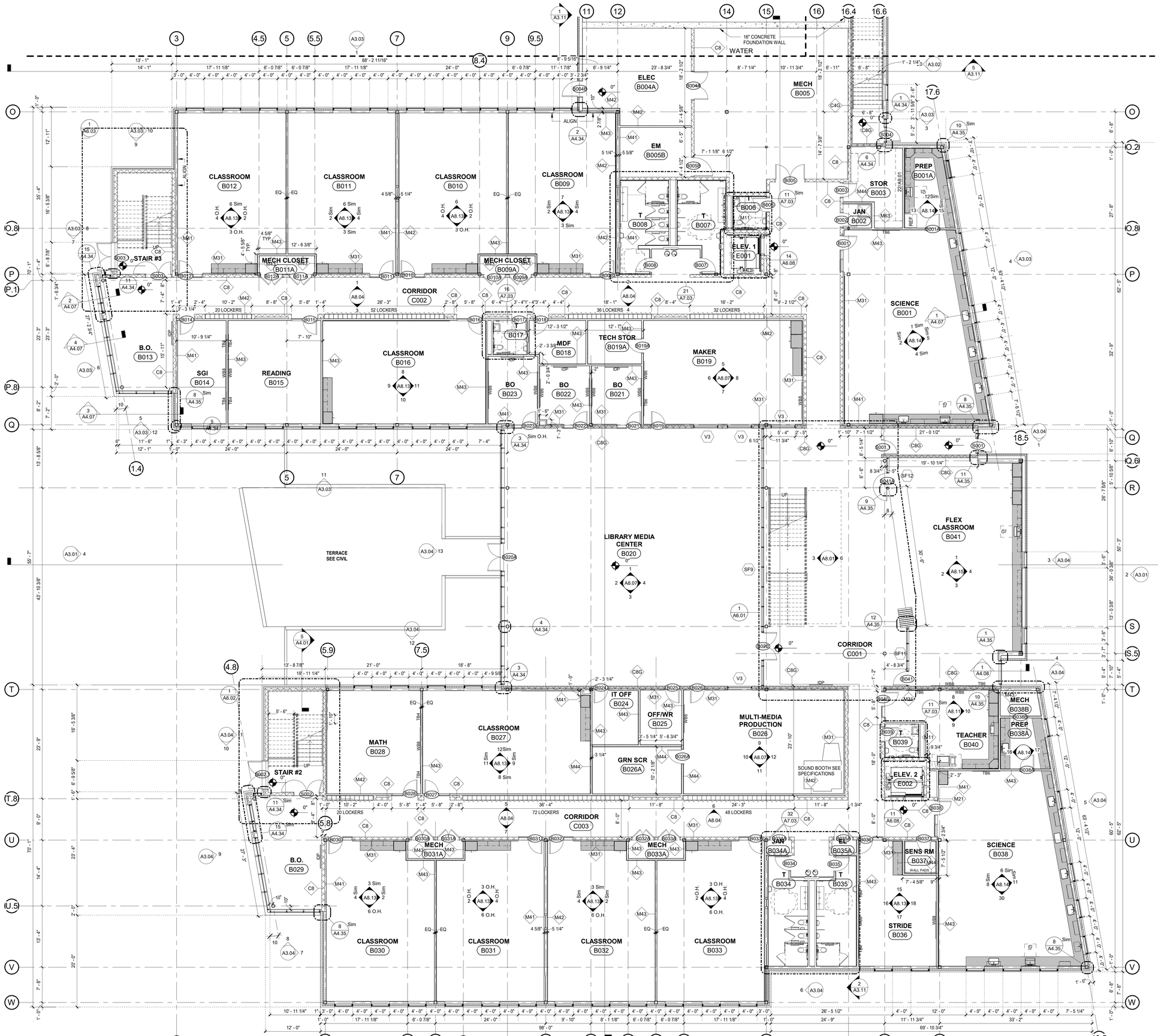

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146 Wyllys Street, Bldg 1-203
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860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

LOWER LEVEL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A1.01

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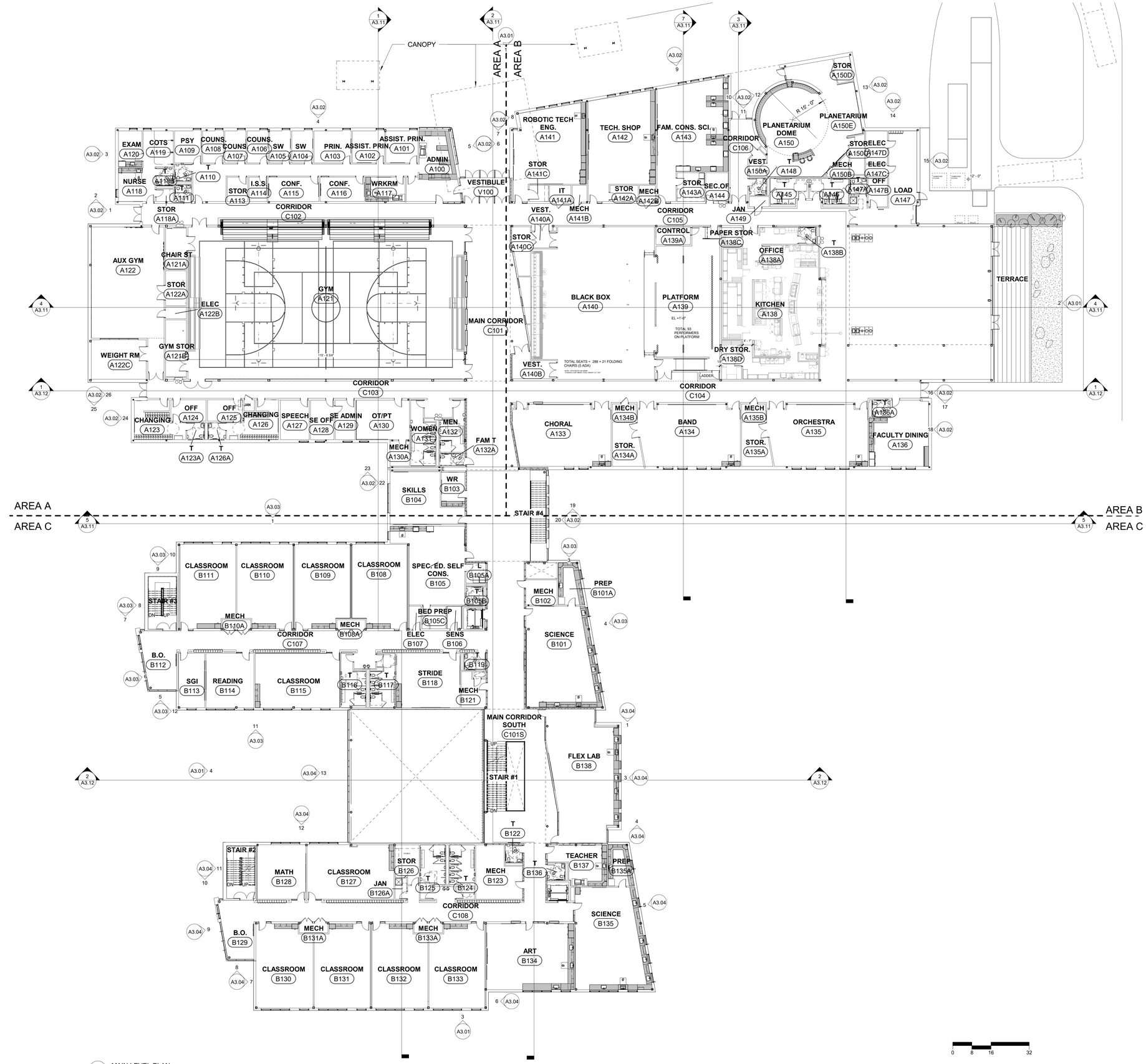

1 MAIN LEVEL PLAN
1/16" = 1'-0"

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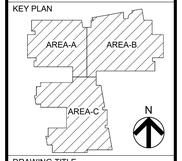
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MAIN LEVEL - OVERALL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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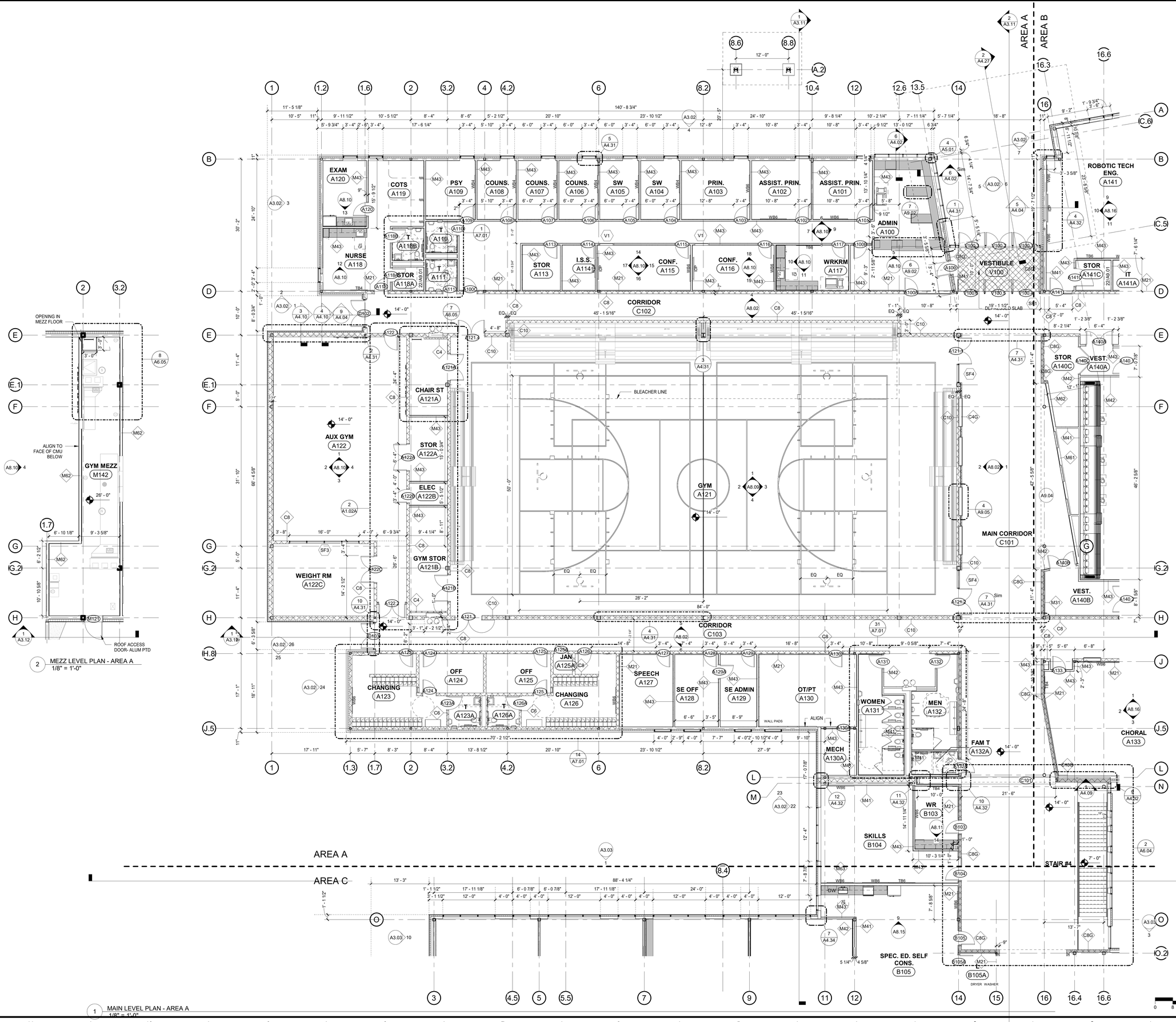

2 MEZZ LEVEL PLAN - AREA A
1/8" = 1'-0"

1 MAIN LEVEL PLAN - AREA A
1/8" = 1'-0"

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DRAWING TITLE

MAIN LEVEL AREA A

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OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

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4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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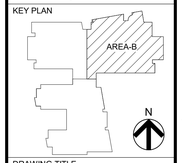
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MAIN LEVEL AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A1.02B

1 MAIN LEVEL PLAN - AREA B
1/8" = 1'-0"

2 MEZZ LEVEL PLAN - AREA B
1/8" = 1'-0"

AREA B

AREA C

0 8 16 32

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AREA A

AREA C

SKILLS B104

STAIR #4

TERRACE SEE CIVIL

PROVIDE FIRE/SMOKE DAMPERS AT PENETRATION

STAIR #3

CLASSROOM B111

CLASSROOM B110

CLASSROOM B109

CLASSROOM B108

SPEC. ED. SELF CONS. B105

B105A

DRYER WASHER

B105B

MECH B102

PREP B101A

REF

ELEC B107

BED PREP B105C

SENS B106

ELE E101

MECH B110A

MECH B108A

CORRIDOR C107

SCIENCE B101

24 LOCKERS

56 LOCKERS

48 LOCKERS

12 LOCKERS

B.O. B112

SGI B113

READING B114

CLASSROOM B115

B116

B117

STRIDE B118

JAN B121A

MECH B121

MAIN CORRIDOR SOUTH C101S

FLEX LAB B138

ALIGN TO FACE OF CMU BELOW

STAIR #2

MATH B128

CLASSROOM B127

STOR B126

B125

B124

JAN B126A

MECH B123

TEACHER B137

PREP B135A

ELE E102

B136

CORRIDOR C108

64 LOCKERS

52 LOCKERS

DISPLAY CASE

B.O. B129

MECH B131A

MECH B133A

SCIENCE B135

CLASSROOM B130

CLASSROOM B131

CLASSROOM B132

CLASSROOM B133

ART B134

1 MAIN LEVEL - AREA C
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

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Project Status

KEY PLAN

AREA C

N

DRAWING TITLE

MAIN LEVEL AREA C

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OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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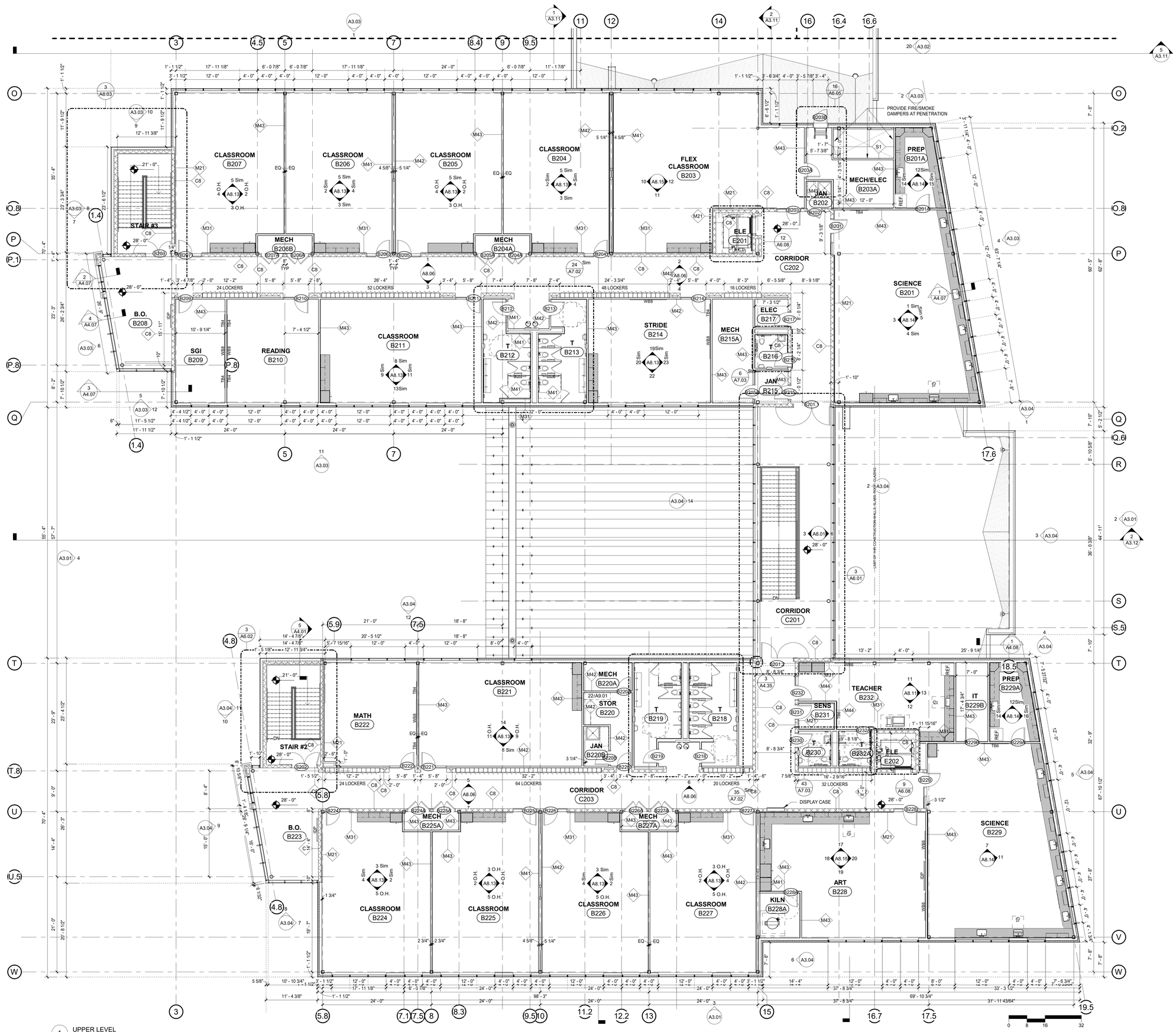

1 UPPER LEVEL
1/8" = 1'-0"

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530 Daniels Farm Road, Trumbull, CT 06611

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UPPER LEVEL

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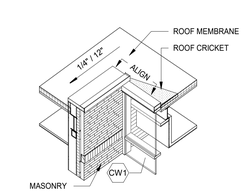
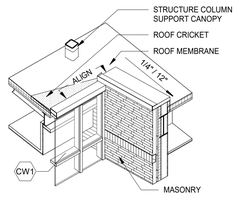


3 FASCIA DETAIL @ CW1 EAST



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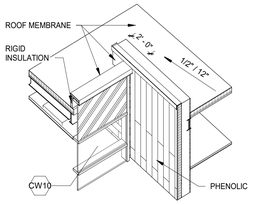
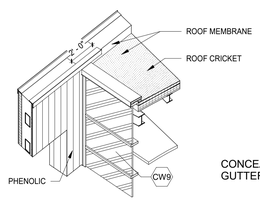
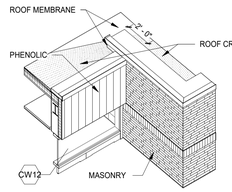


5 FASCIA DETAIL @ CW10



4 FASCIA DETAIL @ CW9



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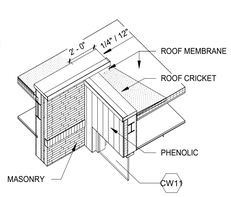
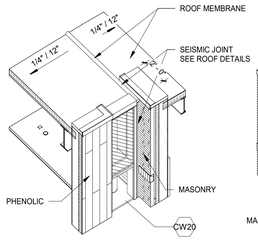
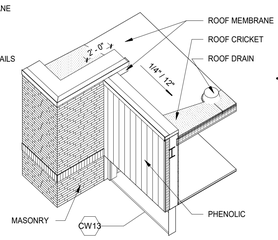


6 FASCIA DETAIL @ CW11



9 FASCIA DETAIL @ CW20



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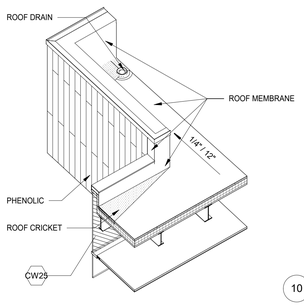
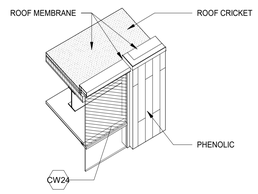


11 FASCIA DETAIL @ CW25



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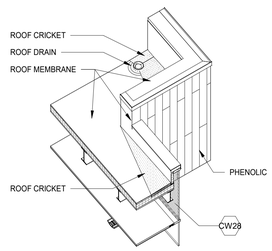

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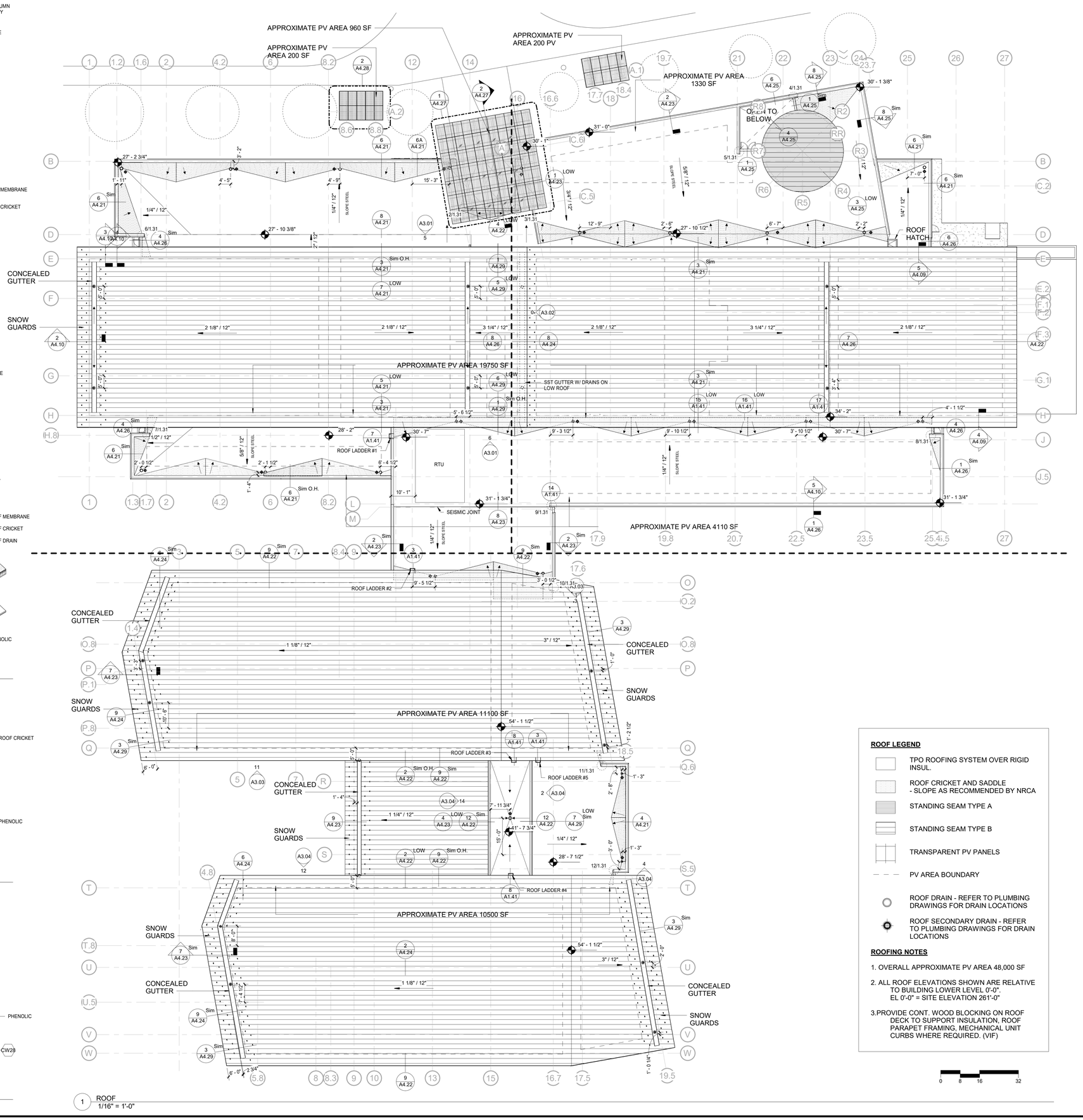

ROOF LEGEND

- TPO ROOFING SYSTEM OVER RIGID INSUL.
- ROOF CRICKET AND SADDLE - SLOPE AS RECOMMENDED BY NRCA
- STANDING SEAM TYPE A
- STANDING SEAM TYPE B
- TRANSPARENT PV PANELS
- PV AREA BOUNDARY
- ROOF DRAIN - REFER TO PLUMBING DRAWINGS FOR DRAIN LOCATIONS
- ROOF SECONDARY DRAIN - REFER TO PLUMBING DRAWINGS FOR DRAIN LOCATIONS

ROOFING NOTES

1. OVERALL APPROXIMATE PV AREA 48,000 SF
2. ALL ROOF ELEVATIONS SHOWN ARE RELATIVE TO BUILDING LOWER LEVEL 0'-0". EL 0'-0" = SITE ELEVATION 261'-0"
3. PROVIDE CONT. WOOD BLOCKING ON ROOF DECK TO SUPPORT INSULATION, ROOF PARAPET FRAMING, MECHANICAL UNIT CURBS WHERE REQUIRED. (VIF)

0 8 16 32

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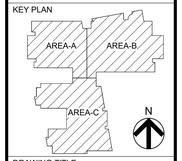
Project Status

KEY PLAN



DRAWING TITLE

ROOF PLAN

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OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
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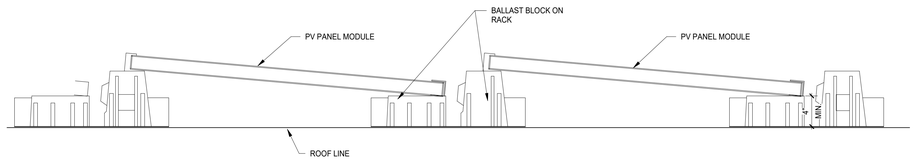
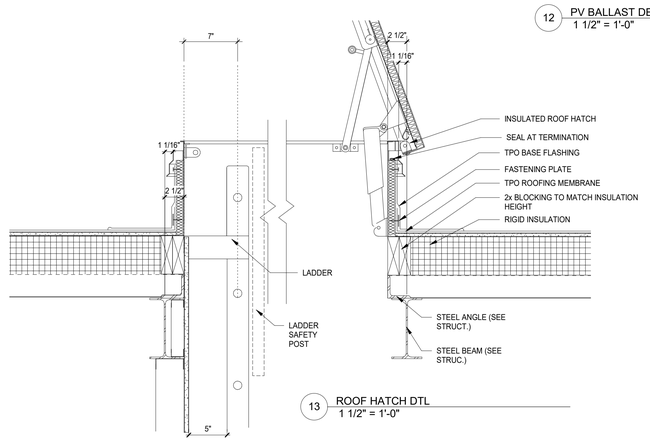


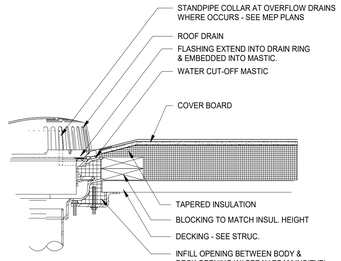
PV INSTALLATION AT FLAT ROOF

PV RACK SYSTEM MUST ALLOW FOR ROOF DRAINAGE TYPICAL

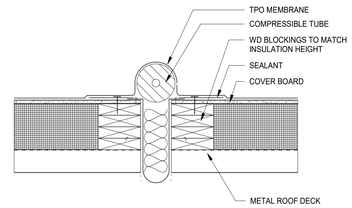
12 PV BALLAST DETAIL
1 1/2" = 1'-0"



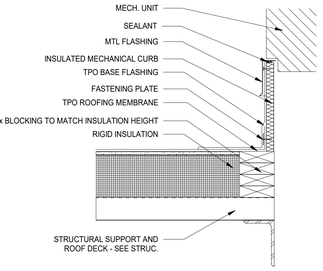
13 ROOF HATCH DTL
1 1/2" = 1'-0"



5 TPO- ROOF DRAIN DETAIL- TYP
1 1/2" = 1'-0"



1 TPO - ROOF SEISMIC JOINT DETAIL (TYP)
1 1/2" = 1'-0"



9 TPO- ROOF MECHANICAL CURB DETAIL (TYP)
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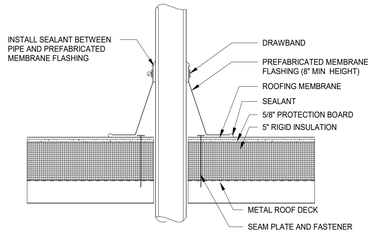
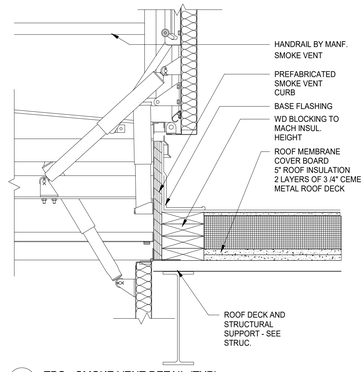


6 TPO - ROOF PENETRATION DETAIL - TYPICAL
1 1/2" = 1'-0"



2 TPO - SMOKE VENT DETAIL (TYP)
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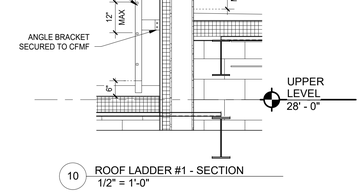
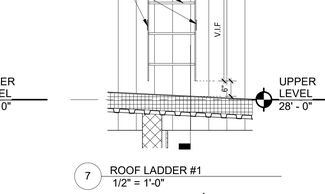


10 ROOF LADDER #1 - SECTION
1/2" = 1'-0"



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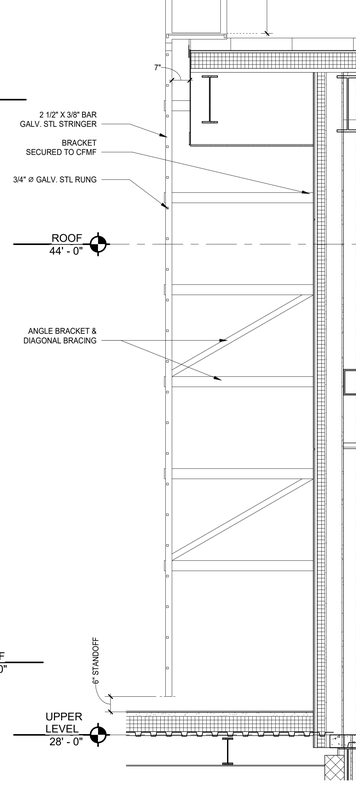
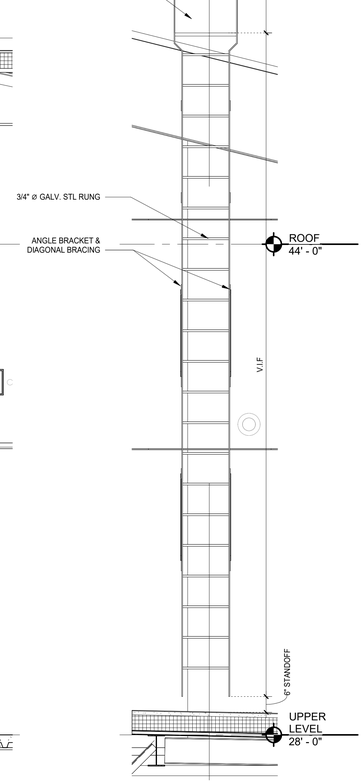
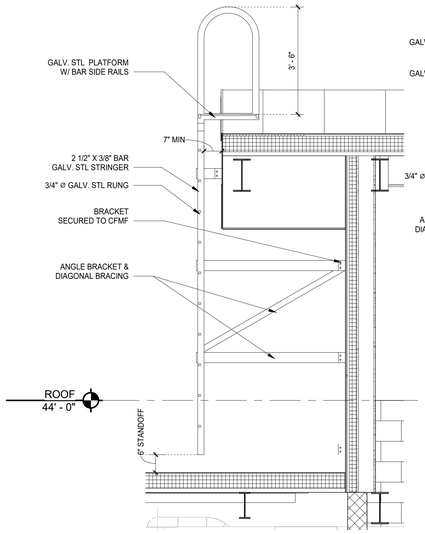
1/2" = 1'-0"



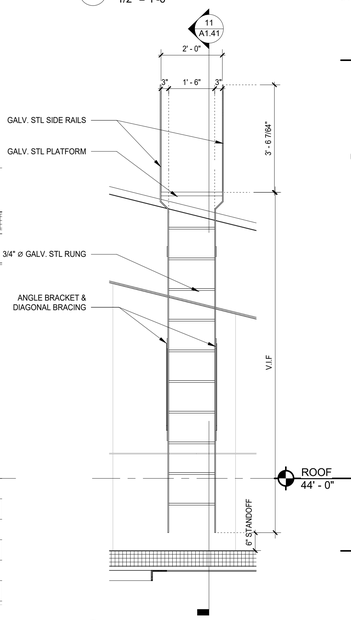
4 ROOF LADDER #2 & #5 - SECTION
1/2" = 1'-0"



3 ROOF LADDER #2 & #5
1/2" = 1'-0"



11 ROOF LADDER #3 & #4 - SECTION
1/2" = 1'-0"



8 ROOF LADDER #3 & #4
1/2" = 1'-0"

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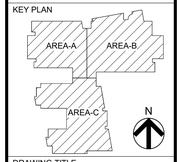

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ROOF DETAILS

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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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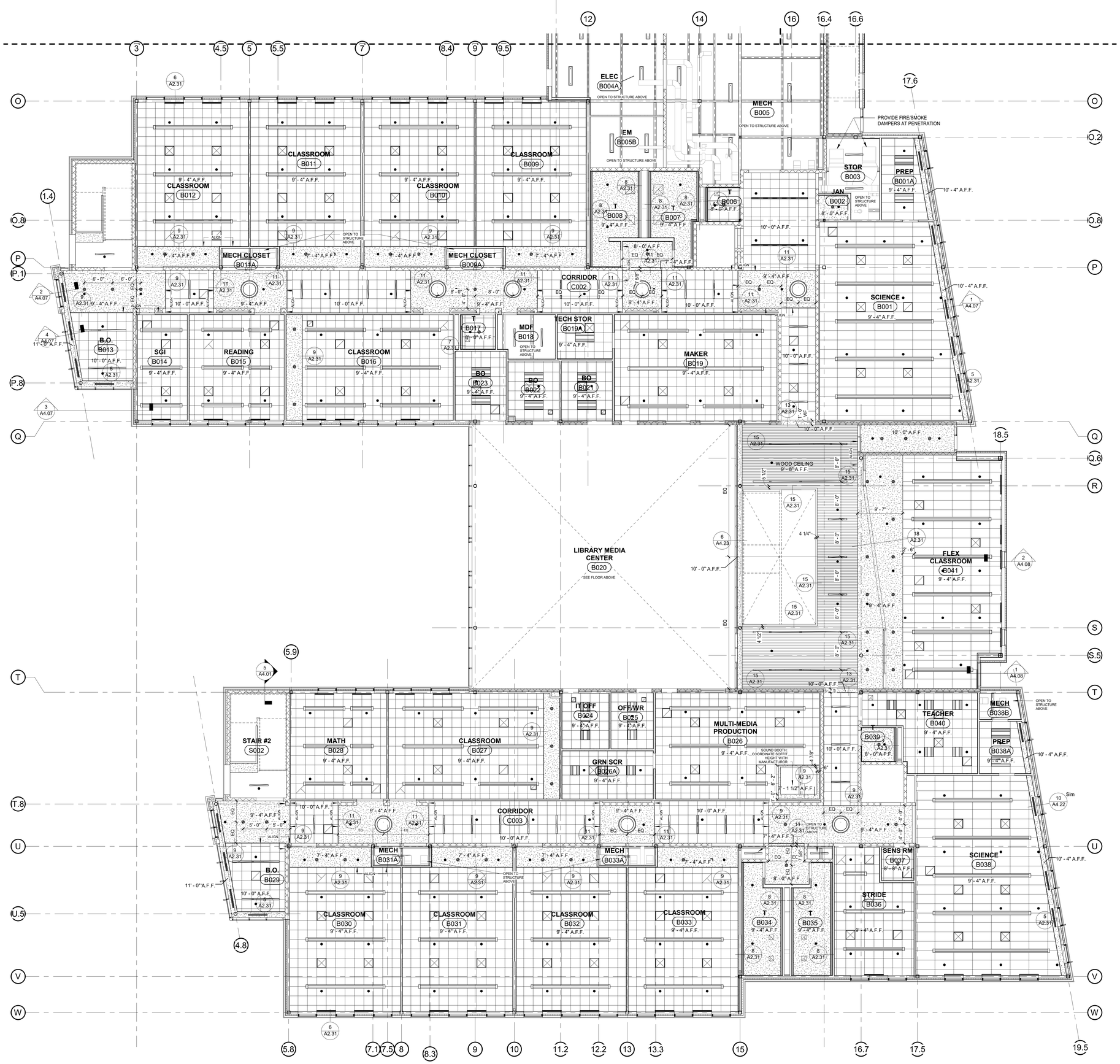

1 LOWER LEVEL
1/8" = 1'-0"

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER — — COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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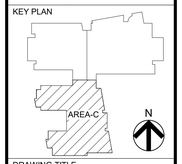
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

LOWER LEVEL REFLECTED CEILING PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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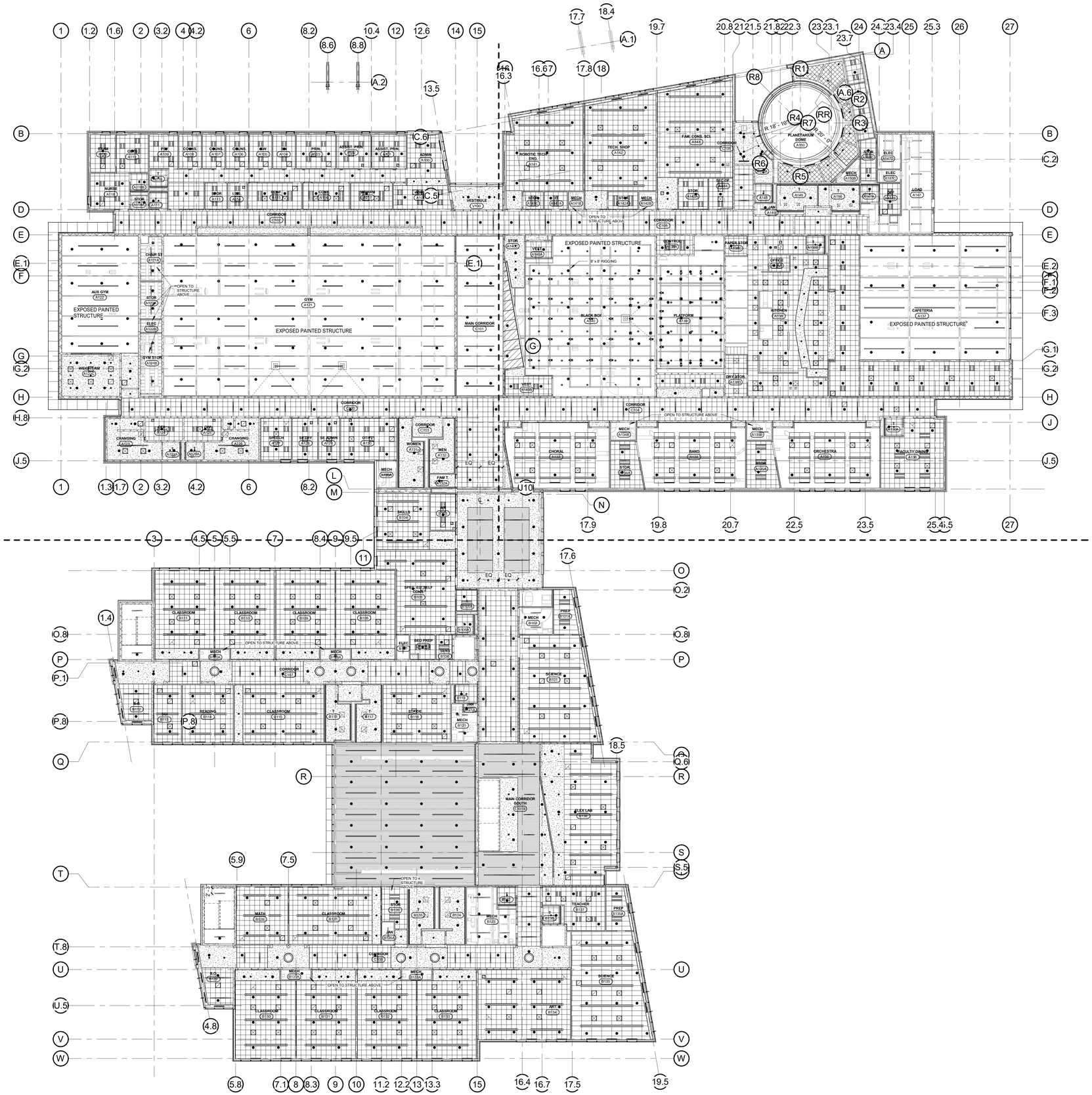

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER — — COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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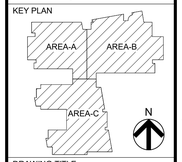
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



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MAIN LEVEL REFLECTED CEILING PLAN OVERALL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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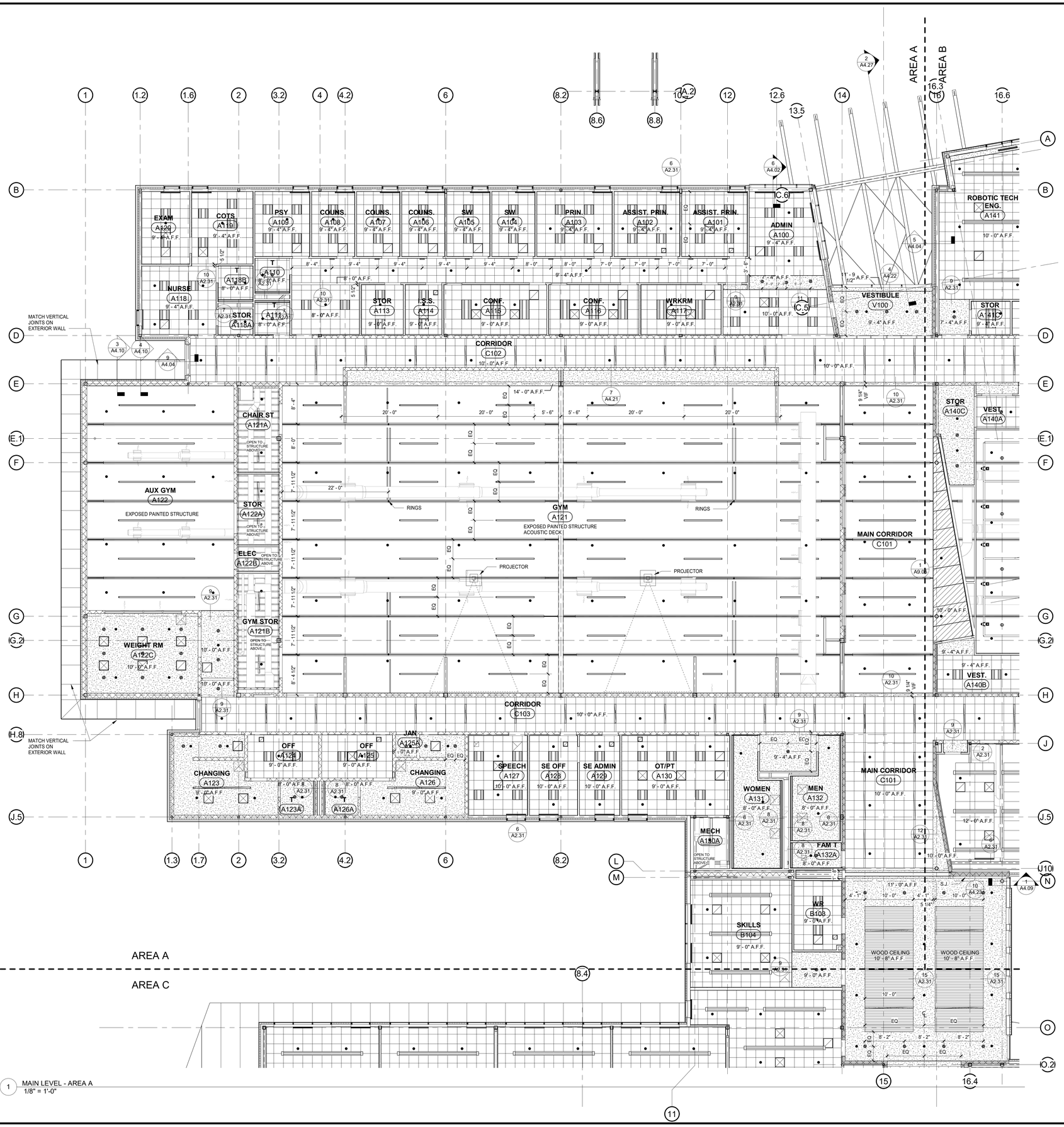

1 MAIN LEVEL - AREA A
1/8" = 1'-0"

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER
- COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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MAIN LEVEL REFLECTED CEILING PLAN AREA A

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OFFICE PROJ. NO.	250501
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DRAWN BY	Author
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4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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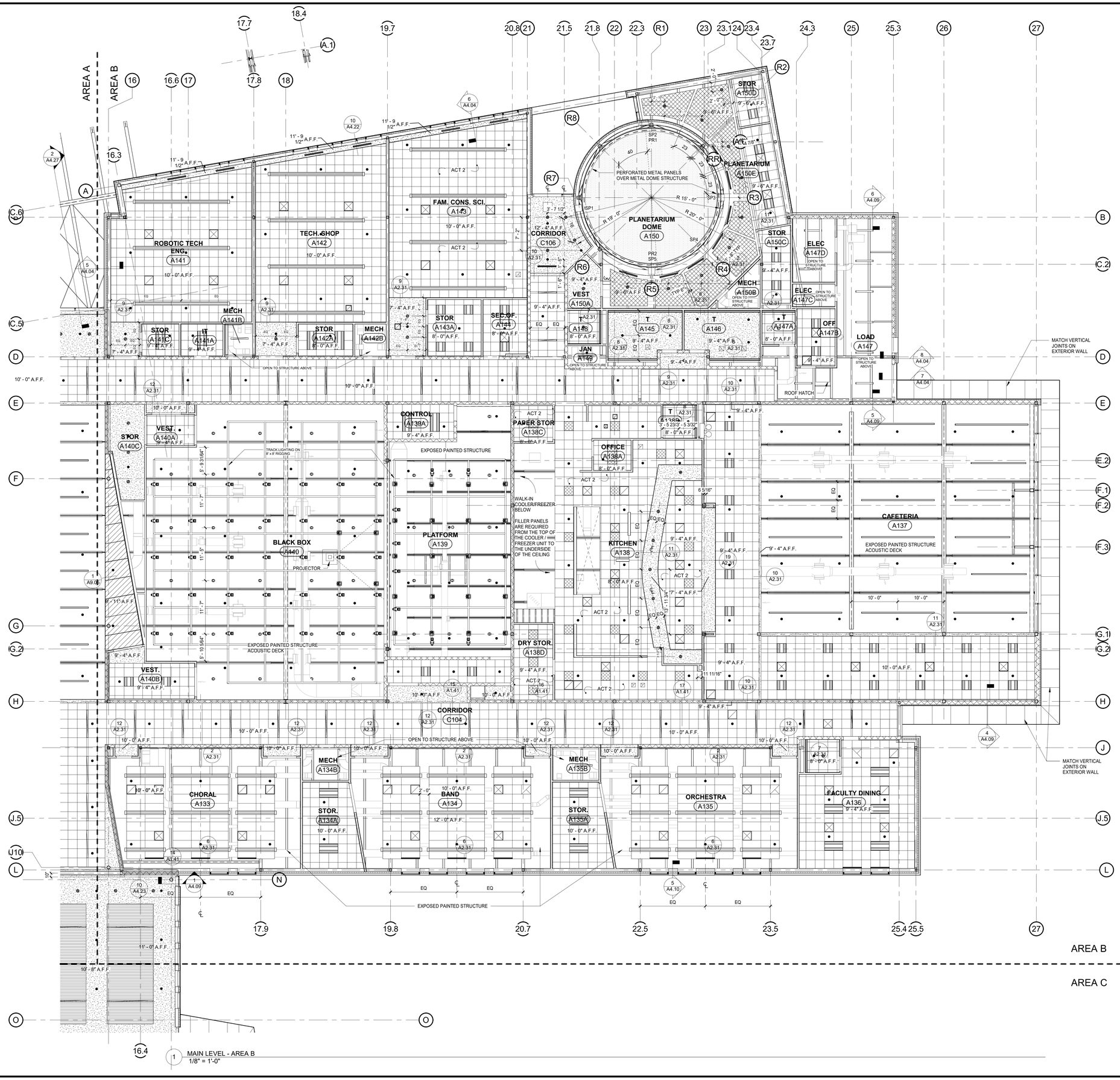

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER
- COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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KEY PLAN



DRAWING TITLE

MAIN LEVEL REFLECTED CEILING PLAN AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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1 MAIN LEVEL - AREA C
1/8" = 1'-0"

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER
- COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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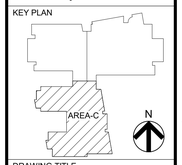

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MAIN LEVEL REFLECTED CEILING PLAN AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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DRAWN BY	Author
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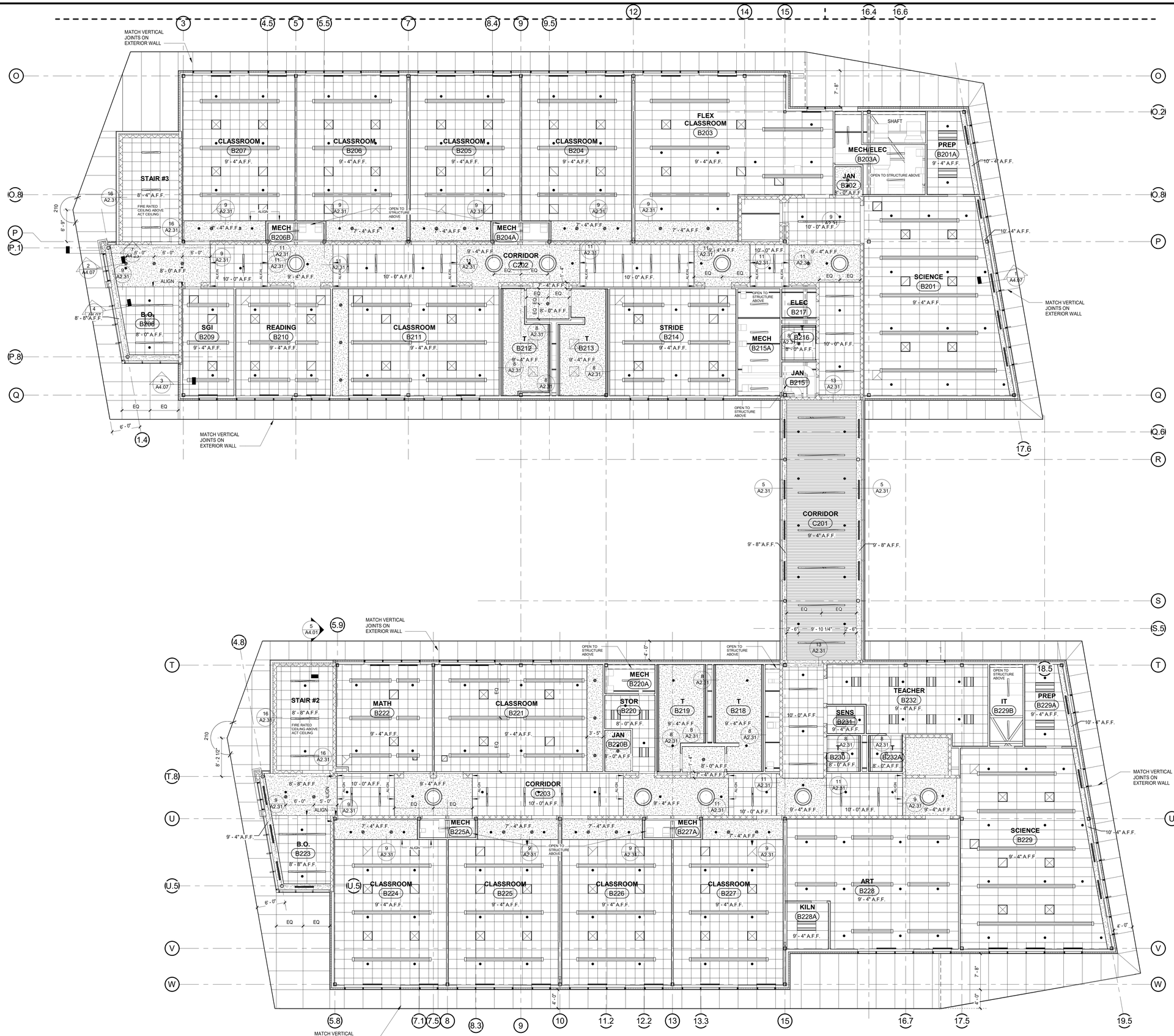

1 UPPER LEVEL
1/8" = 1'-0"

CEILING LEGEND

- WOOD CEILING
- PLANETARIUM ACOUSTIC CEILING
- METAL PANELS @ DOME
- ACT # - REFER TO SPECS
- GWB
- FIRE RATED CEILING
- RETURN DIFFUSER
- SUPPLY DIFFUSER
- LINEAR DIFFUSER
- SPRINKLER — — COVE LIGHT
- CEILING MOUNTED CAMERA
- CIRCLE CEILING MOUNTED SPEAKER
- SQUARE CEILING MOUNTED SPEAKER

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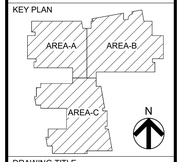

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UPPER LEVEL REFLECTED CEILING PLAN

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OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
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2	12/15/2025	DD Pricing Set
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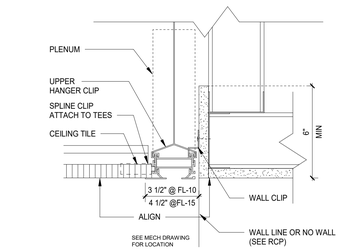
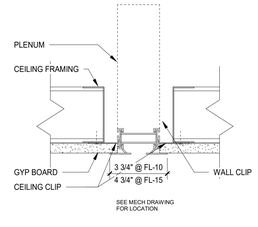
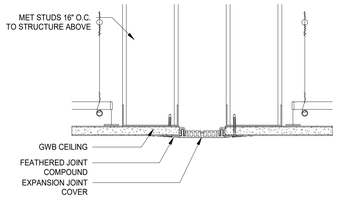


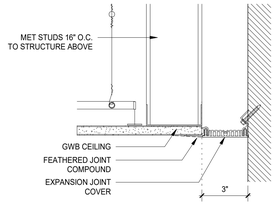
6 CL-LINEAR DIFFUSER @ ACT (TYP)
3" = 1'-0"



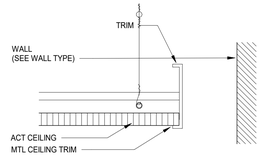
5 CL-LINEAR DIFFUSER @ GWB (TYP)
3" = 1'-0"



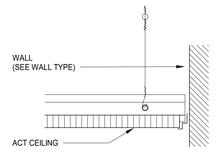
4 CL-EXPANSION JOINT - GWB TO GWB
3" = 1'-0"



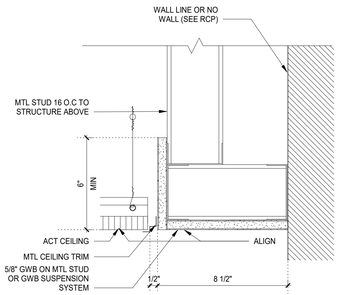
3 CL-EXPANSION JOINT - GYP TO WALL
3" = 1'-0"



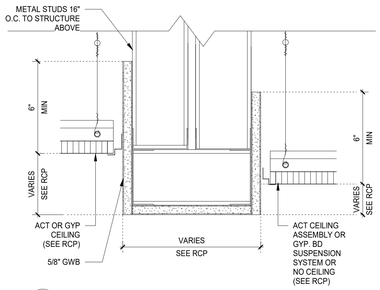
2 CL-ACT CEILING TRIM (TYP)
3" = 1'-0"



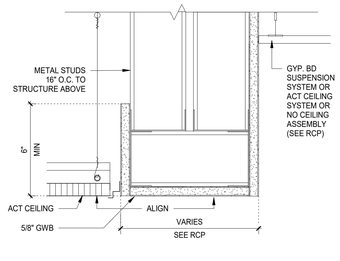
1 CL-ACT CEILING AT WALL (TYP.)
3" = 1'-0"



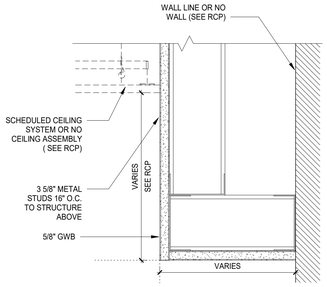
12 CL-GWB/ACT INTERSECTION
3" = 1'-0"



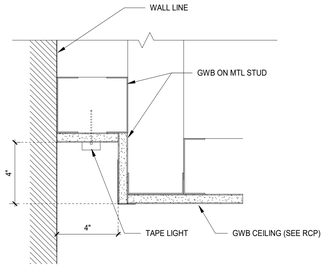
11 CL-GWB SOFFIT - ACT/ACT
3" = 1'-0"



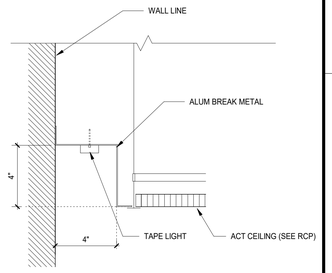
10 CL-GWB SOFFIT - ACT/GWB ALIGN
3" = 1'-0"



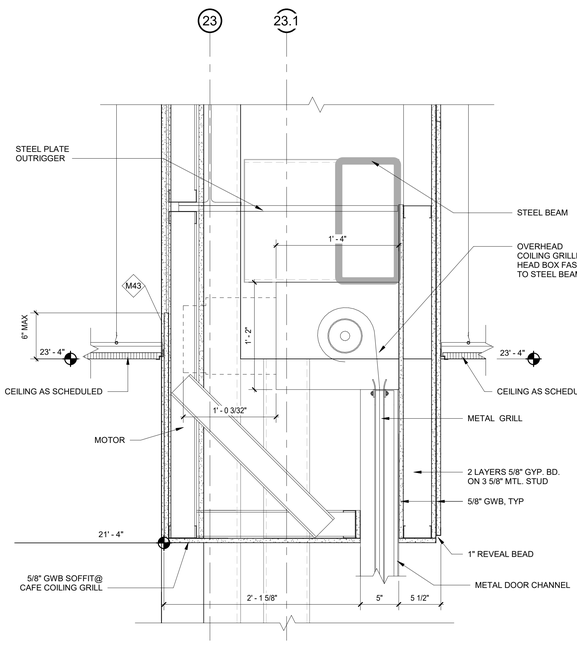
9 CL-GWB SOFFIT - GWB / WALL
3" = 1'-0"



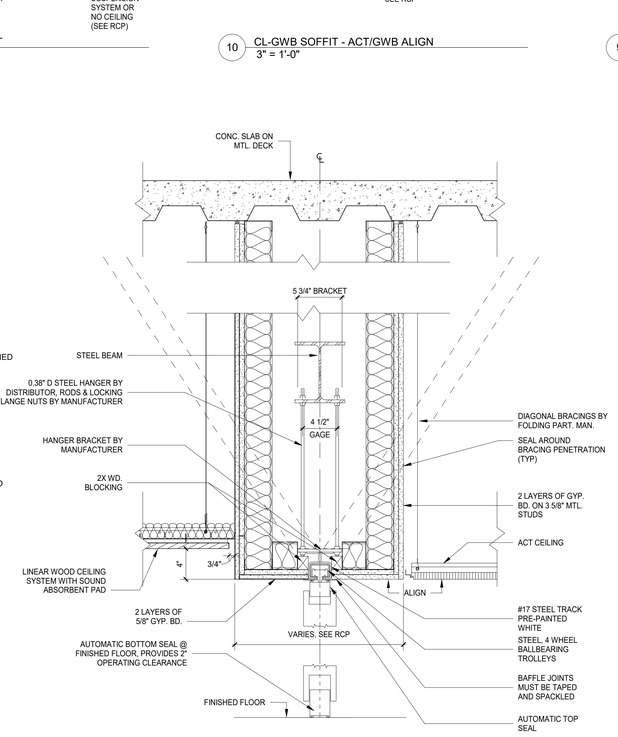
8 CL-TOILET LIGHT POCKET @ GWB (TYP)
3" = 1'-0"



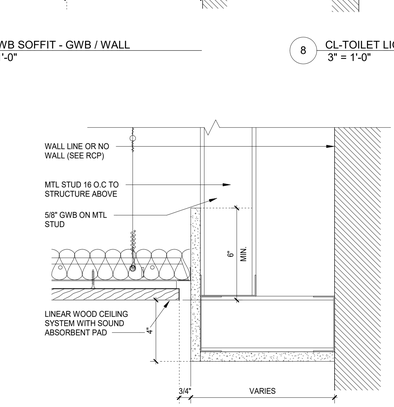
7 CL-TOILET LIGHT POCKET @ ACT (TYP)
3" = 1'-0"



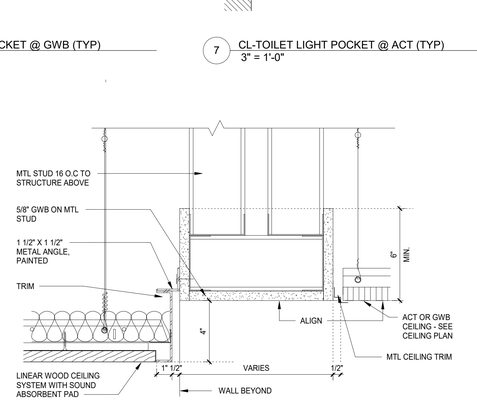
19 COILING GRILLE HEAD DETAIL
1 1/2" = 1'-0"



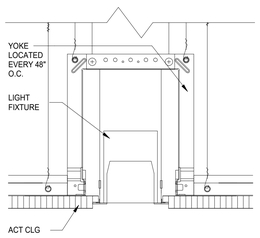
18 FOLDING PARTITION HEAD AND SEAL DETAIL
1 1/2" = 1'-0"



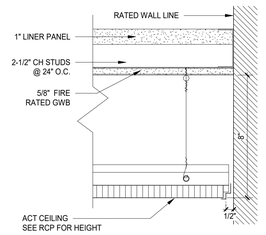
14 WOOD CEILING @ WALL
3" = 1'-0"



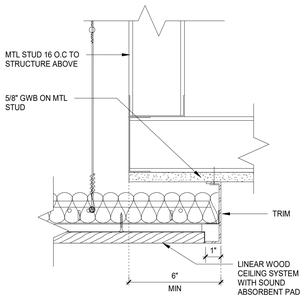
13 WOOD CLG/ ACT INTERSECTION
3" = 1'-0"



17 CL-LIGHT FIXTURE DETAIL @ ACT (TYP)
3" = 1'-0"



16 CL-STAIR CEILING DETAIL
3" = 1'-0"



15 WOOD CEILING DETAIL
3" = 1'-0"

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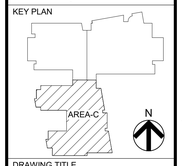
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

CEILING DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
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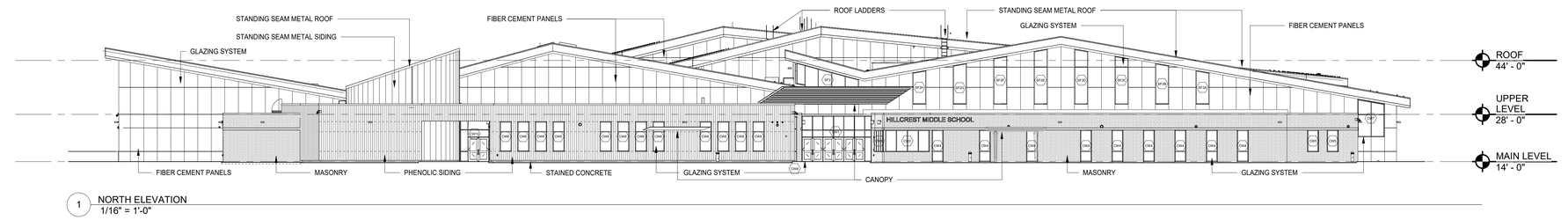
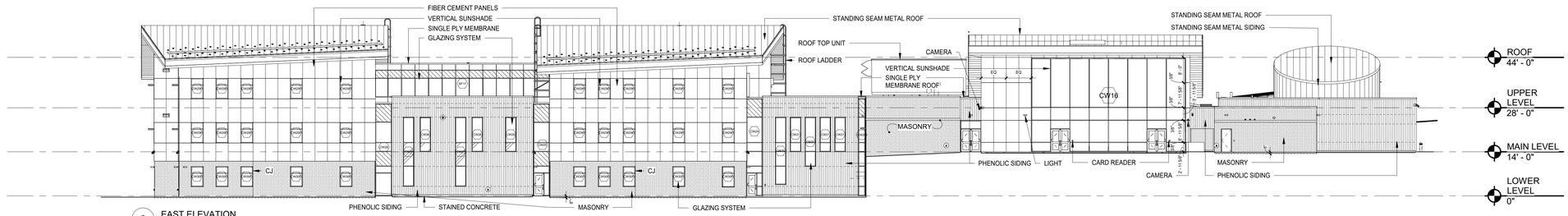
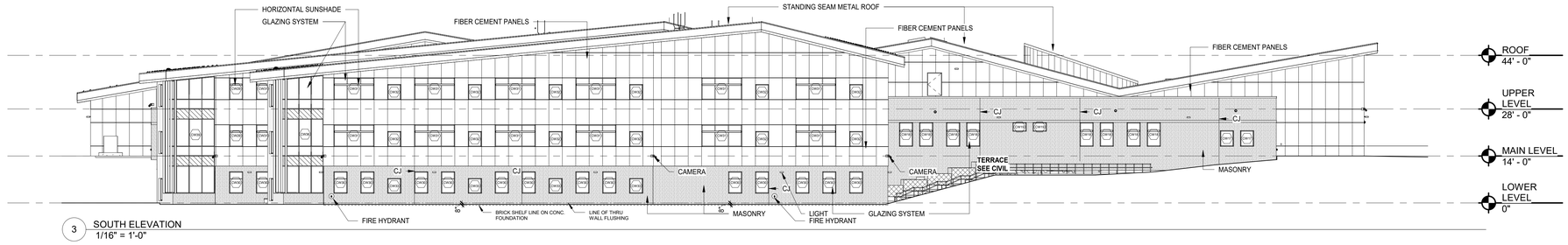


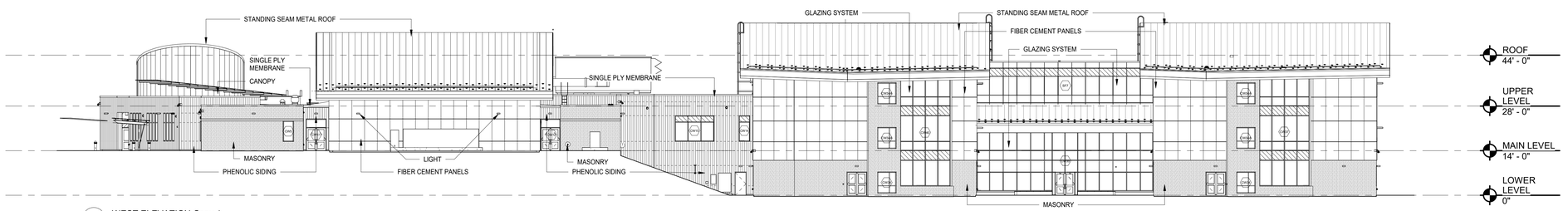
1 NORTH ELEVATION
1/16" = 1'-0"



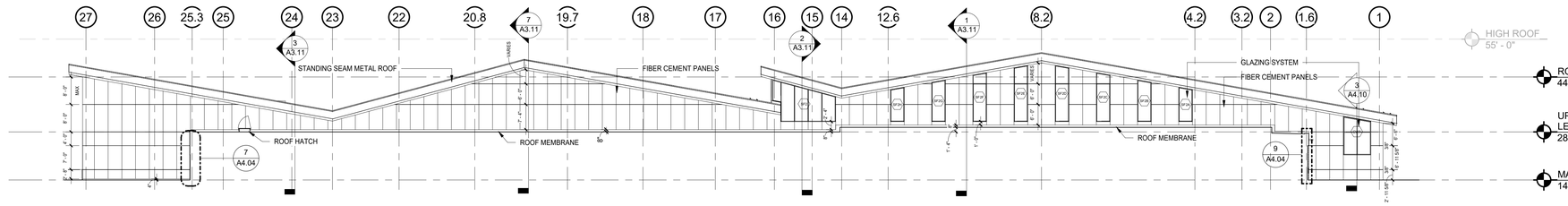
2 EAST ELEVATION
1/16" = 1'-0"



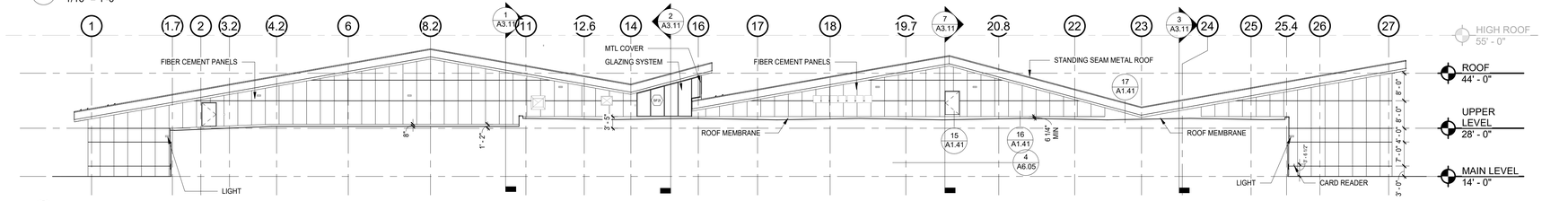
3 SOUTH ELEVATION
1/16" = 1'-0"



4 WEST ELEVATION Copy 1
1/16" = 1'-0"



5 PARTIAL ELEVATION
1/16" = 1'-0"



6 PARTIAL ELEVATION
1/16" = 1'-0"

EXTERIOR ELEVATION NOTE

EXPOSED CONCRETE TO BE STAINED DARK AT PHENOLIC WALL LOCATIONS - TYP

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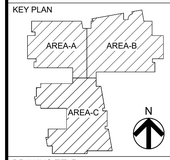
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

EXTERIOR ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
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5	05/19/2026	100% CD

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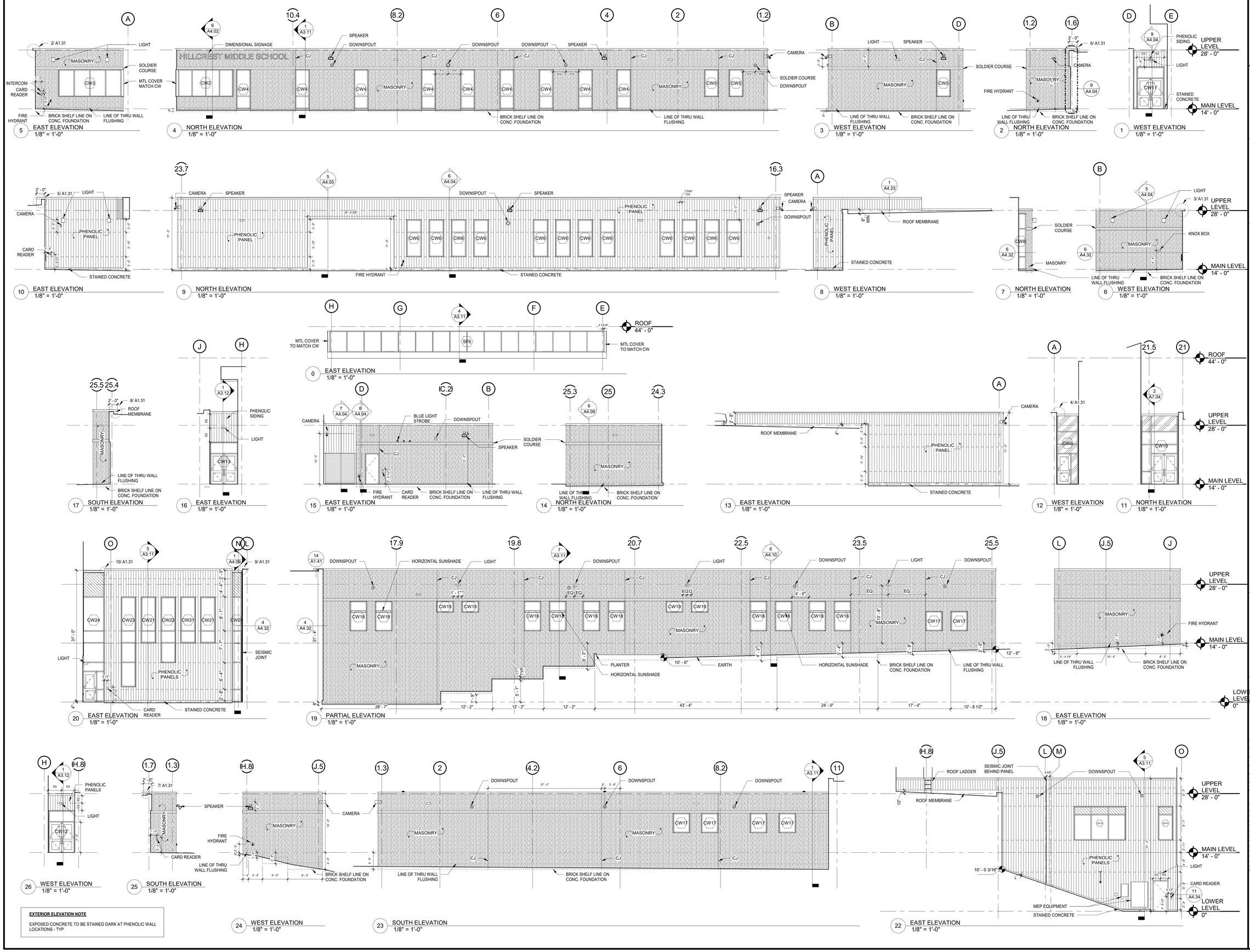

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A3.02

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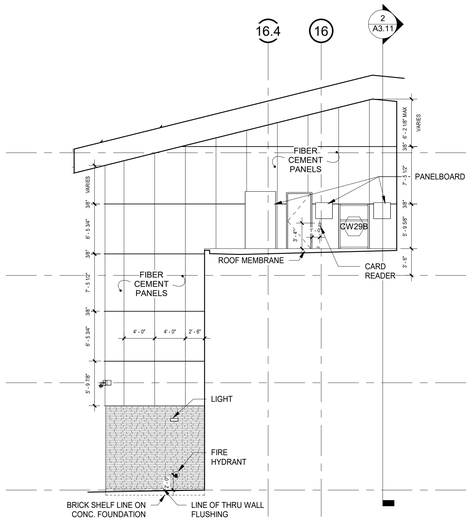
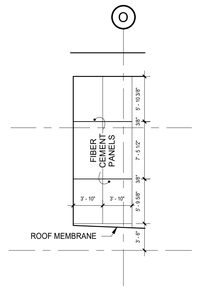
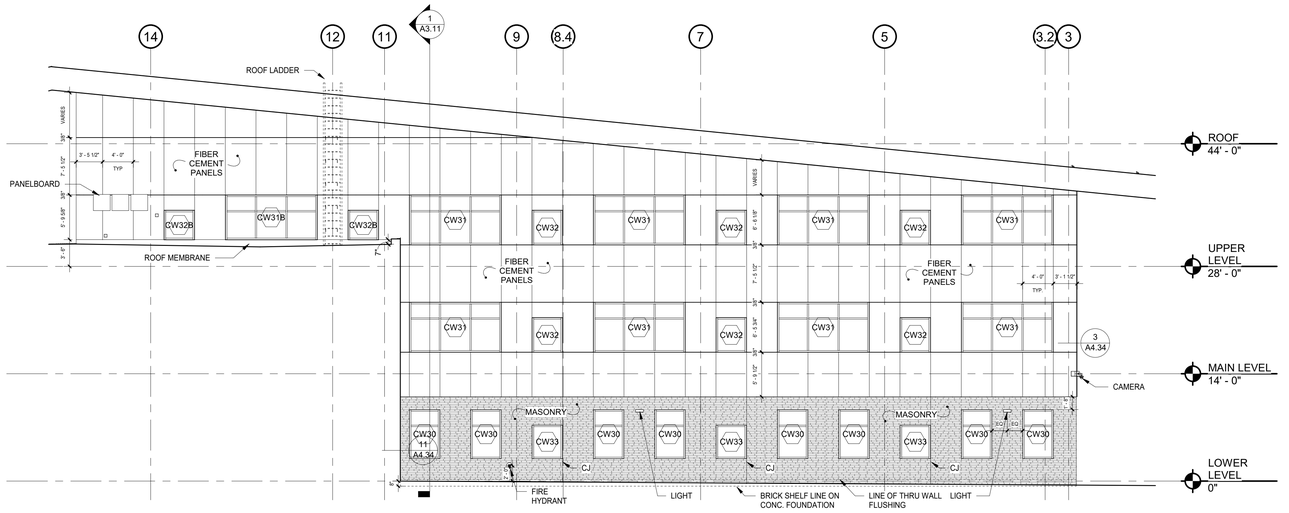


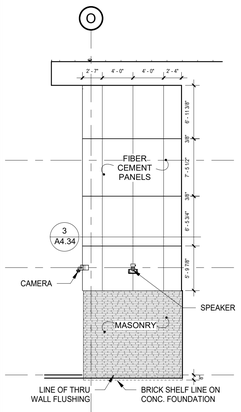
3 NORTH ELEVATION
1/8" = 1'-0"



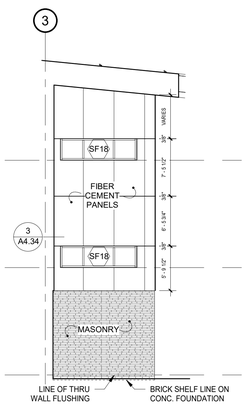
2 EAST ELEVATION
1/8" = 1'-0"



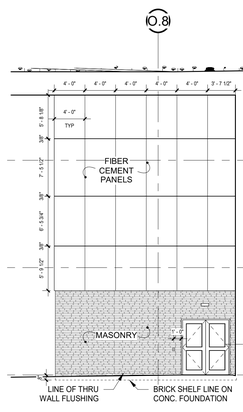
1 NORTH ELEVATION
1/8" = 1'-0"



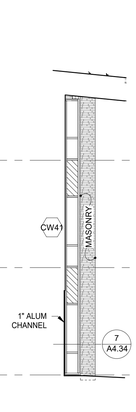
10 WEST ELEVATION
1/8" = 1'-0"



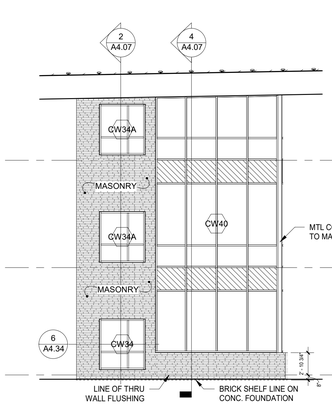
9 NORTH ELEVATION
1/8" = 1'-0"



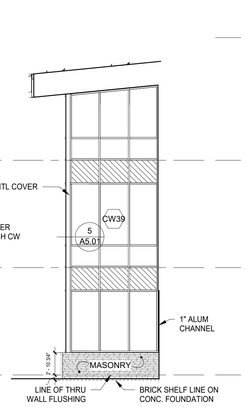
8 WEST ELEVATION
1/8" = 1'-0"



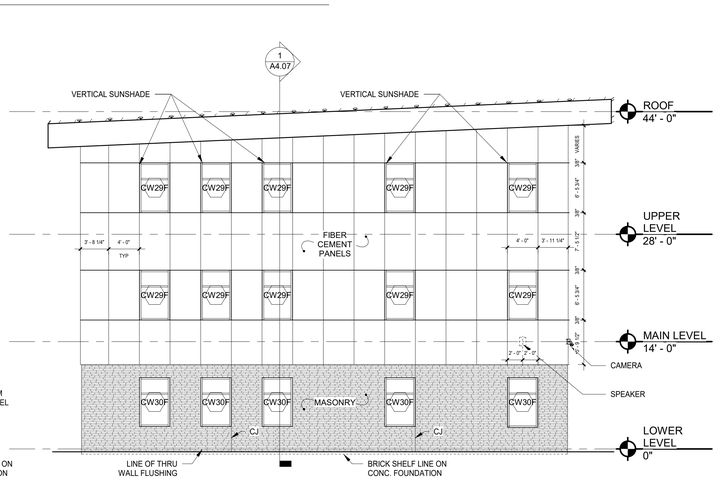
7 NORTH ELEVATION
1/8" = 1'-0"



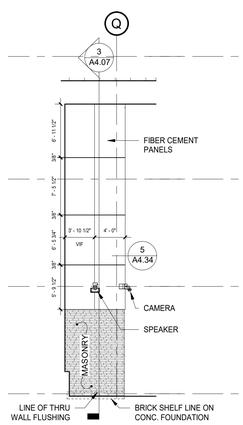
6 WEST ELEVATION
1/8" = 1'-0"



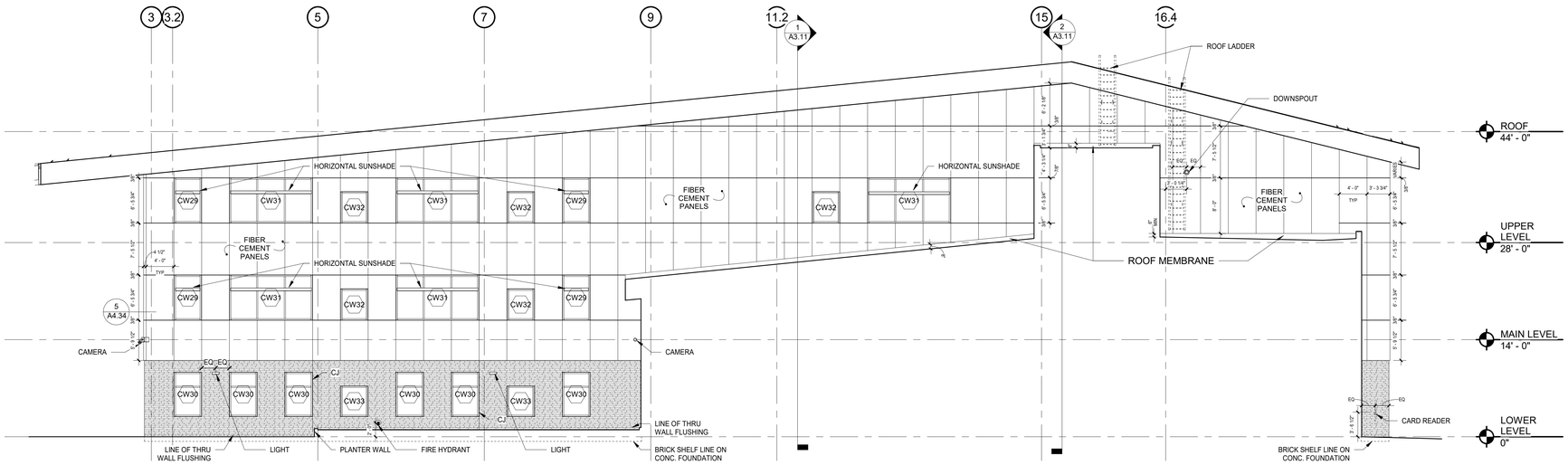
5 SOUTH ELEVATION
1/8" = 1'-0"



4 EAST ELEVATION
1/8" = 1'-0"



12 WEST ELEVATION
1/8" = 1'-0"



11 SOUTH ELEVATION
1/8" = 1'-0"

EXTERIOR ELEVATION NOTE

EXPOSED CONCRETE TO BE STAINED DARK AT PHENOLIC WALL LOCATIONS - TYP

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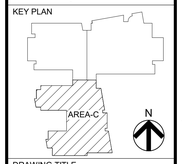
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



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EXTERIOR ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

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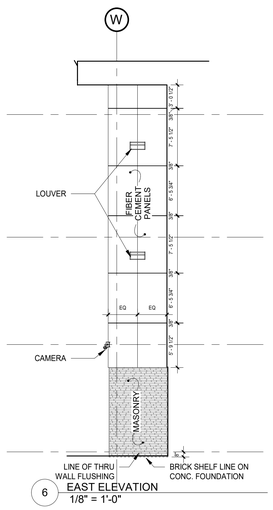
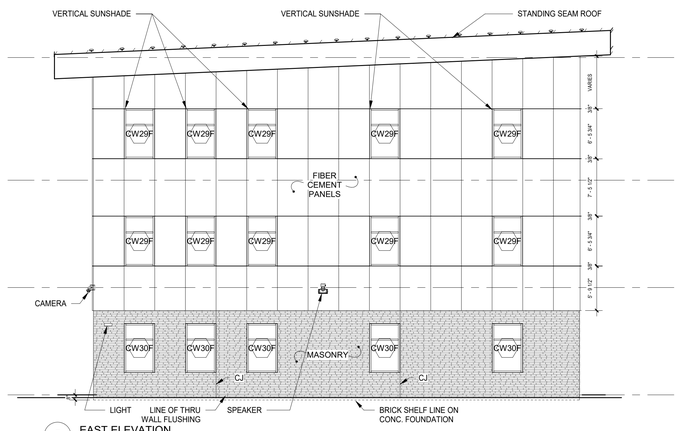
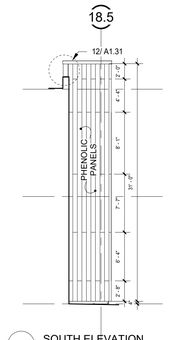


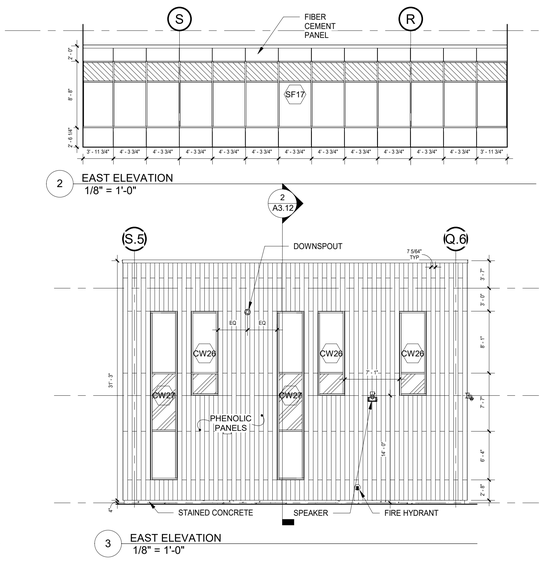
6 EAST ELEVATION
1/8" = 1'-0"



5 EAST ELEVATION
1/8" = 1'-0"

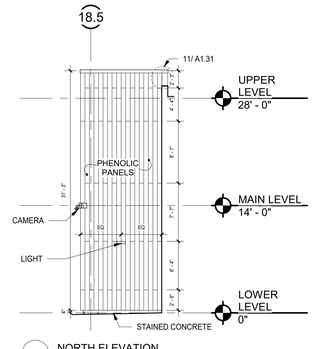


4 SOUTH ELEVATION
1/8" = 1'-0"

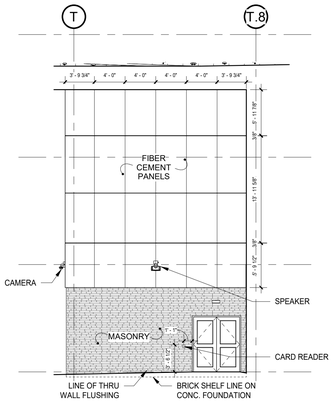


2 EAST ELEVATION
1/8" = 1'-0"

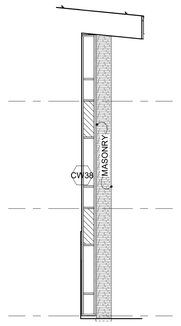
3 EAST ELEVATION
1/8" = 1'-0"



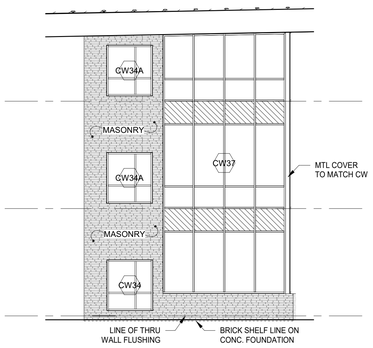
1 NORTH ELEVATION
1/8" = 1'-0"



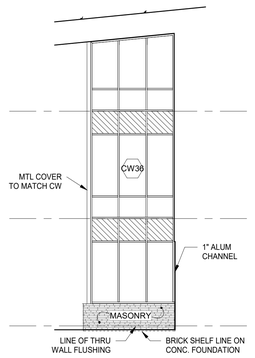
11 WEST ELEVATION
1/8" = 1'-0"



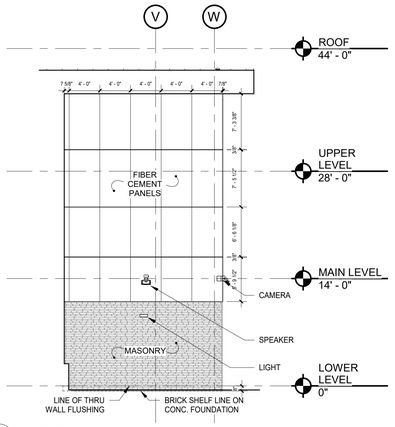
10 NORTH ELEVATION
1/8" = 1'-0"



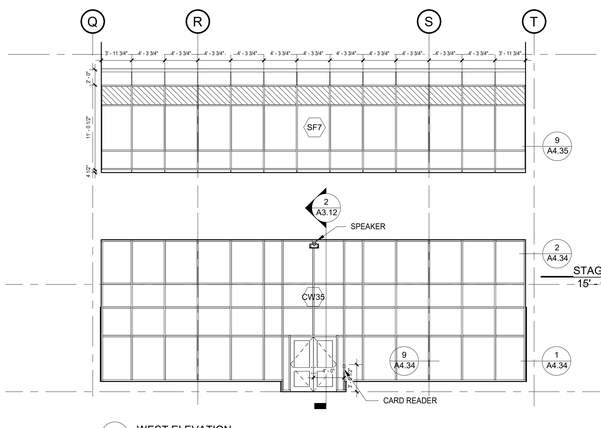
9 WEST ELEVATION
1/8" = 1'-0"



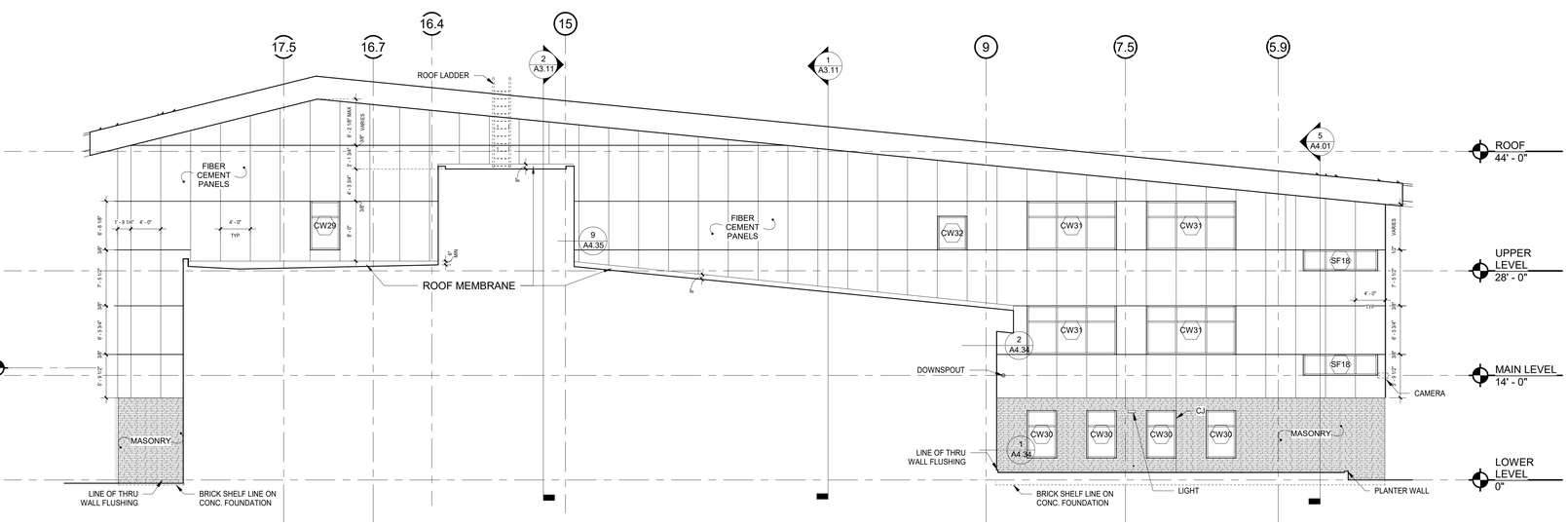
8 WEST ELEVATION
1/8" = 1'-0"



7 WEST ELEVATION
1/8" = 1'-0"



13 WEST ELEVATION
1/8" = 1'-0"



12 NORTH ELEVATION
1/8" = 1'-0"

EXTERIOR ELEVATION NOTE

EXPOSED CONCRETE TO BE STAINED DARK AT PHENOLIC WALL LOCATIONS - TYP

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

EXTERIOR ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
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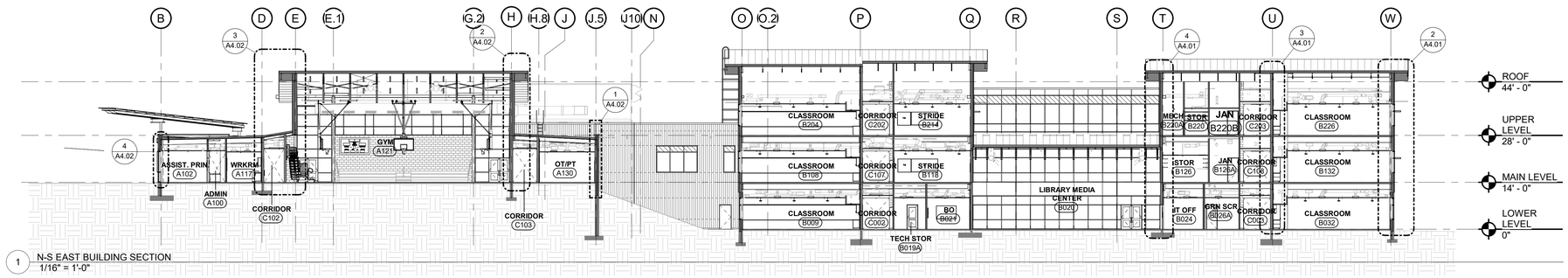
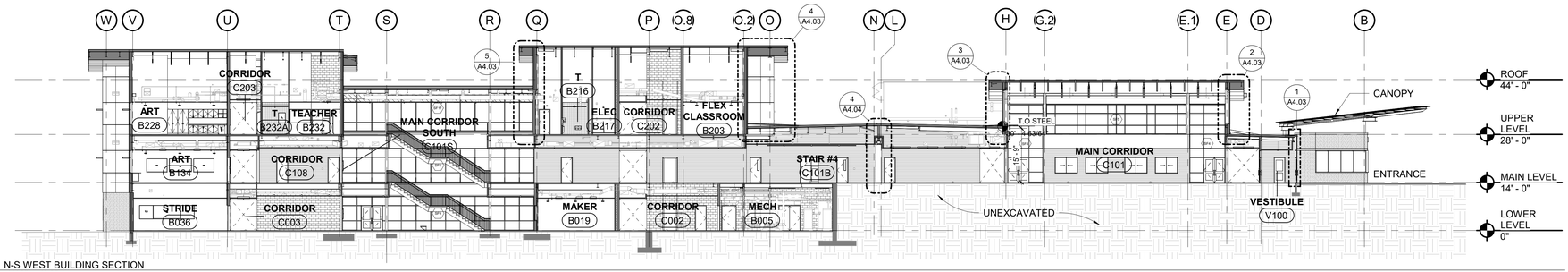


1 N-S EAST BUILDING SECTION
1/16" = 1'-0"



2 N-S WEST BUILDING SECTION
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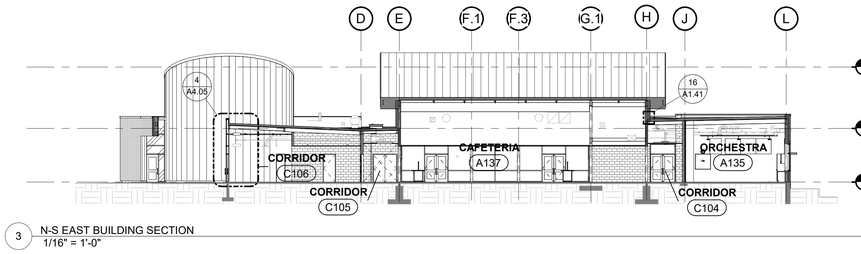
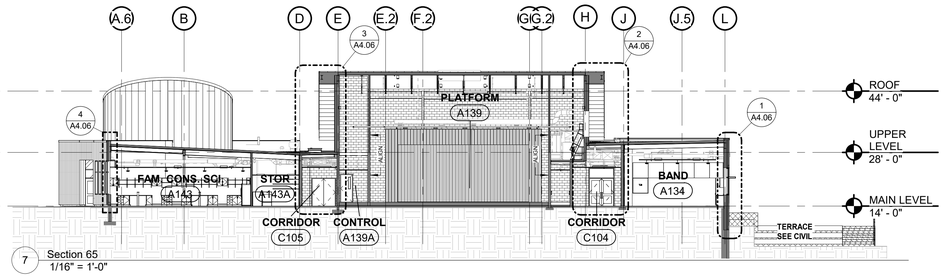
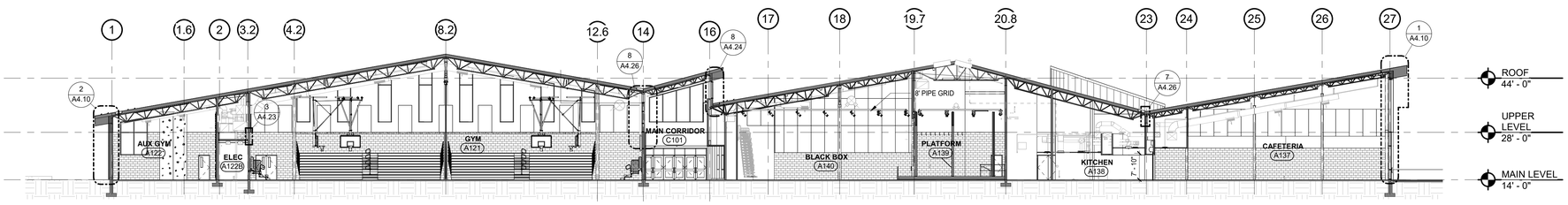


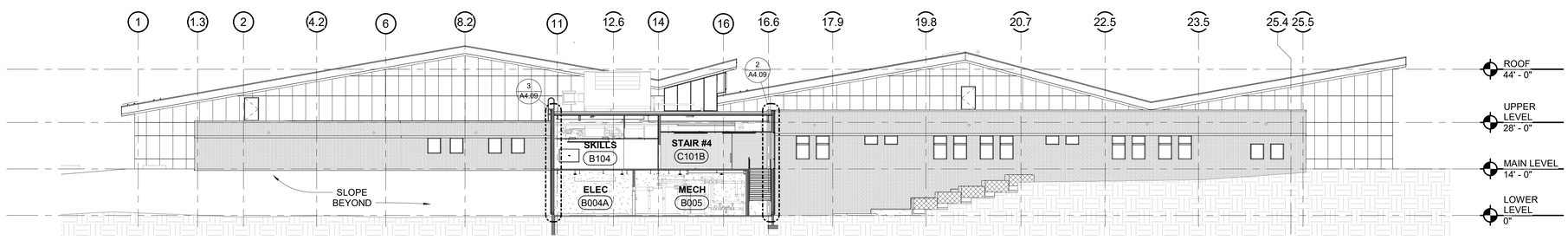
3 N-S EAST BUILDING SECTION
1/16" = 1'-0"



7 Section 65
1/16" = 1'-0"



4 E-W NORTH BUILDING SECTION
1/16" = 1'-0"



5 E-W NORTH BUILDING SECTION
1/16" = 1'-0"

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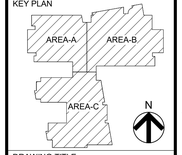

DRAWING TITLE

BUILDING SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
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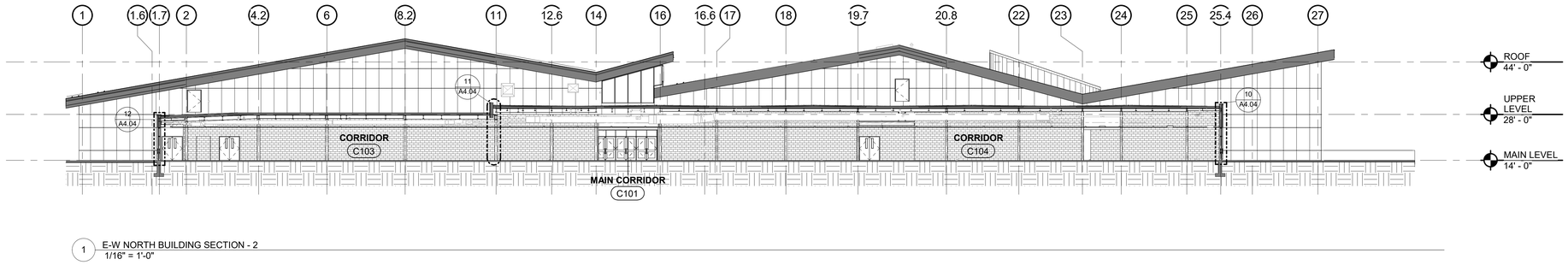
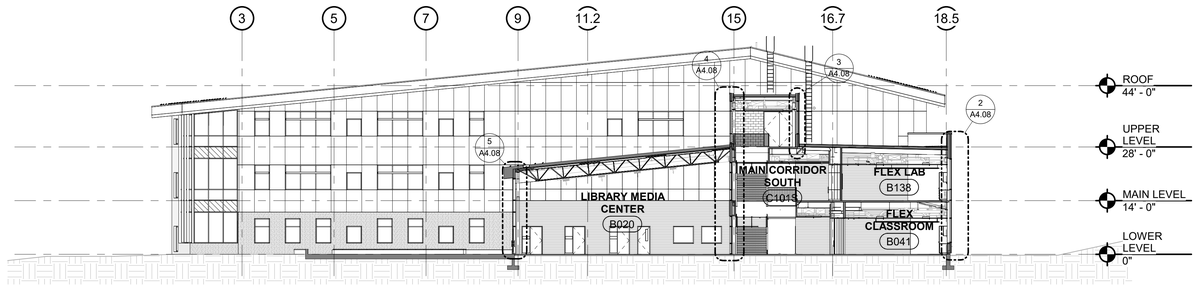


1 E-W NORTH BUILDING SECTION - 2
1/16" = 1'-0"



2 E-W NORTH BUILDING SECTION
1/16" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

BUILDING SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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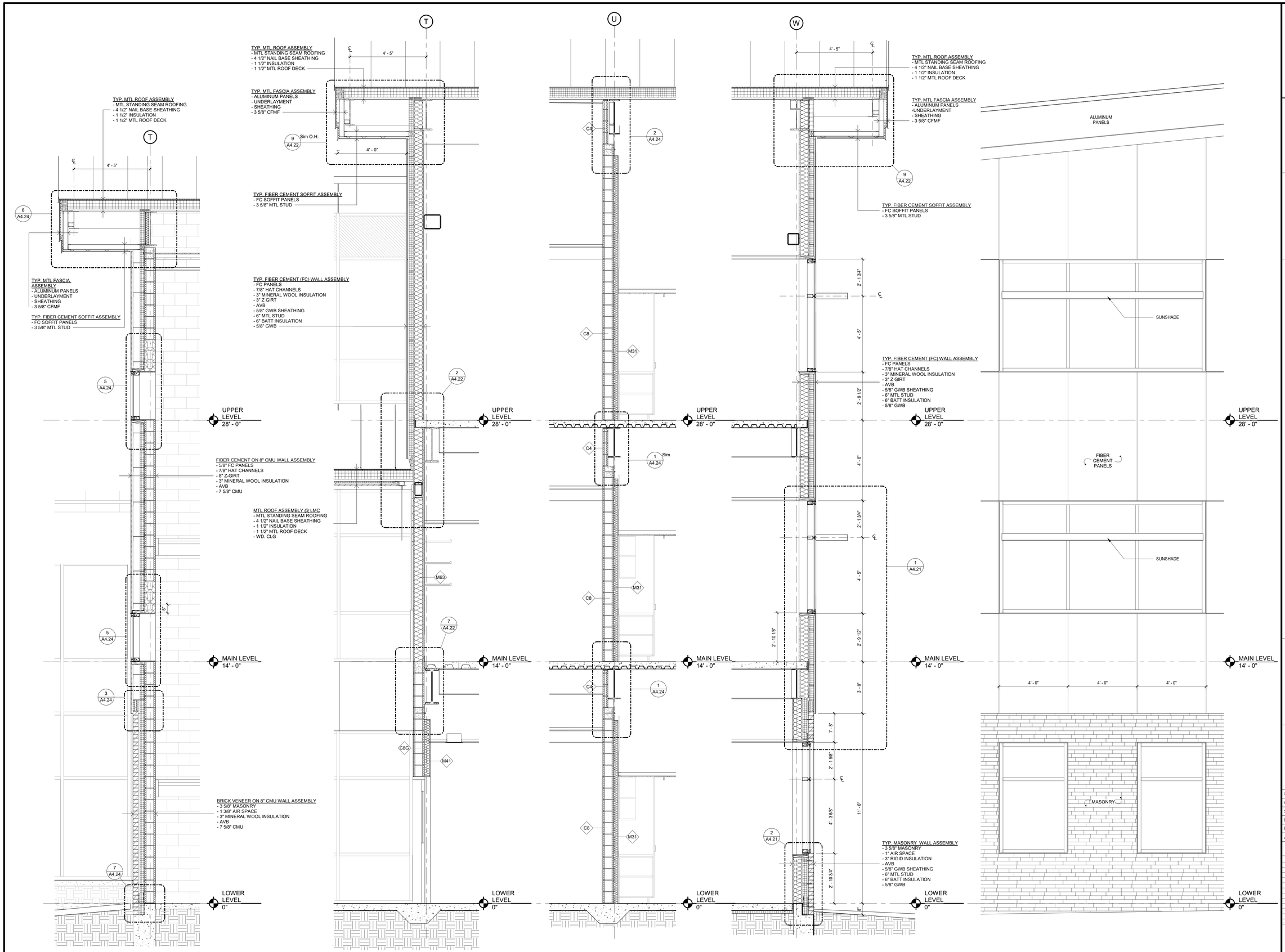

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TRUMBULL HILLCREST MIDDLE SCHOOL

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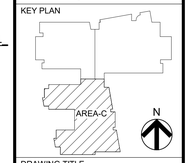
KEY PLAN



DRAWING TITLE

WALL SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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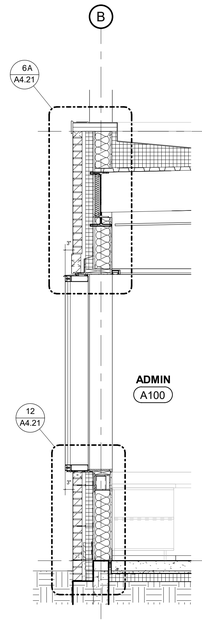
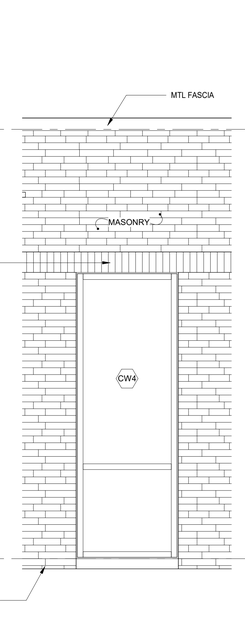
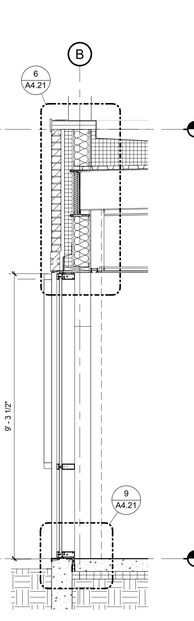


6 WALL SECTION
1/2" = 1'-0"



5 PARTIAL ELEVATION
1/2" = 1'-0"



4 WALL SECTION
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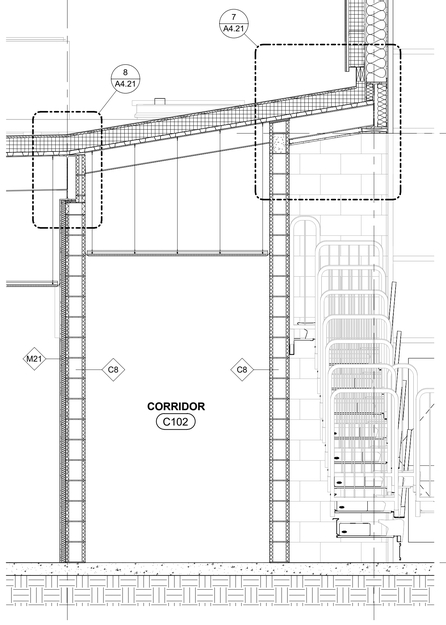

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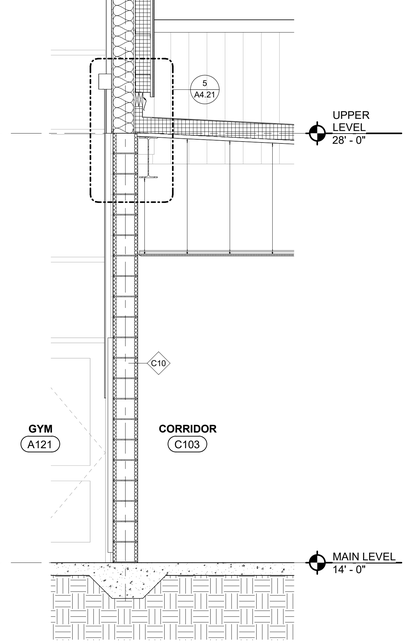
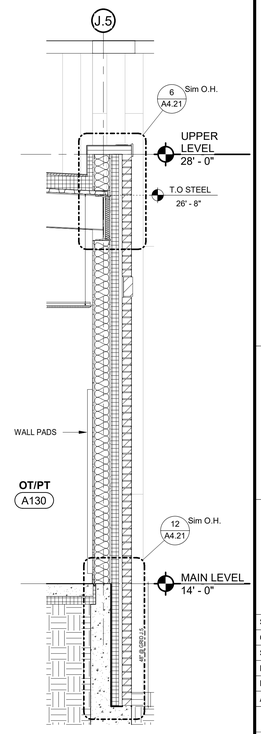
1/2" = 1'-0"



2 WALL SECTION
1/2" = 1'-0"



1 WALL SECTION
1/2" = 1'-0"

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KEY PLAN



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WALL SECTIONS

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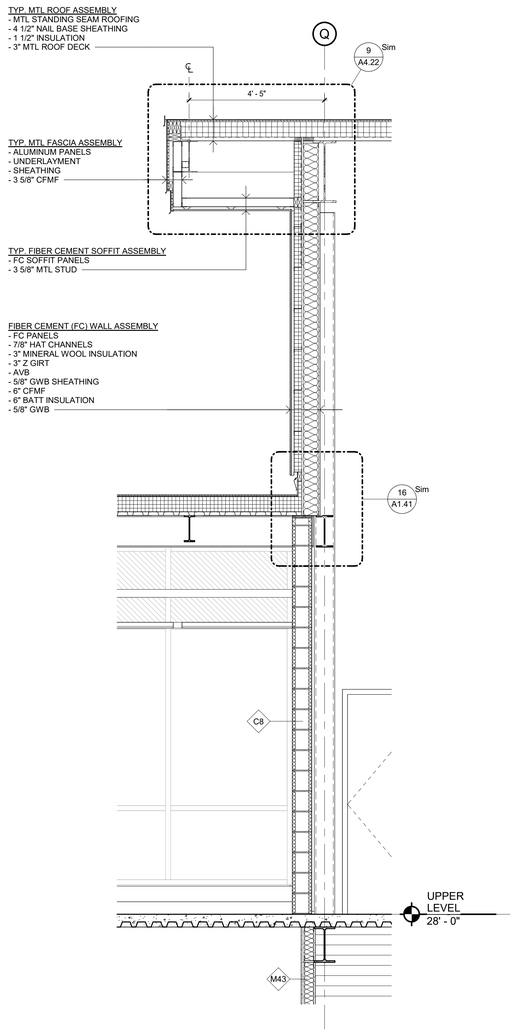

5 WALL SECTION
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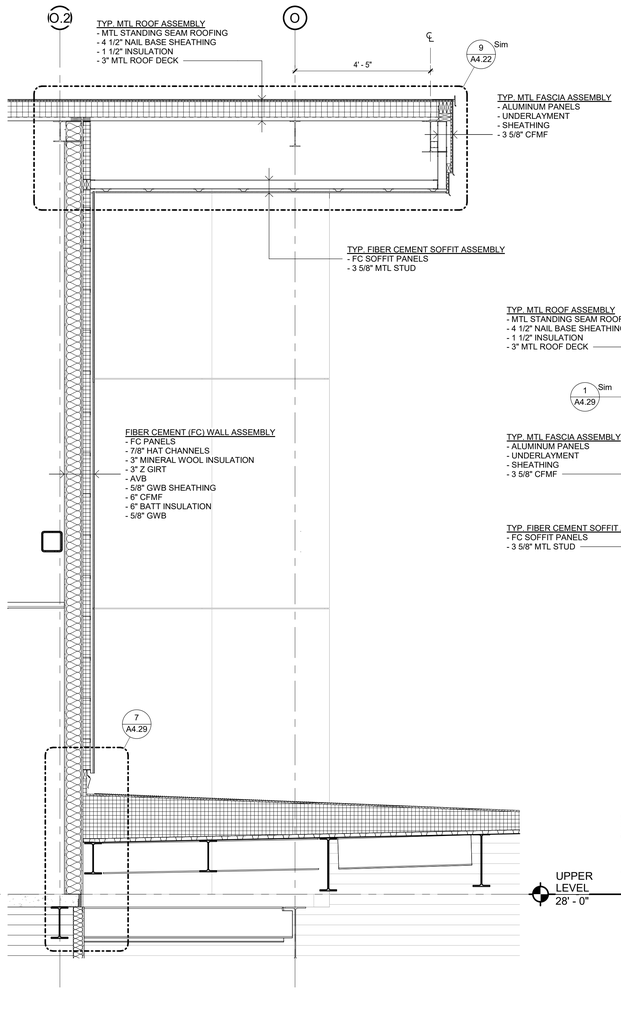

4 WALL SECTION
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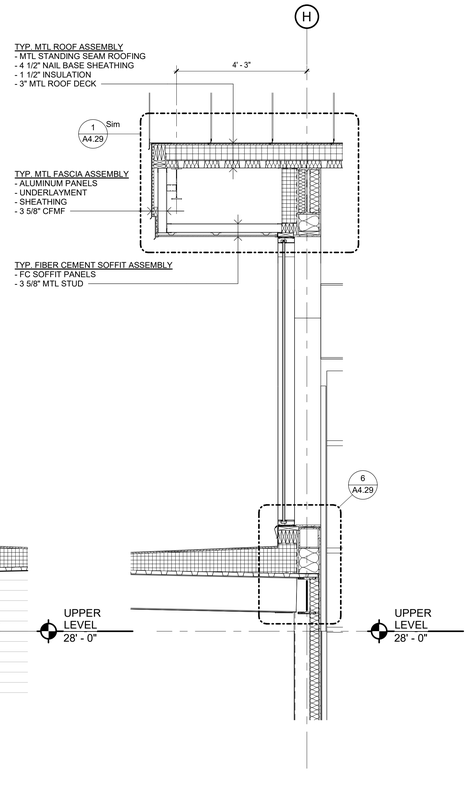

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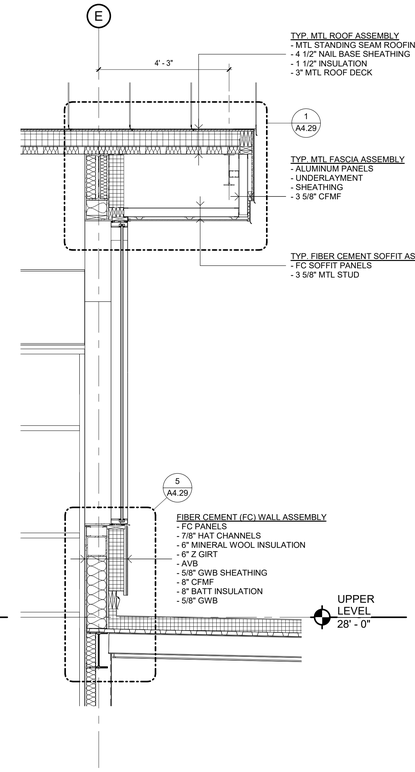
1/2" = 1'-0"



2 WALL SECTION
1/2" = 1'-0"



1 WALL SECTION
1/2" = 1'-0"

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Project Status

KEY PLAN



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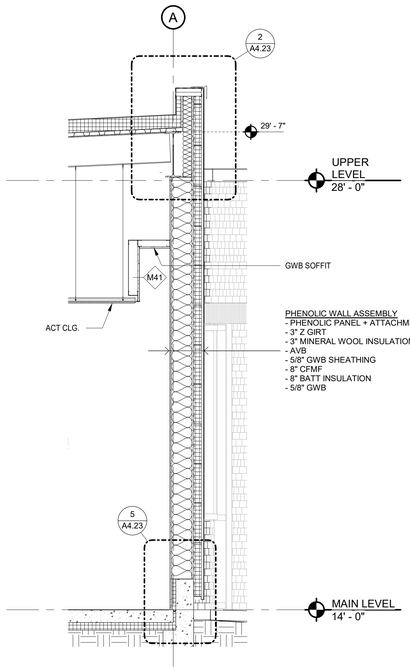

6 WALL SECTION
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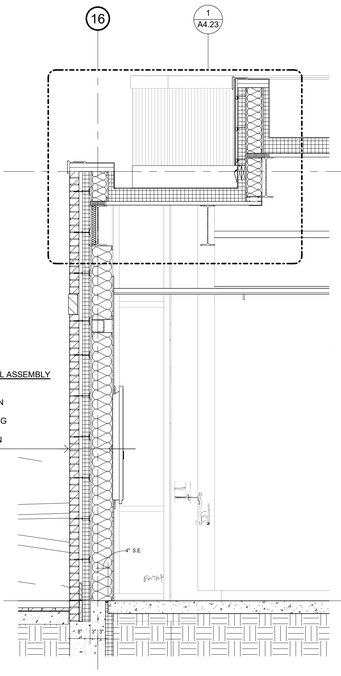
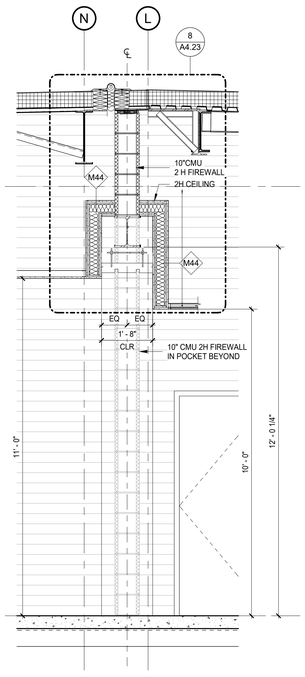
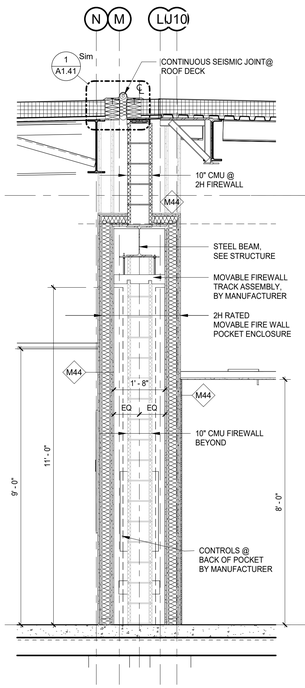


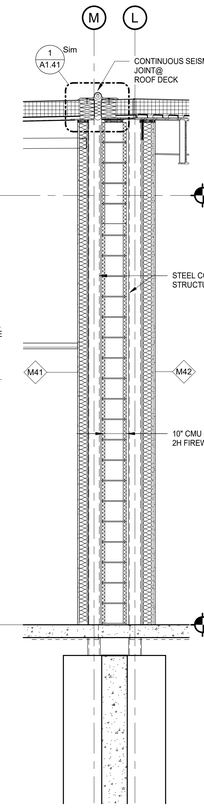
5 WALL SECTION
1/2" = 1'-0"



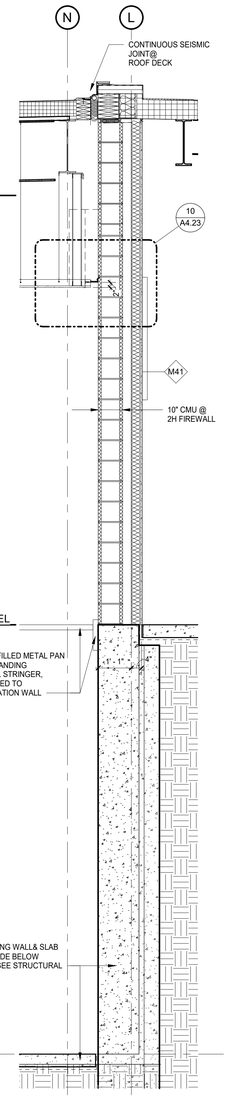
4 WALL SECTION
1/2" = 1'-0"



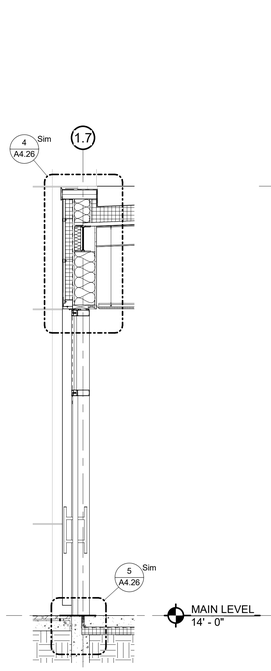
3 WALL SECTION MFW POCKET
1/2" = 1'-0"



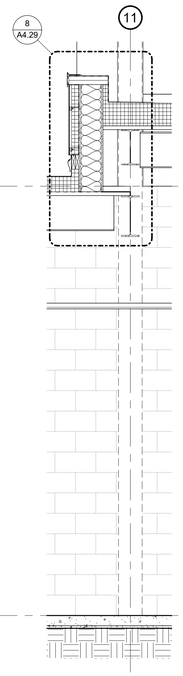
2 WALL SECTION FIREWALL
1/2" = 1'-0"



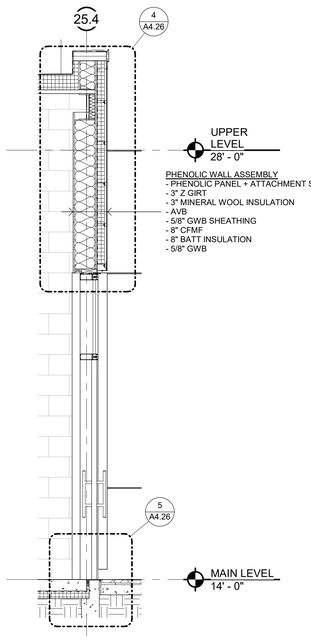
1 WALL SECTION FIREWALL
1/2" = 1'-0"



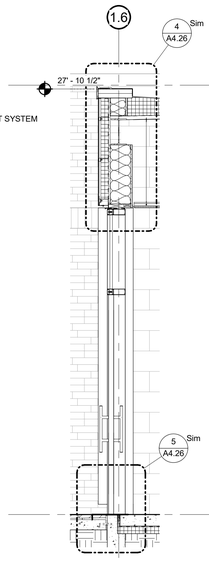
12 WALL SECTION
1/2" = 1'-0"



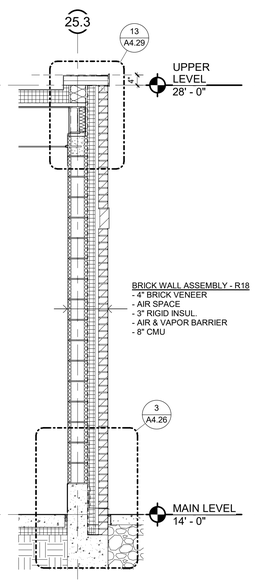
11 WALL SECTION
1/2" = 1'-0"



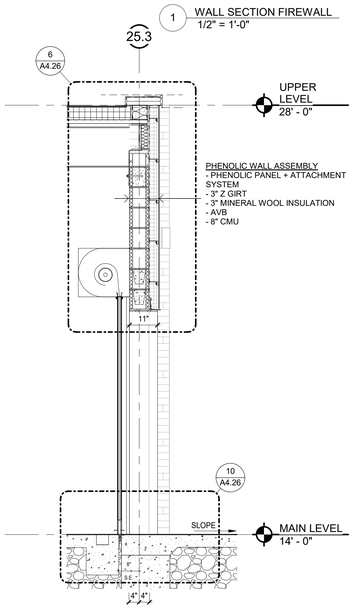
10 WALL SECTION
1/2" = 1'-0"



9 WALL SECTION @ CORRIDOR C102
1/2" = 1'-0"



8 WALL SECTION AT LOADING
1/2" = 1'-0"



7 WALL SECTION THROUGH COILING DOOR
1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

WALL SECTIONS

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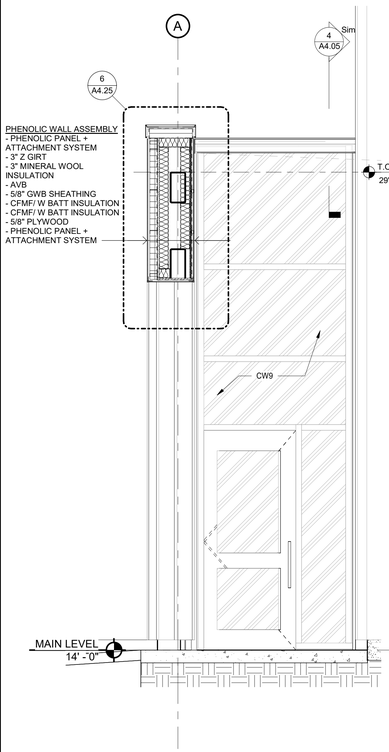

5 WALL SECTION
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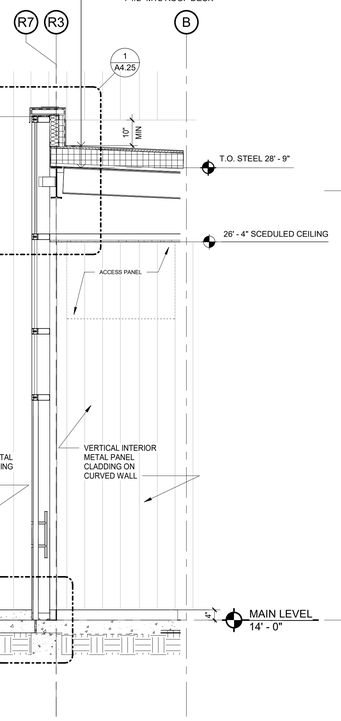
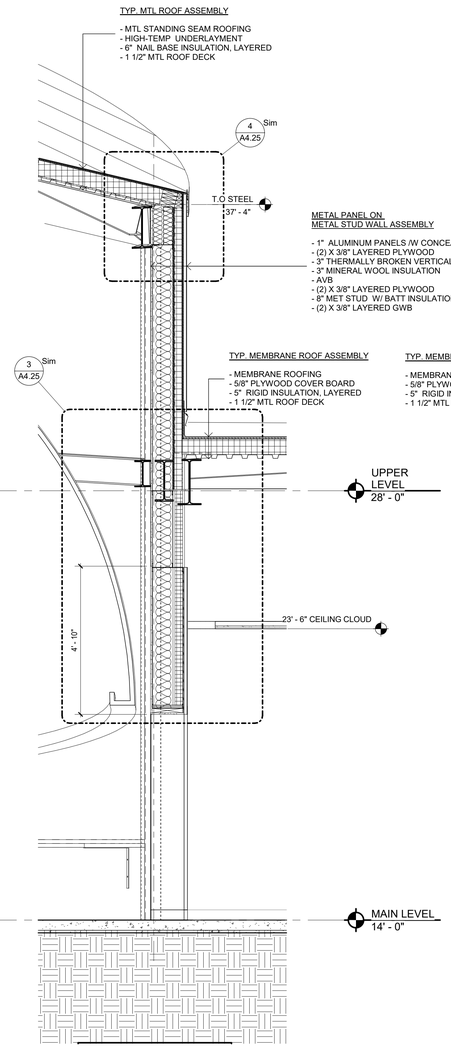


4 WALL SECTION PLANETARIUM
1/2" = 1'-0"



3 WALL SECTION PLANETARIUM
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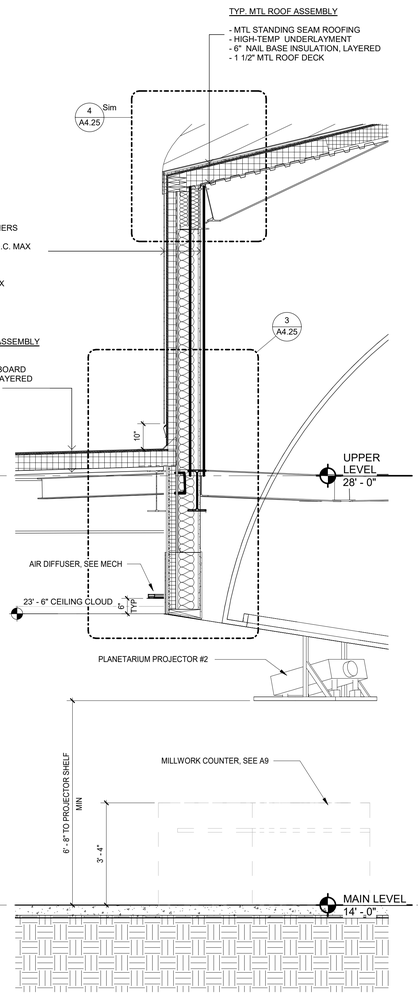
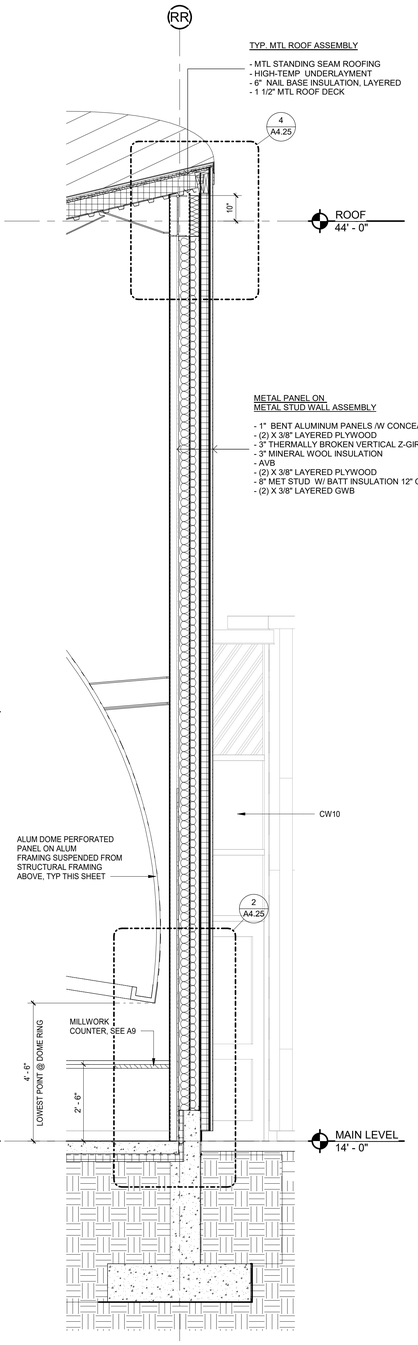


2 WALL SECTION PLAENTARIUM
1/2" = 1'-0"



1 WALL SECTION PLANETARIUM
1/2" = 1'-0"

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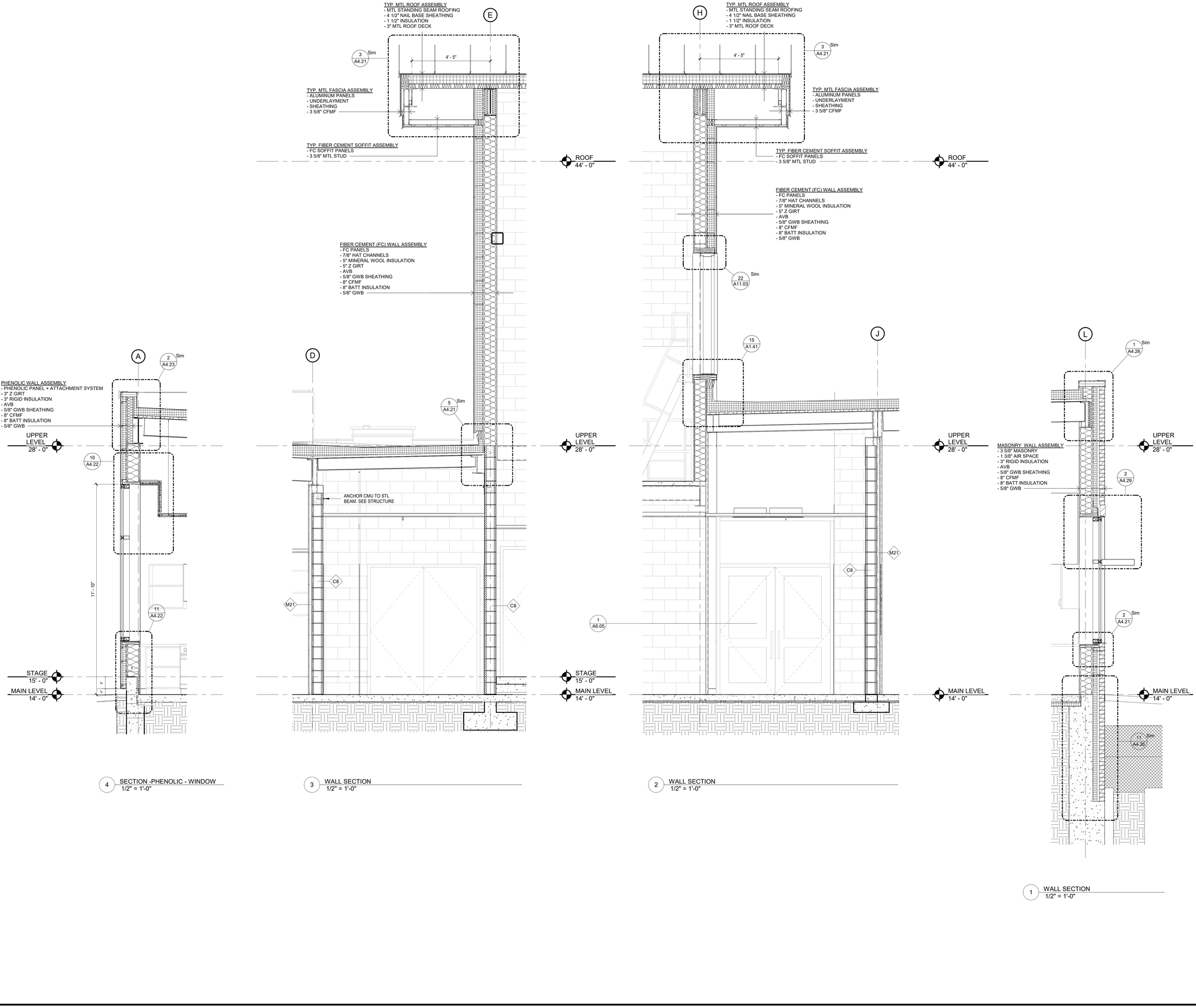

4 SECTION -PHENOLIC - WINDOW
1/2" = 1'-0"

3 WALL SECTION
1/2" = 1'-0"

2 WALL SECTION
1/2" = 1'-0"

1 WALL SECTION
1/2" = 1'-0"

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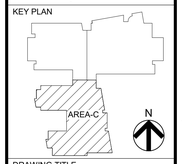

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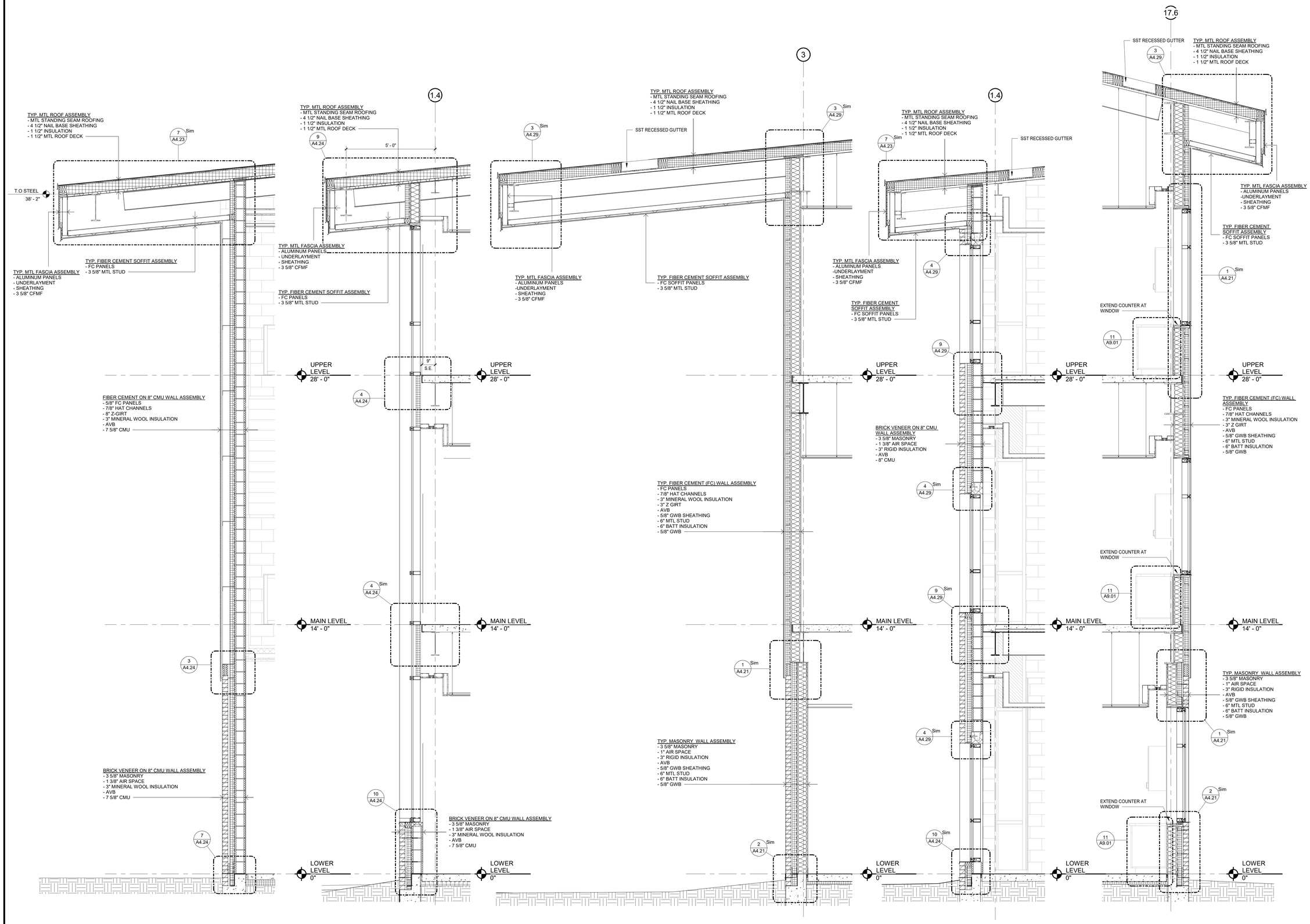

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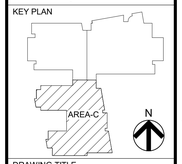

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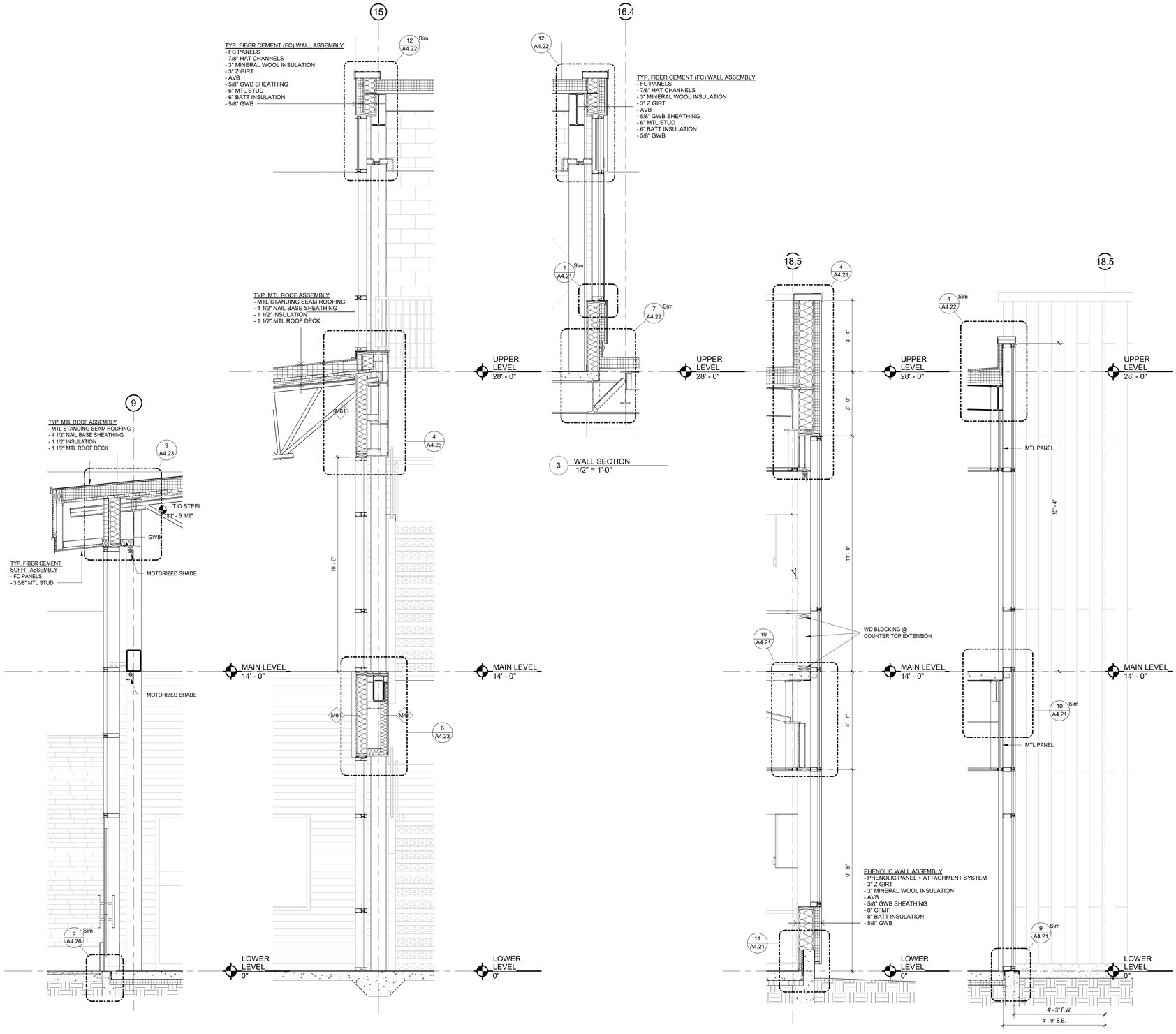

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

WALL SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A4.08

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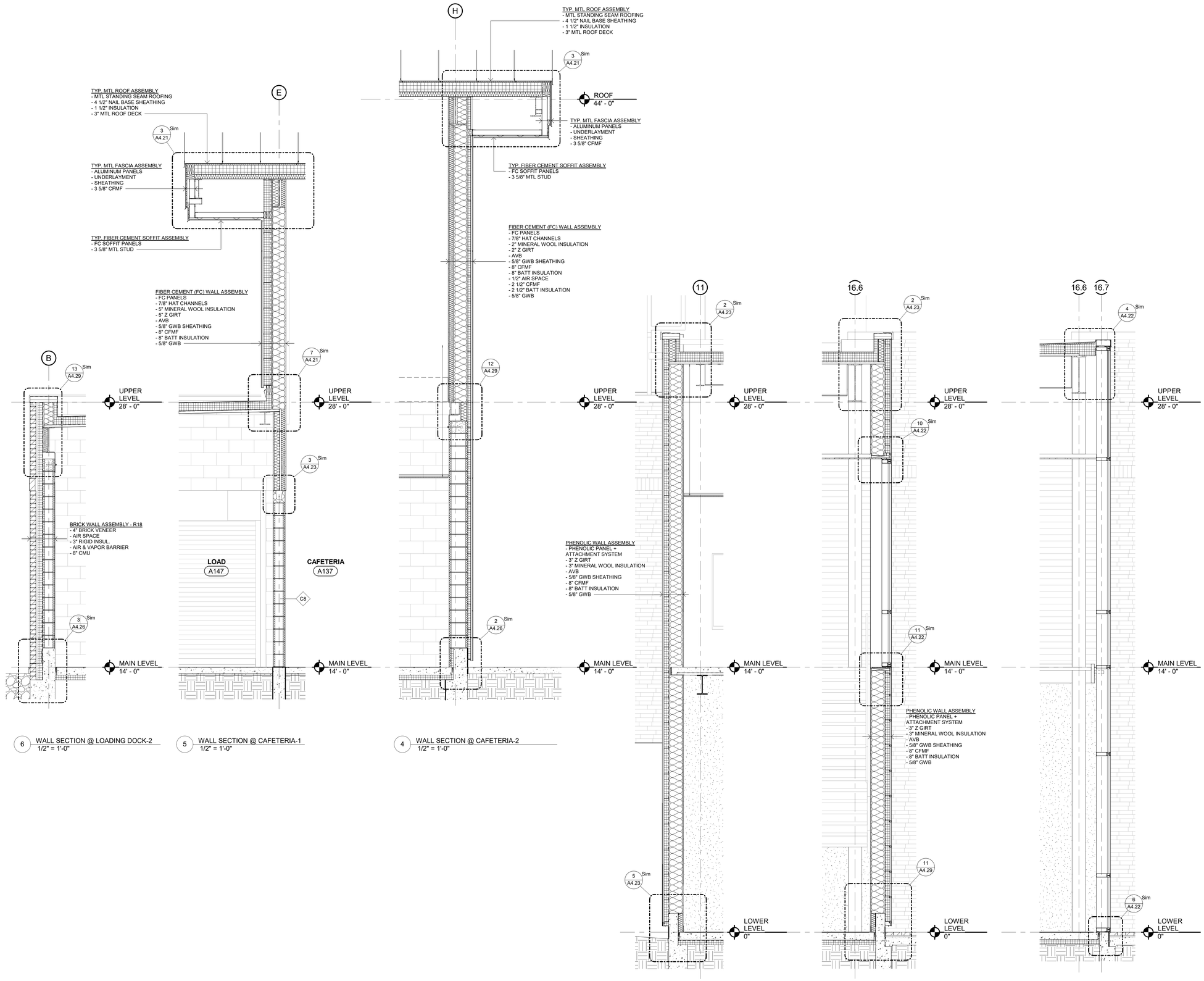

6 WALL SECTION @ LOADING DOCK-2
1/2" = 1'-0"

5 WALL SECTION @ CAFETERIA-1
1/2" = 1'-0"

4 WALL SECTION @ CAFETERIA-2
1/2" = 1'-0"

3 WALL SECTION
1/2" = 1'-0"

2 WALL SECTION
1/2" = 1'-0"

1 WALL SECTION AT LANDING, STAIR #4
1/2" = 1'-0"

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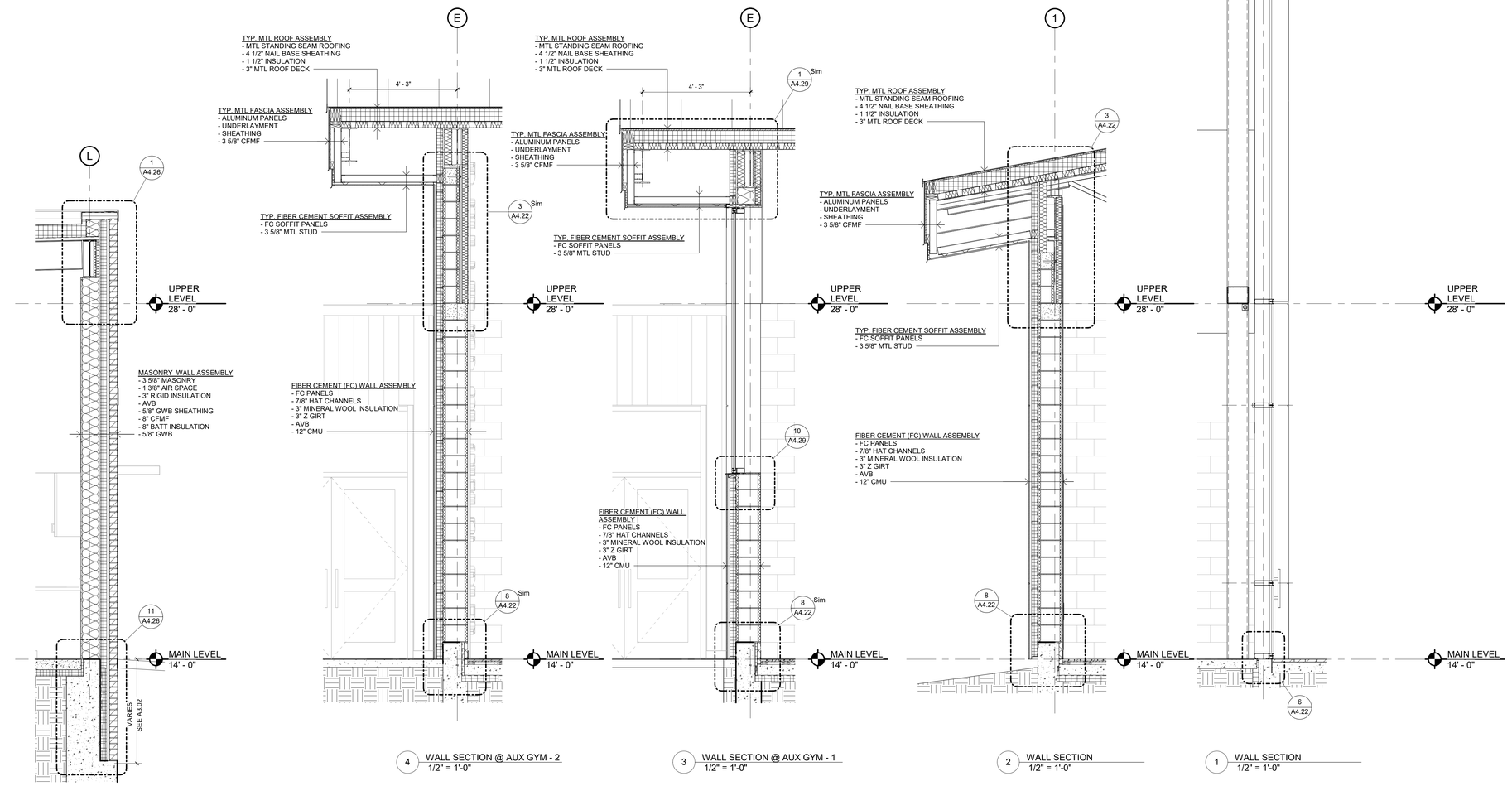

5 WALL SECTION AT ORCHESTRA A135
1/2" = 1'-0"

4 WALL SECTION @ AUX GYM - 2
1/2" = 1'-0"

3 WALL SECTION @ AUX GYM - 1
1/2" = 1'-0"

2 WALL SECTION
1/2" = 1'-0"

1 WALL SECTION
1/2" = 1'-0"

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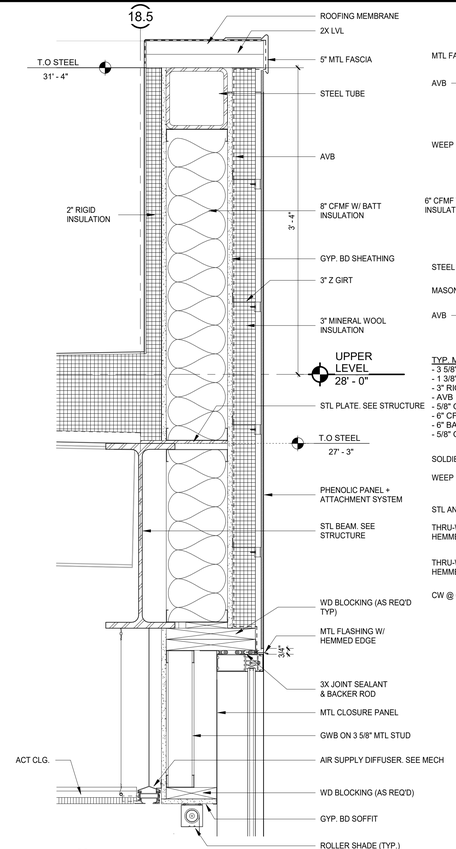
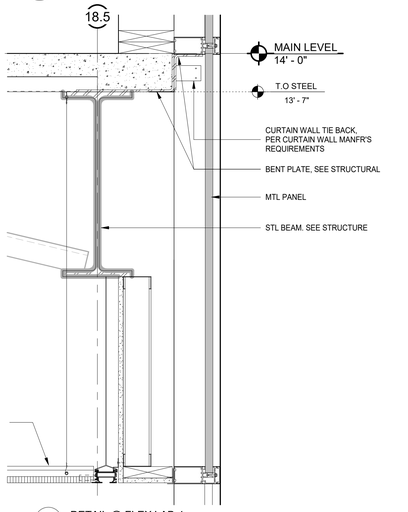
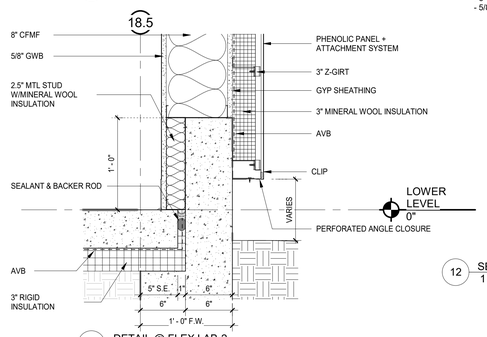


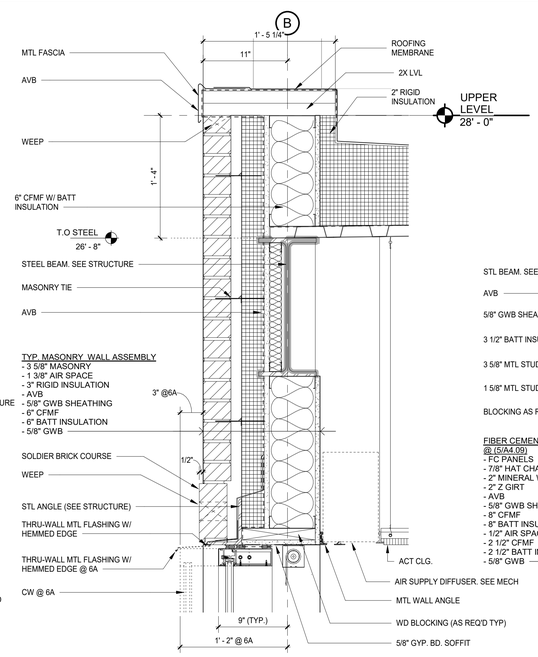
4 PARAPET DETAIL @ FLEX LAB
1 1/2" = 1'-0"



10 DETAIL @ FLEX LAB-1
1 1/2" = 1'-0"

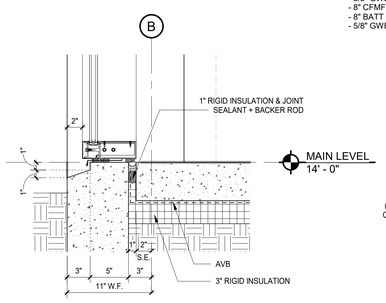


11 DETAIL @ FLEX LAB-2
1 1/2" = 1'-0"

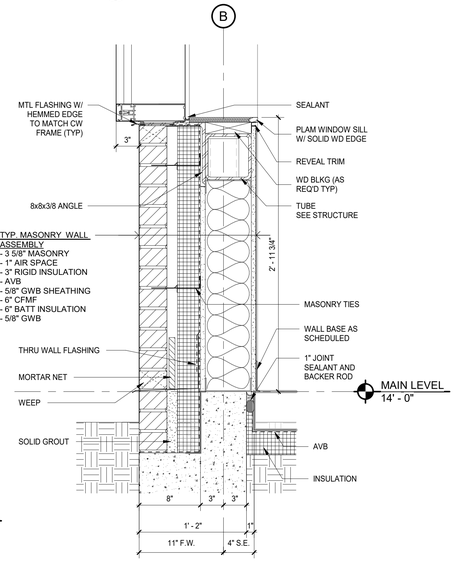


6 PARAPET DETAIL TYP.
1 1/2" = 1'-0"

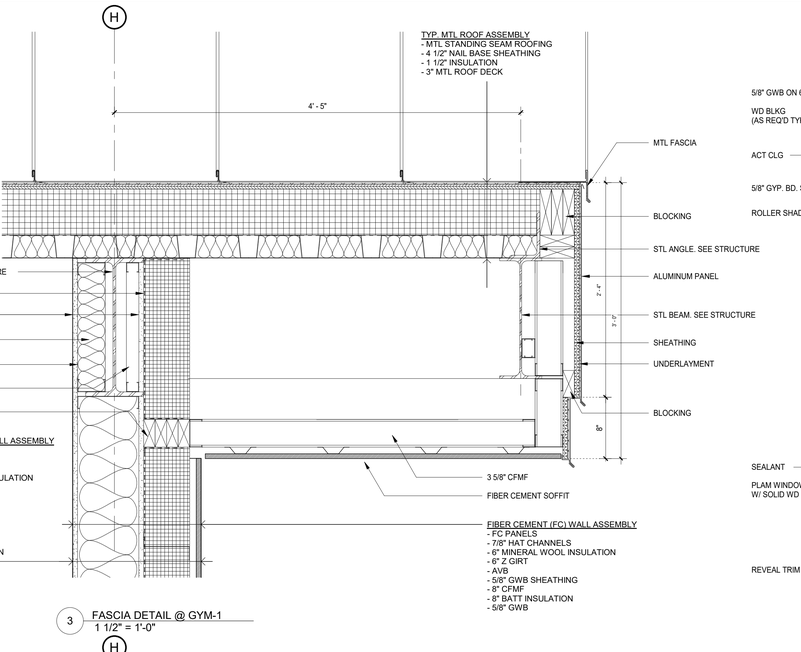
6A PARAPET DETAIL @ ADMIN 100



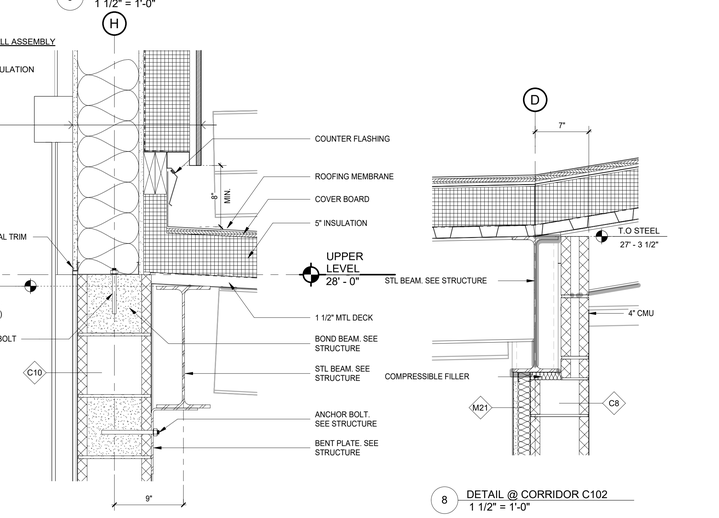
9 DETAIL @MASONRY WALL TYP.
1 1/2" = 1'-0"



12 SECTION DETAIL - SILL
1 1/2" = 1'-0"

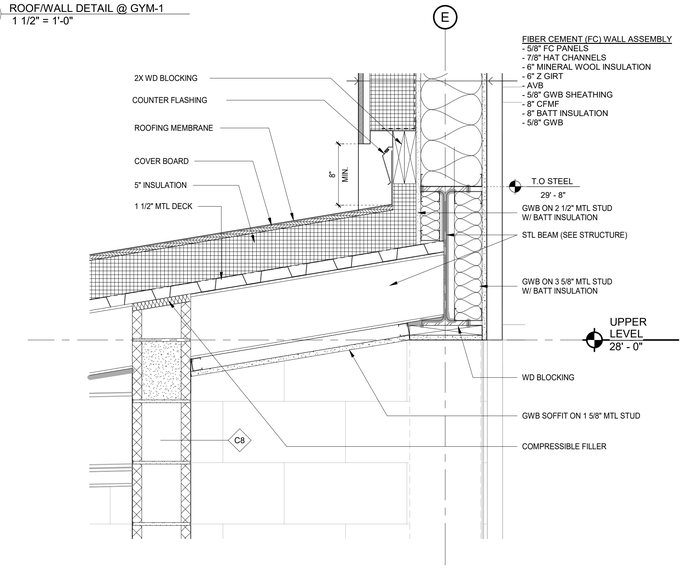


3 FASCIA DETAIL @ GYM-1
1 1/2" = 1'-0"

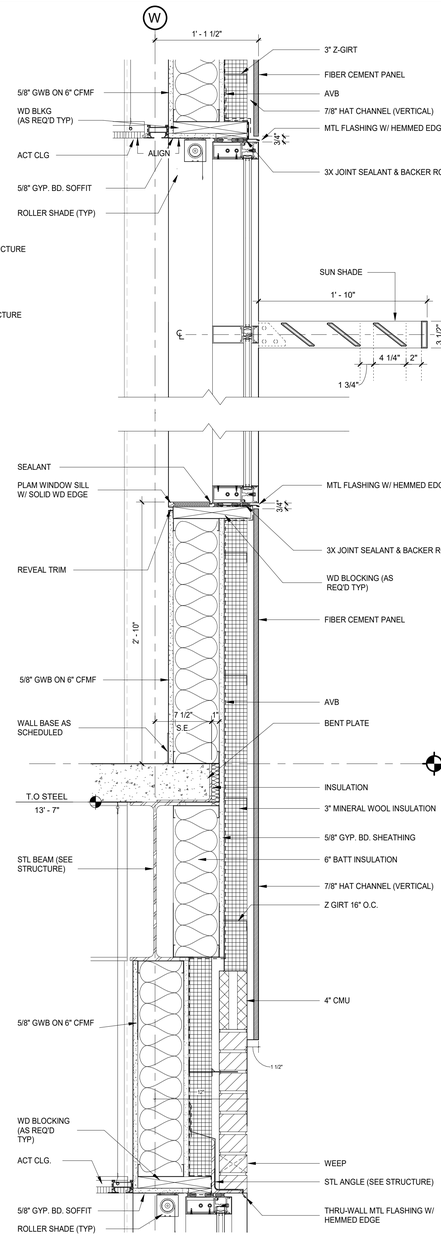


5 ROOF/WALL DETAIL @ GYM-1
1 1/2" = 1'-0"

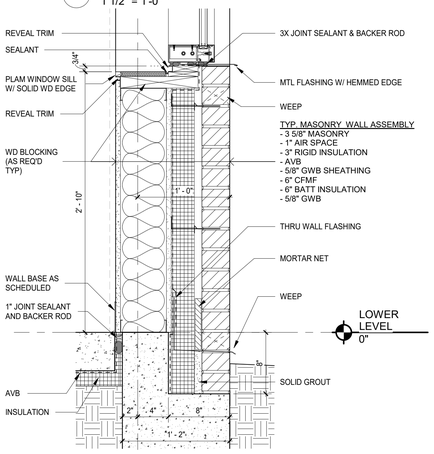
8 DETAIL @ CORRIDOR C102
1 1/2" = 1'-0"



7 DETAIL @ GYM WALL
1 1/2" = 1'-0"



1 SECTION DETAIL - FIBER CEMENT (TYP)
1 1/2" = 1'-0"



2 SECTION DETAIL - SILL (TYP.)
1 1/2" = 1'-0"

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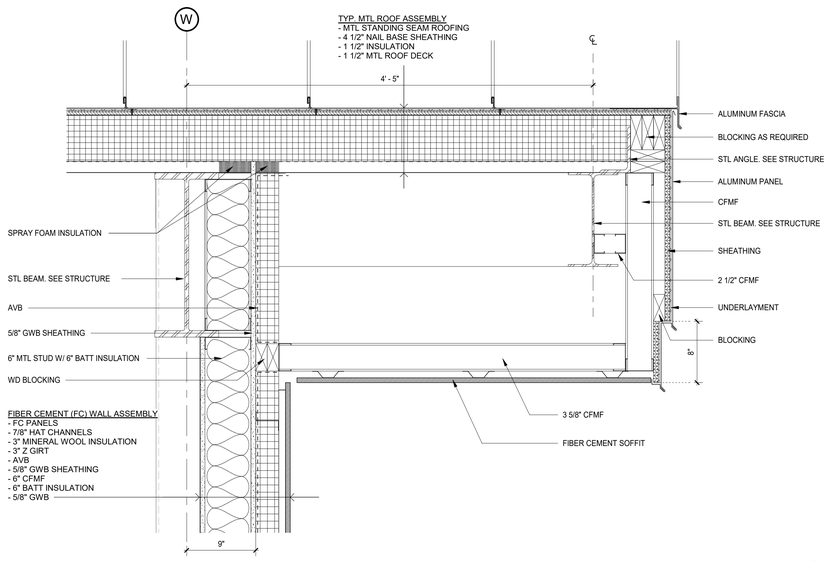
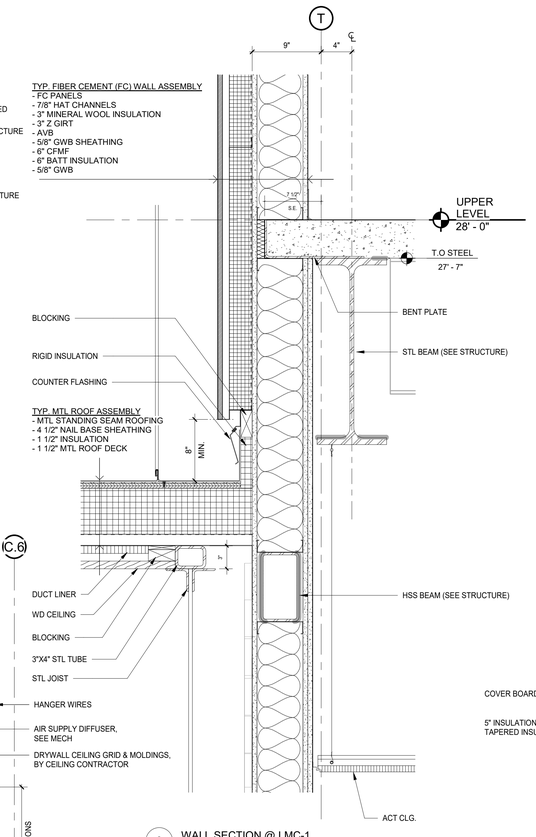
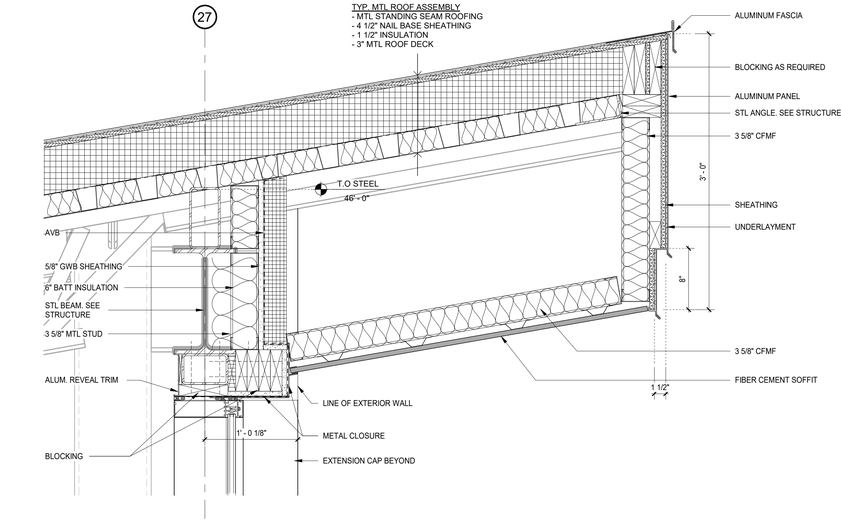


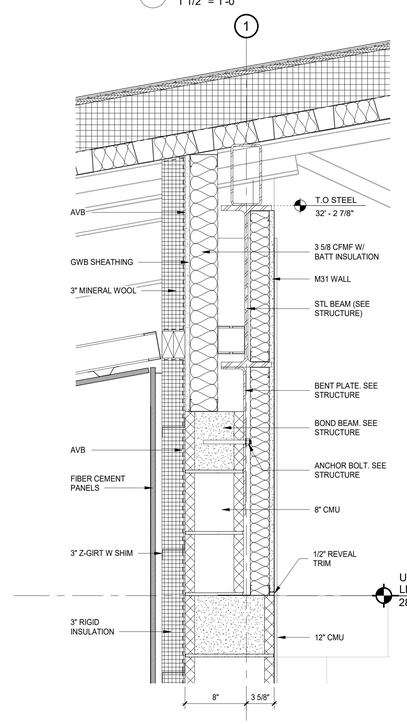
9 FASCIA DETAIL (TYP.)
1 1/2" = 1'-0"



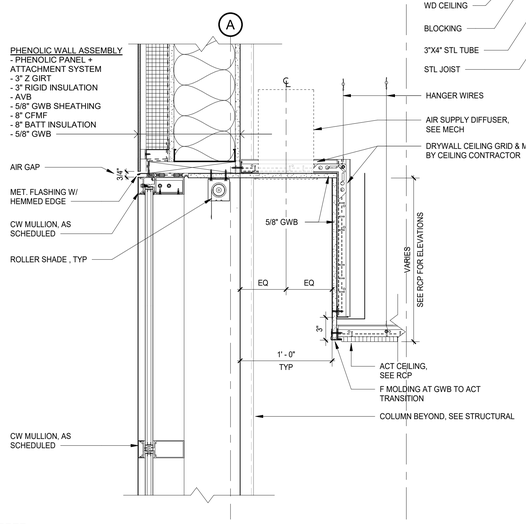
2 WALL SECTION @ LMC-1
1 1/2" = 1'-0"



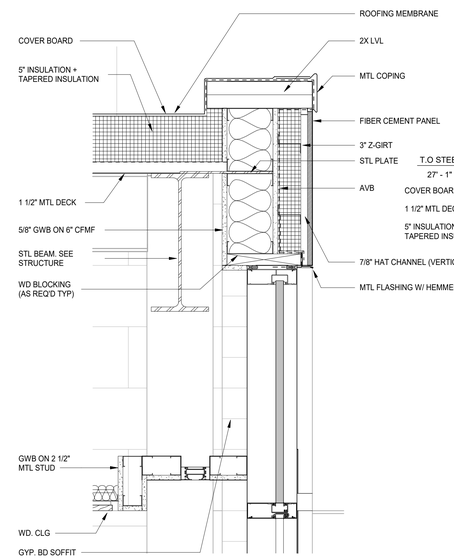
1 DETAIL @ CAFETERIA OVERHANG
1 1/2" = 1'-0"



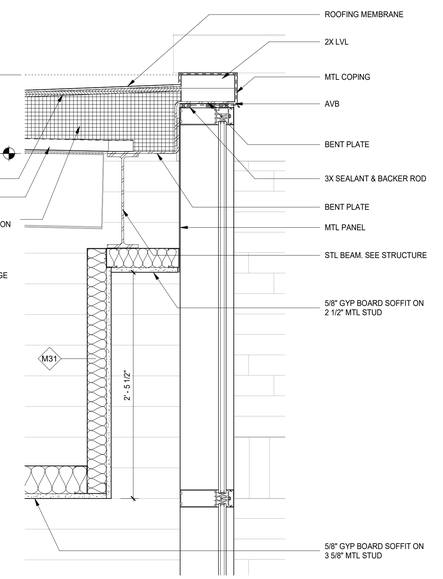
3 DETAIL @ AUX. GYM-1
1 1/2" = 1'-0"



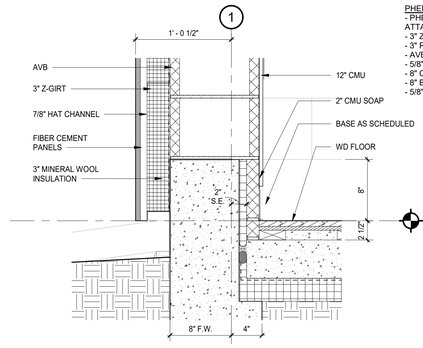
10 DETAIL @ WINDOW HEADER - PHENOLIC ASSEMBLY
1 1/2" = 1'-0"



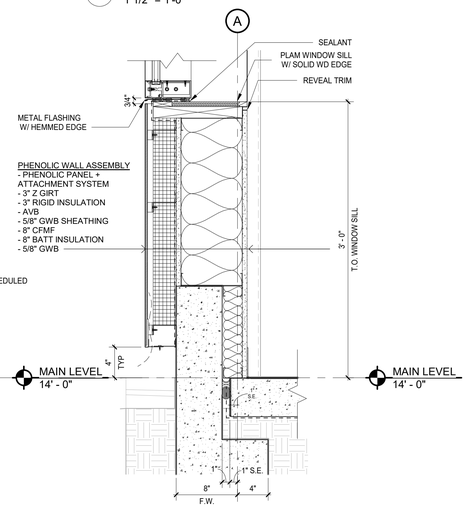
12 PARAPET DETAIL @ FIBER CEMENT WALL
1 1/2" = 1'-0"



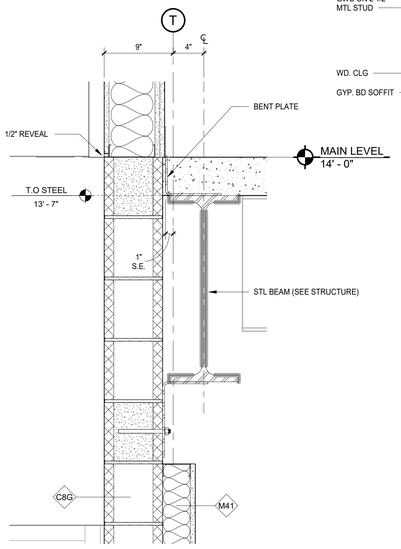
4 SECTION DETAIL @ V100 - 1
1 1/2" = 1'-0"



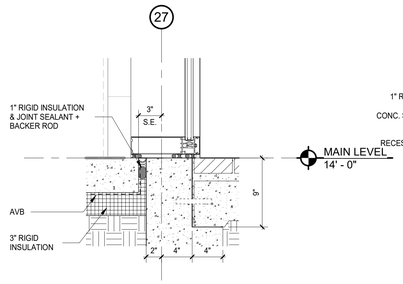
8 DETAIL @ AUX. GYM-2
1 1/2" = 1'-0"



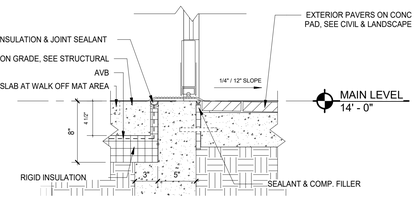
11 DETAIL @ WINDOW SILL - PHENOLIC ASSEMBLY
1 1/2" = 1'-0"



7 WALL SECTION @ LMC-2
1 1/2" = 1'-0"



6 DETAIL @ CAFETERIA
1 1/2" = 1'-0"



5 DETAIL @ CW MAIN ENTRANCE
1 1/2" = 1'-0"

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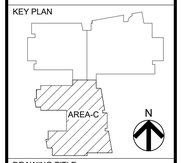

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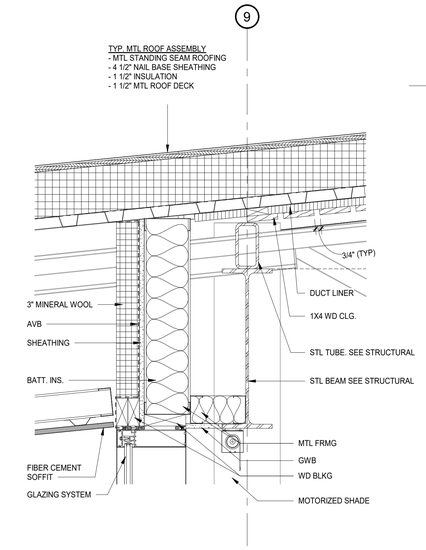
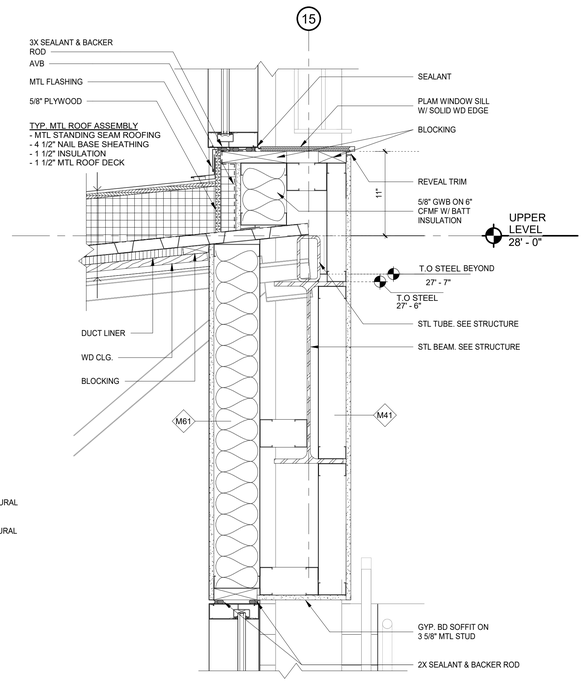
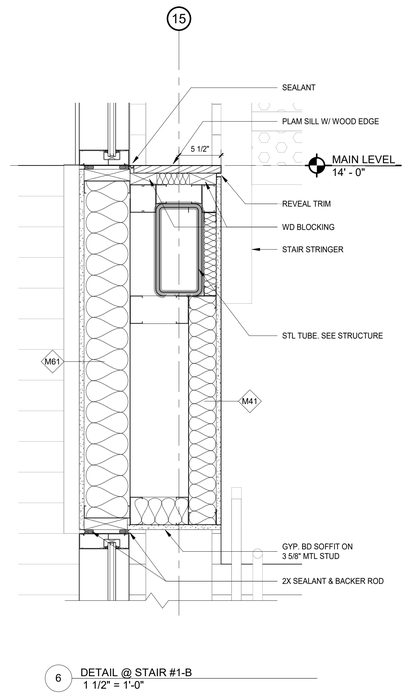


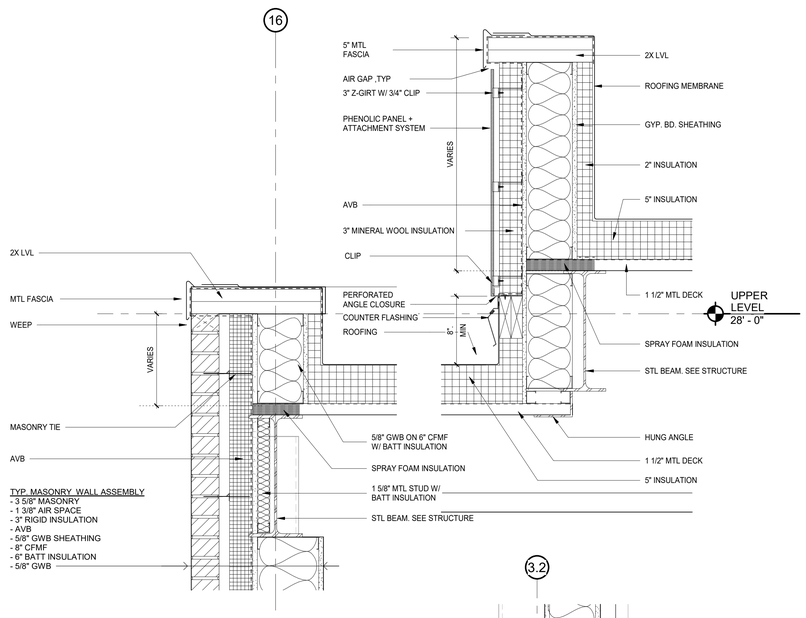
9 DETAIL @ GRIDLINE 9
1 1/2" = 1'-0"



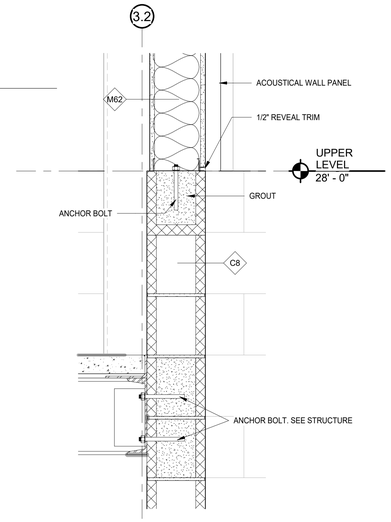
4 DETAIL @ STAIR #1
1 1/2" = 1'-0"



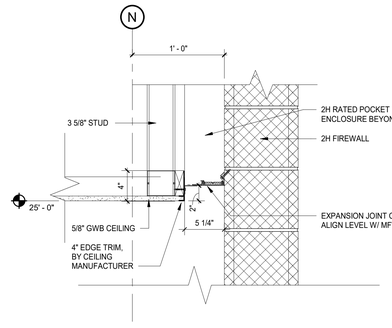
6 DETAIL @ STAIR #1-B
1 1/2" = 1'-0"



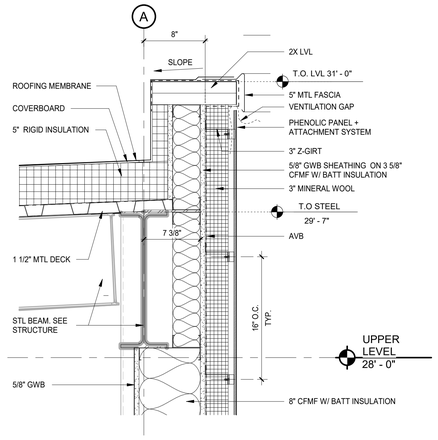
1 DETAIL @ ENTRY
1 1/2" = 1'-0"



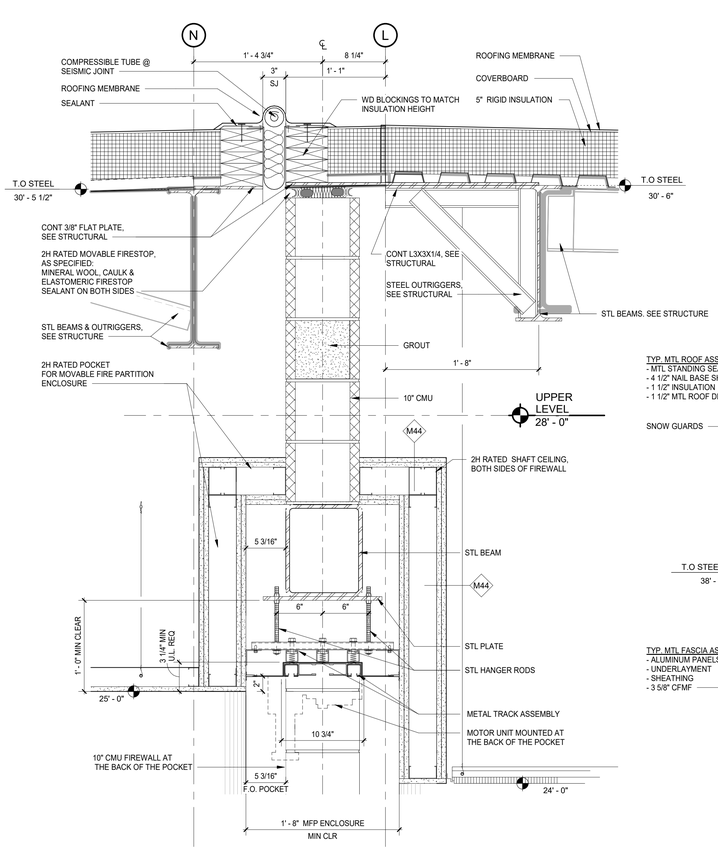
3 DETAIL @GYM/121B
1 1/2" = 1'-0"



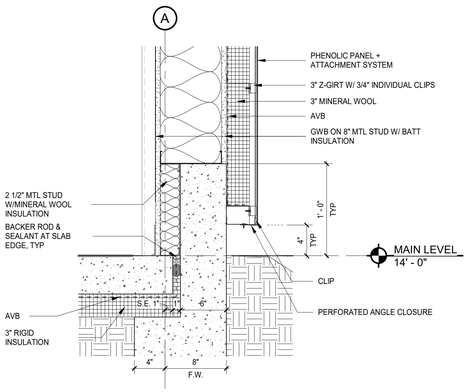
10 FIRE WALL EJ CEILING DETAIL
1 1/2" = 1'-0"



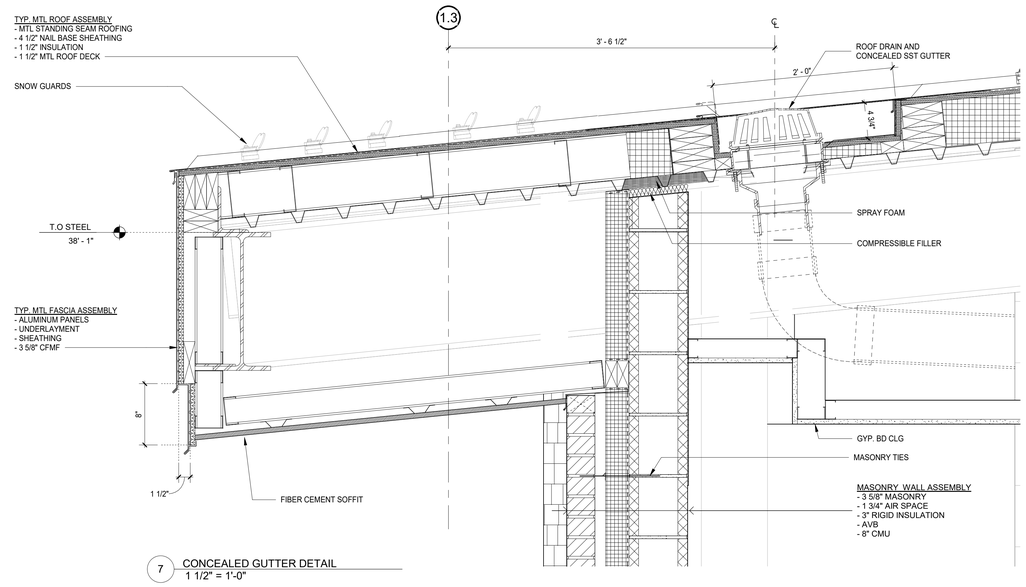
2 DETAIL @ PHENOLIC WALL TOP
1 1/2" = 1'-0"



8 DETAIL @ FIRE DOOR
1 1/2" = 1'-0"



5 DETAIL @ PHENOLIC WALL BASE
1 1/2" = 1'-0"



7 CONCEALED GUTTER DETAIL
1 1/2" = 1'-0"

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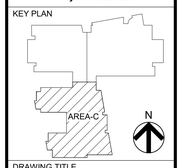

DRAWING TITLE

SECTION DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

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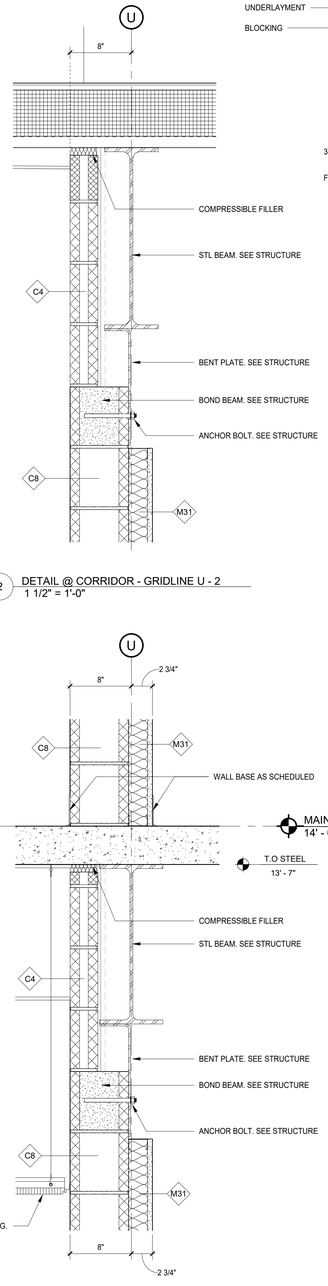
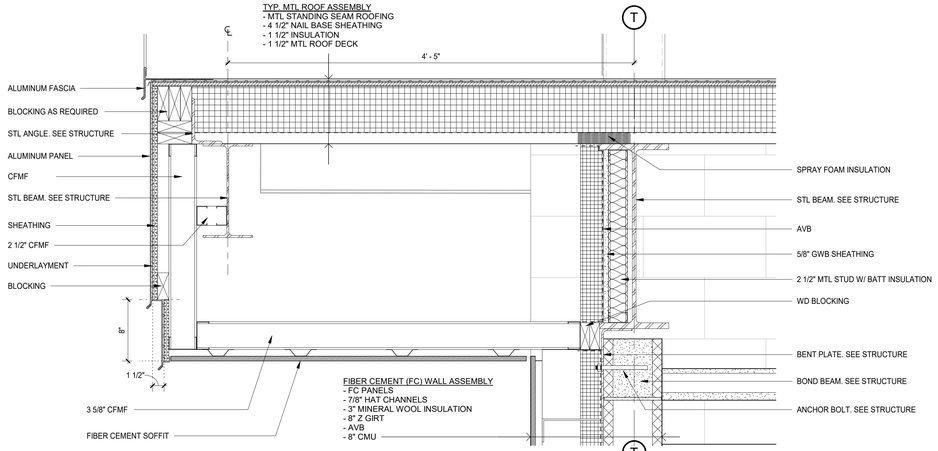
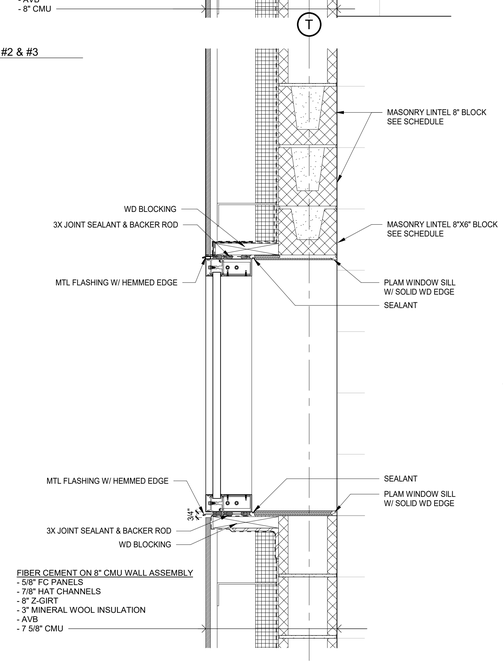


2 DETAIL @ CORRIDOR - GRIDLINE U - 2
1 1/2" = 1'-0"

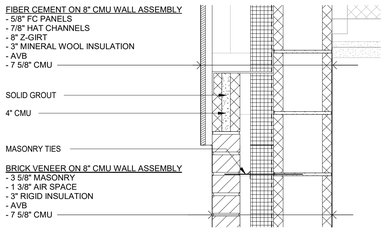
1 DETAIL @ CORRIDOR - GRIDLINE U - 1
1 1/2" = 1'-0"



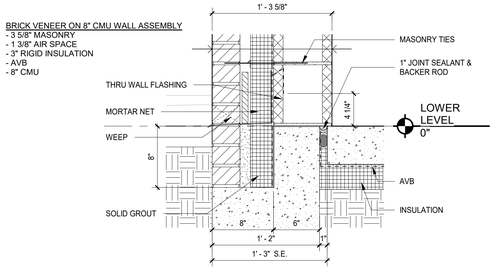
6 FASCIA DETAIL @ STAIR #2 & #3
1 1/2" = 1'-0"



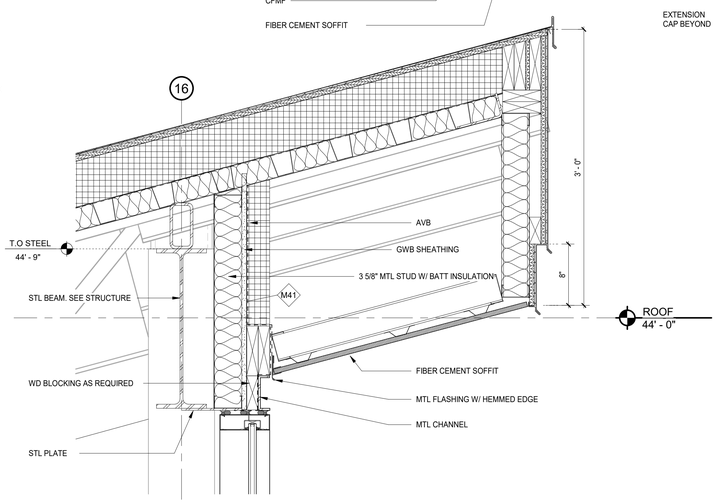
5 SECTION DETAIL @ STAIR #2 & #3
1 1/2" = 1'-0"

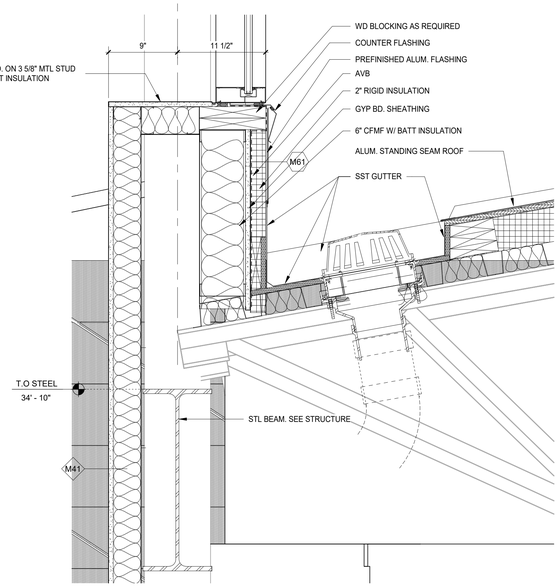


3 DETAIL @ STAIR #2/3
1 1/2" = 1'-0"

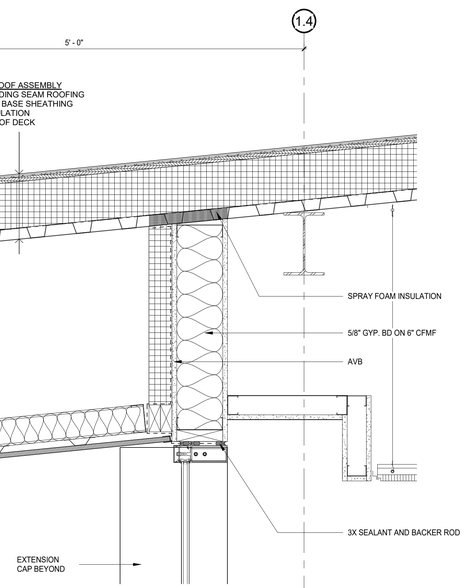


7 DETAIL @STAIR #2 & #3
1 1/2" = 1'-0"

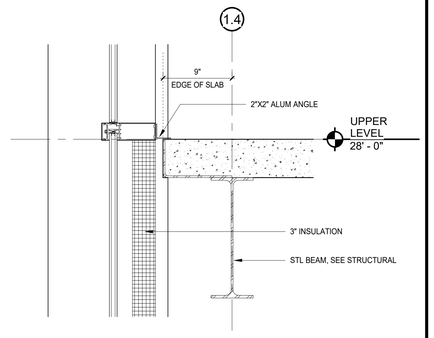




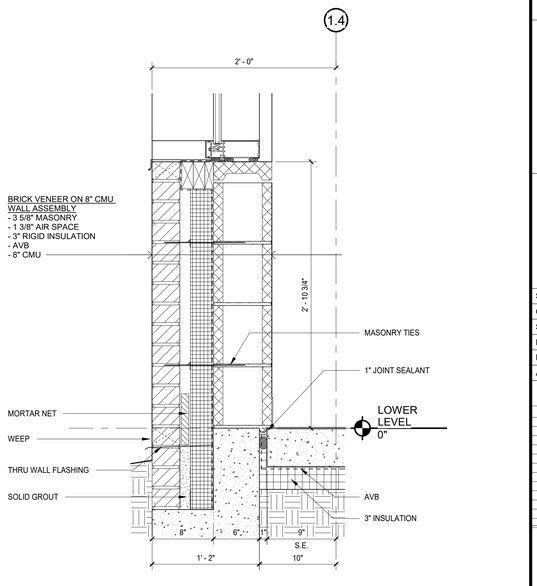
8 DETAIL @ 16 (C101)
1 1/2" = 1'-0"



9 DETAIL @ B.O-1 (TYP.)
1 1/2" = 1'-0"



4 DETAIL @ B.O-3 (TYP.)
1 1/2" = 1'-0"



10 DETAIL @ B.O-2 (TYP.)
1 1/2" = 1'-0"

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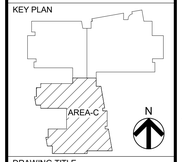
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



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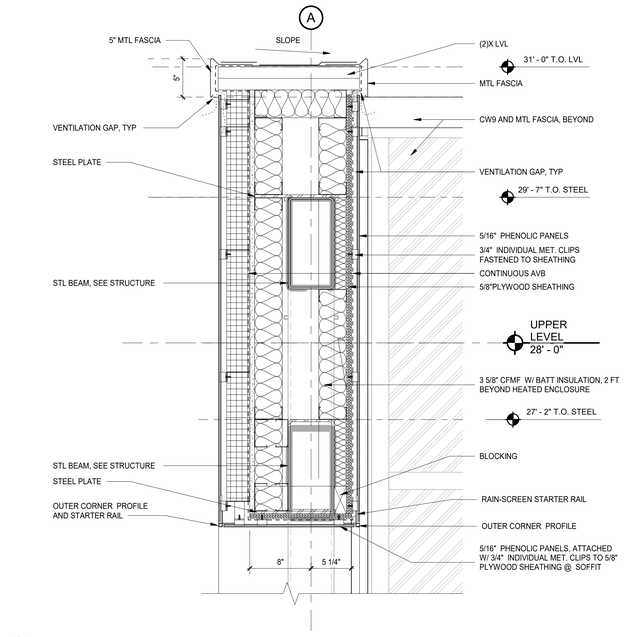
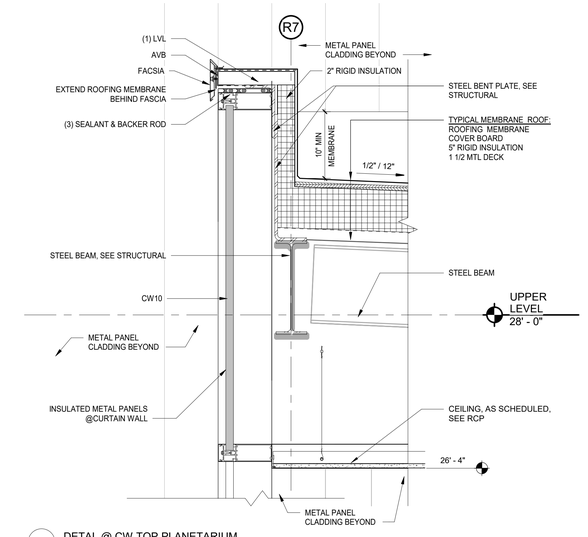
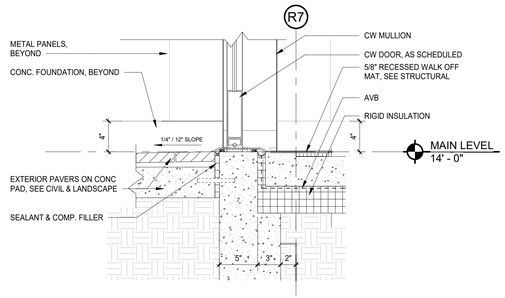


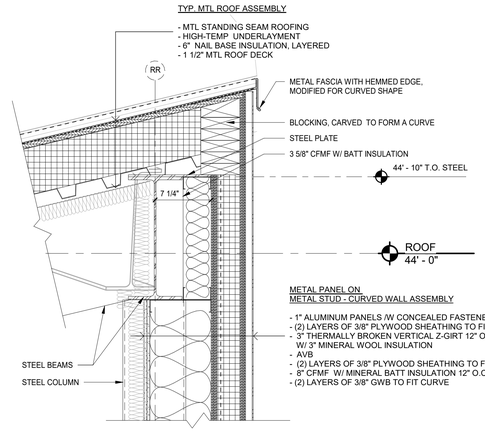
2 SECTION DETAIL @ PHENOLIC SOFFIT, PLANETARIUM
1 1/2" = 1'-0"



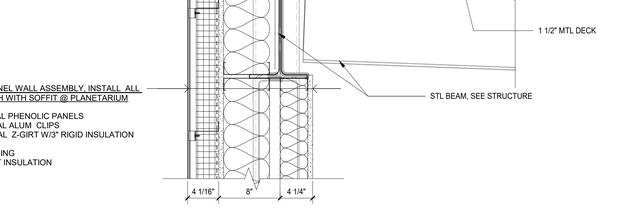
1 DETAIL @ CW TOP PLANETARIUM
1 1/2" = 1'-0"



4 SECTION DETAIL @ PLANETARIUM ENTRANCE
1 1/2" = 1'-0"



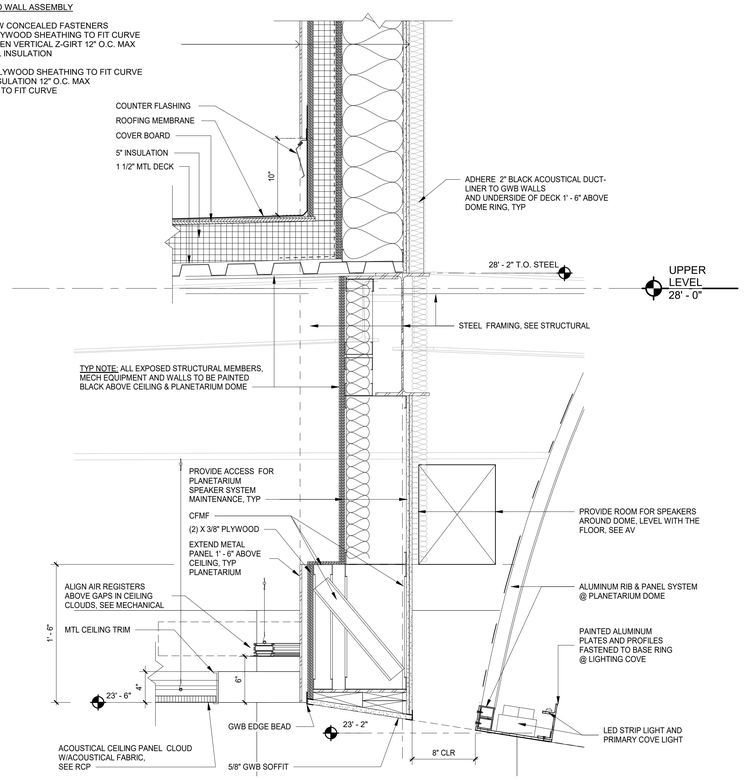
3 SECTION DETAIL @ PLANETARIUM STANDING SEAM ROOF
1 1/2" = 1'-0"



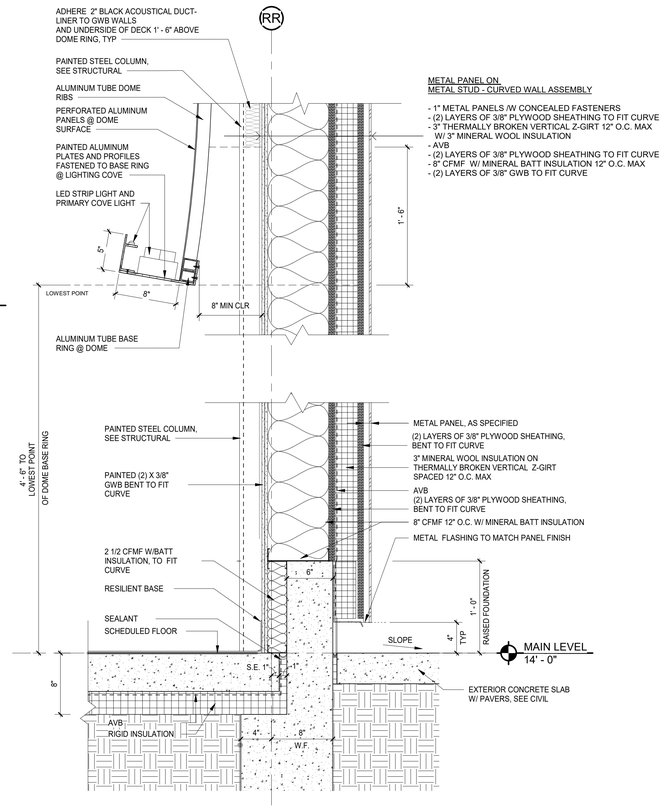
5 DETAIL @ TOP OF PLANETARIUM PHENOLIC WALL
1 1/2" = 1'-0"

METAL PANEL ON
METAL STUD - CURVED WALL ASSEMBLY

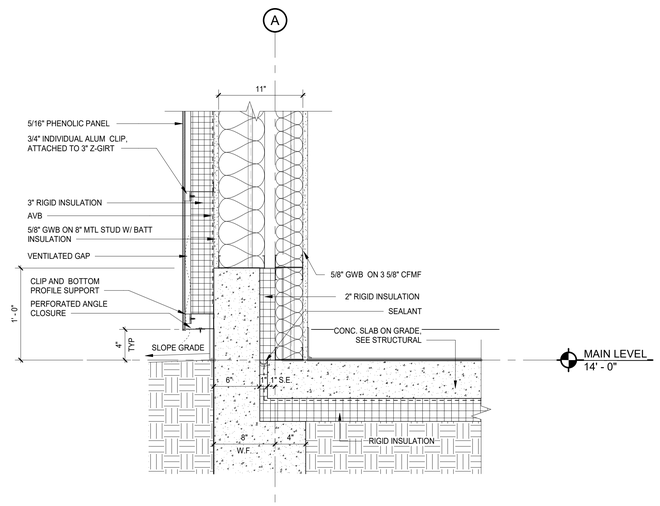
- ALUMINUM PANELS /W CONCEALED FASTENERS
- (2) LAYERS OF 3/8" PLYWOOD SHEATHING TO FIT CURVE
- 3" THERMALLY BROKEN VERTICAL Z-GIRT 12" O.C. MAX W/ 3" MINERAL WOOL INSULATION
- AVB
- (2) LAYERS OF 3/8" PLYWOOD SHEATHING TO FIT CURVE
- 8" CFMF W/ BATT INSULATION 12" O.C. MAX
- (2) LAYERS 3/8" GWB TO FIT CURVE



7 DETAIL @ METAL PANEL TO MEMBRNE ROOF
1 1/2" = 1'-0"



6 SECTION DETAIL @ PLANETARIUM EXT WALL
1 1/2" = 1'-0"



8 SECTION DETAIL @ PLANETARIUM BASE OF PHENOLIC WALL
1 1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



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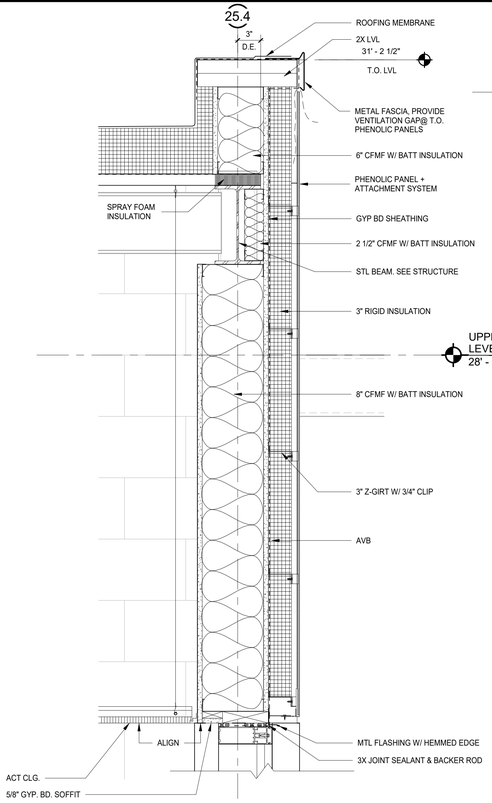
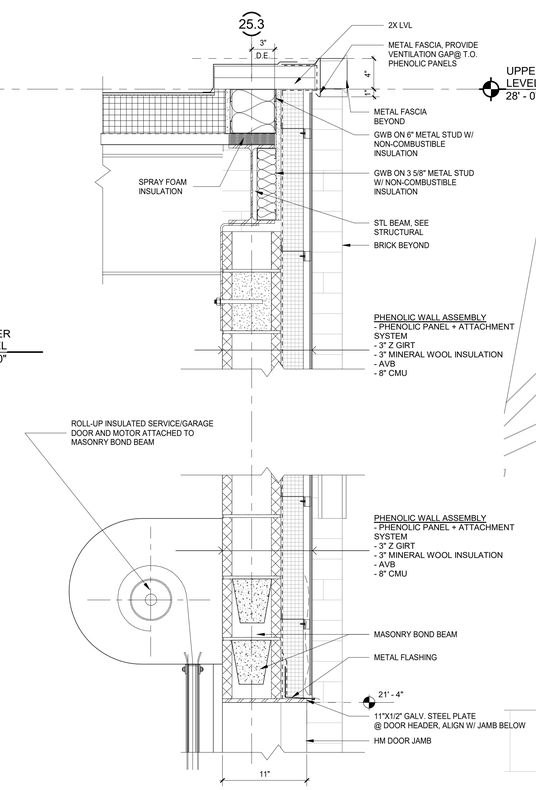
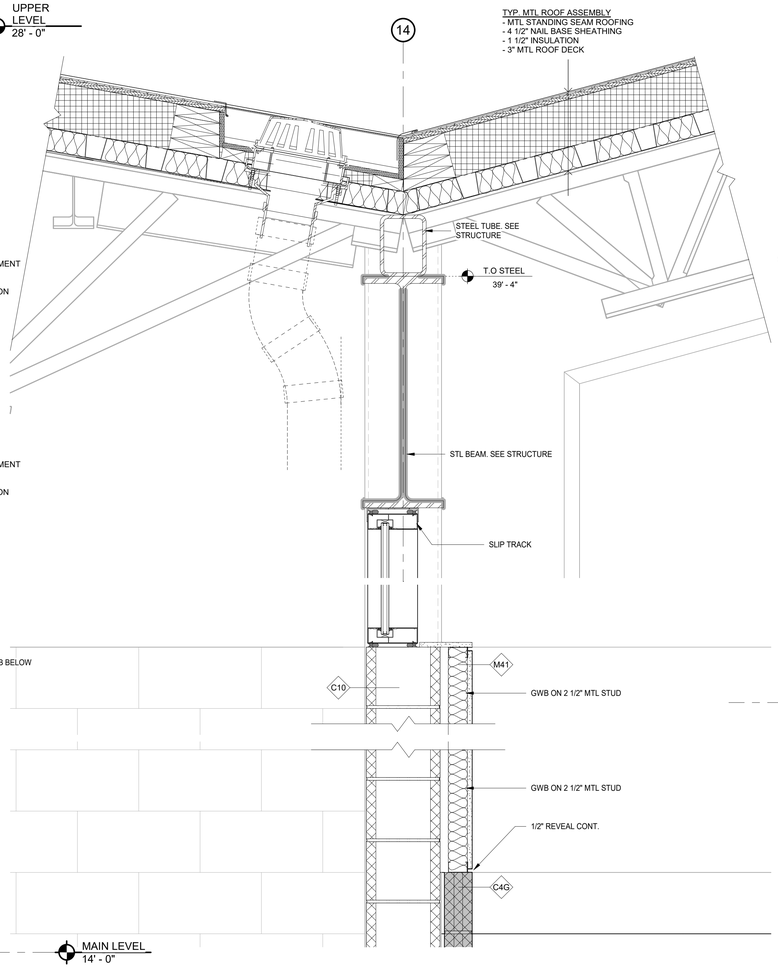


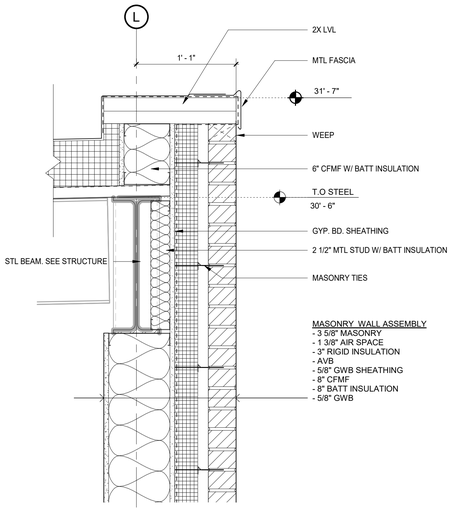
4 DETAIL @ DOOR C104
1 1/2" = 1'-0"



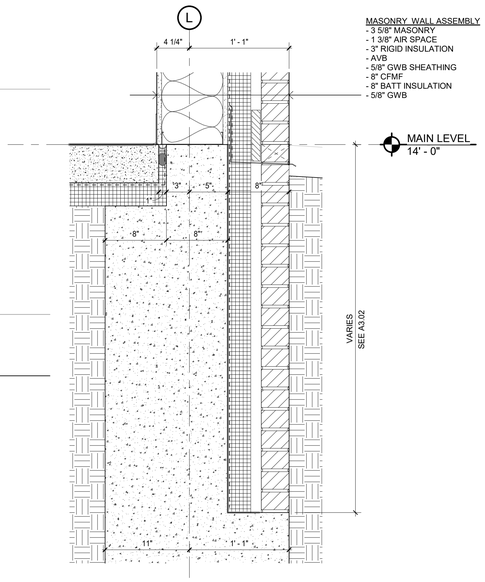
6 SECTION DETAIL @ LOADING DOOR HEAD
1 1/2" = 1'-0"



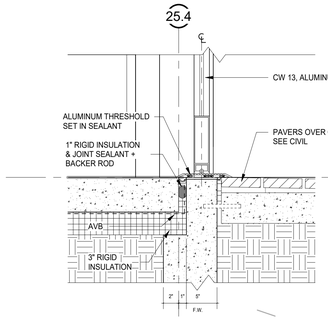
8 CURTAIN WALL AND WALL BETWEEN GYM A121 AND MAIN COORIDOR C101
1 1/2" = 1'-0"



1 T.O. WALL
1 1/2" = 1'-0"



11 SECTION DETAIL AT MASONRY - AMPHITEATRE
1 1/2" = 1'-0"



5 FOUNDATION DETAIL @ DOOR C104
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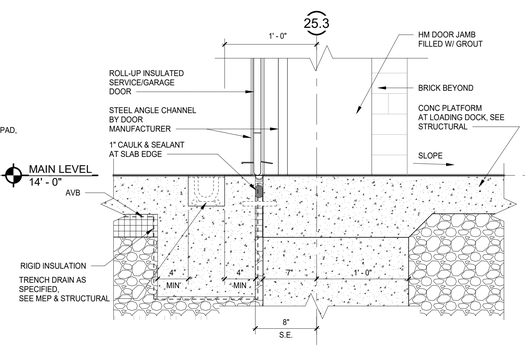
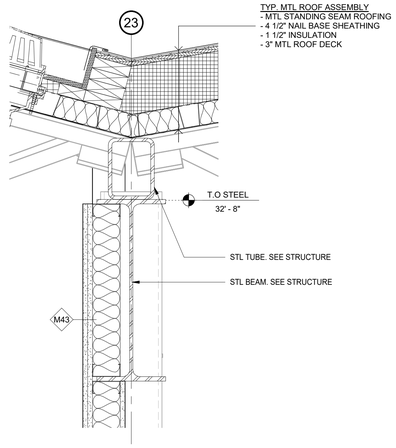
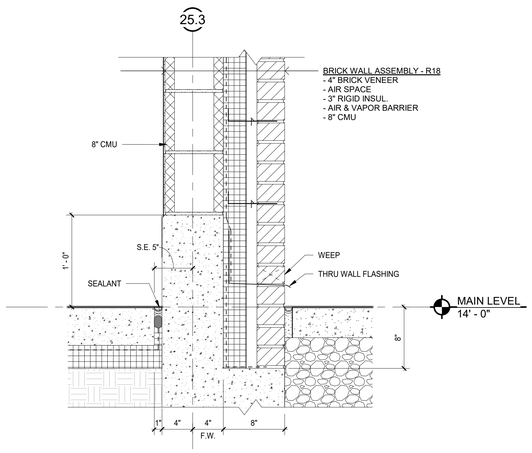


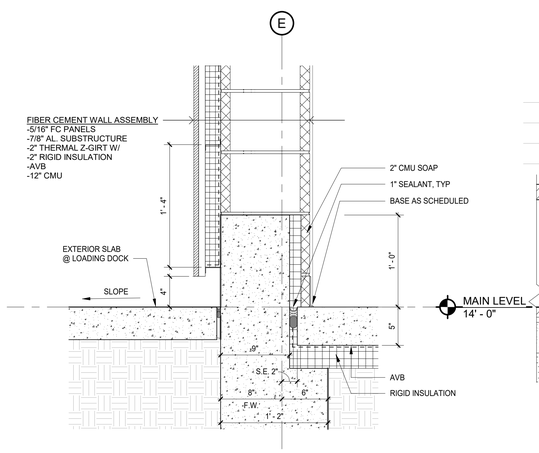
10 SECTION DETAIL @ LOADING DOOR THRESHOLD
1 1/2" = 1'-0"



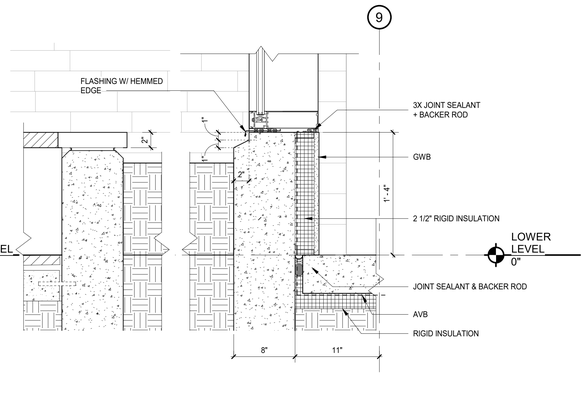
7 DETAIL @ 23
1 1/2" = 1'-0"



3 SECTION DETAIL AT BASE OF WALL BY LOADING
1 1/2" = 1'-0"



2 SECTION DETAIL @ BASE OF CAFE WALL
1 1/2" = 1'-0"



9 BASE OF WALL B020 LIBRARY MEDIA CENTER
1 1/2" = 1'-0"

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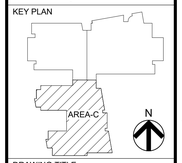

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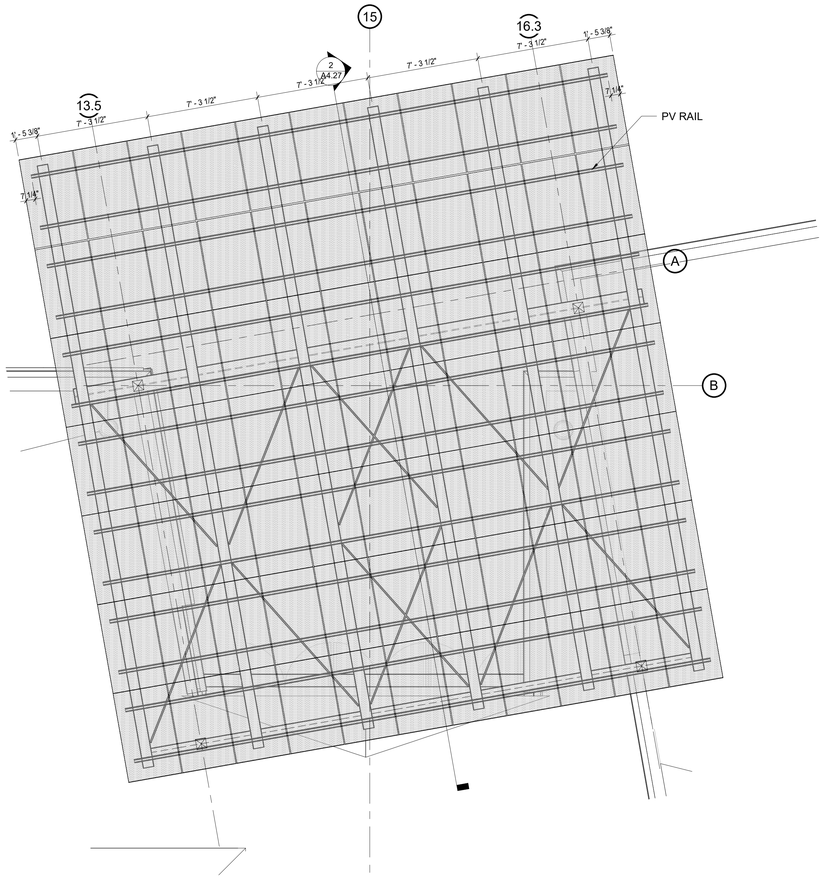
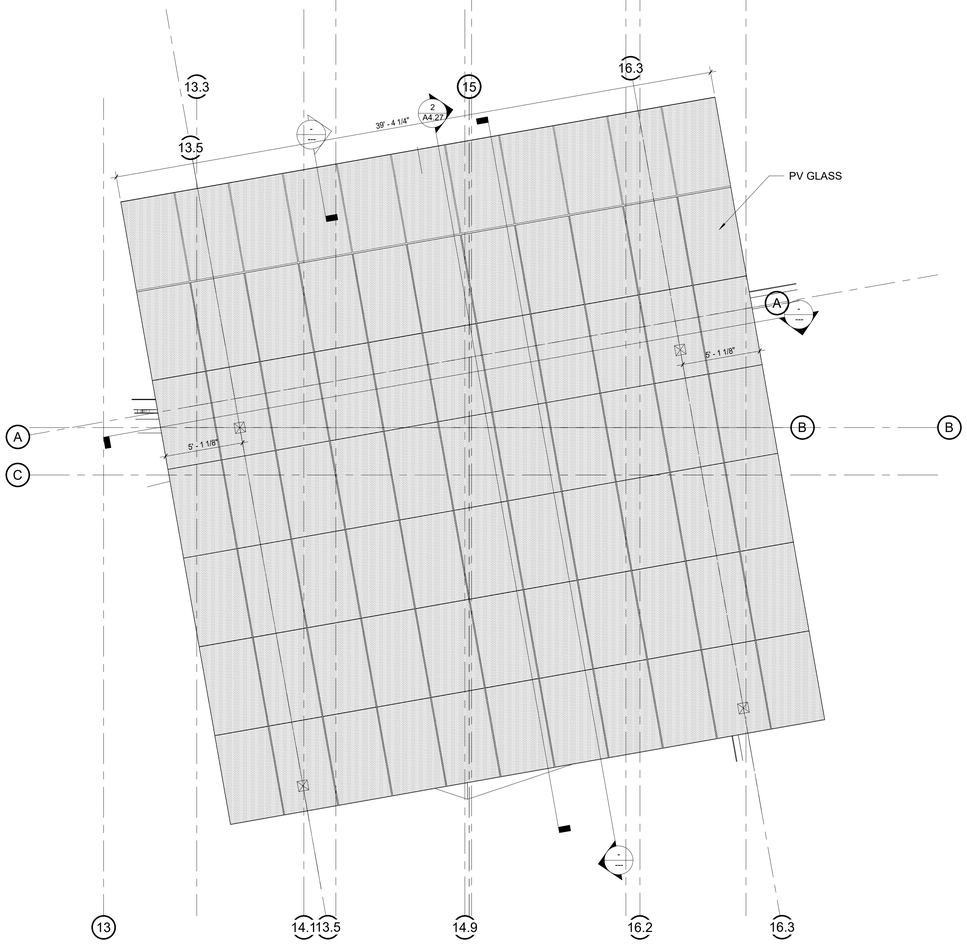
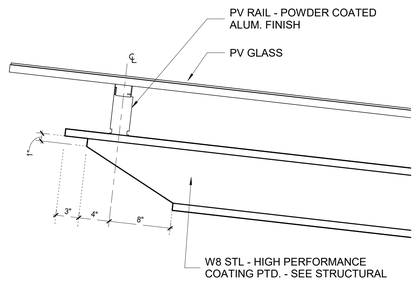


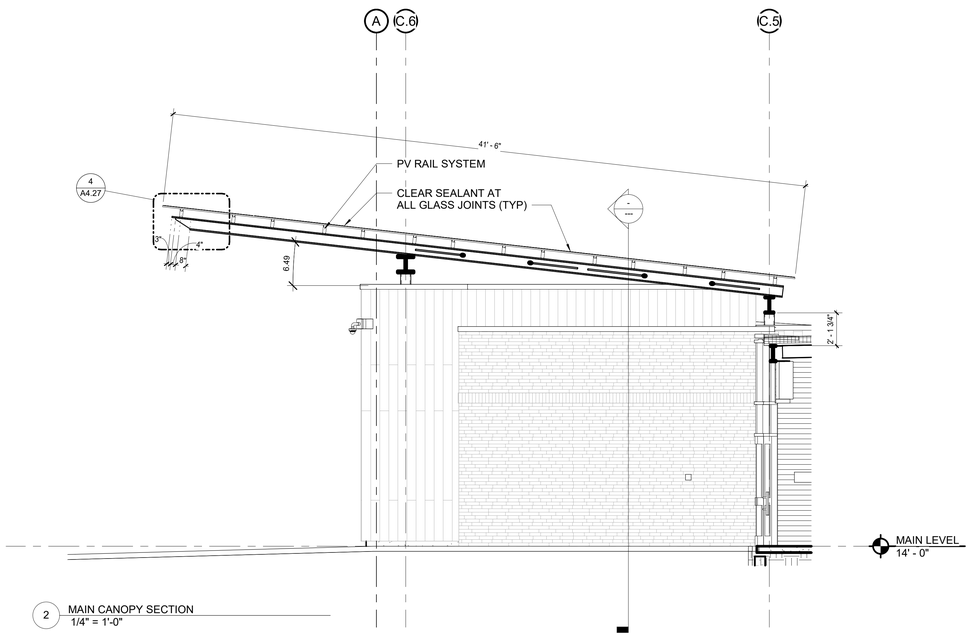
3 MAIN ENTRY CANOPY PLAN FRAMING
1/4" = 1'-0"



1 MAIN ENTRY CANOPY PLAN- PV
1/4" = 1'-0"



4 MAIN CANOPY SECTION DTL.
1 1/2" = 1'-0"



2 MAIN CANOPY SECTION
1/4" = 1'-0"

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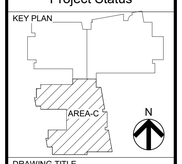

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MAIN ENTRY CANOPY

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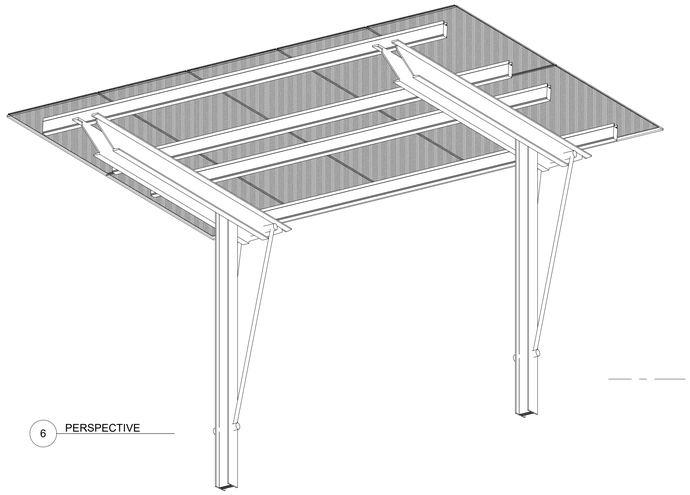
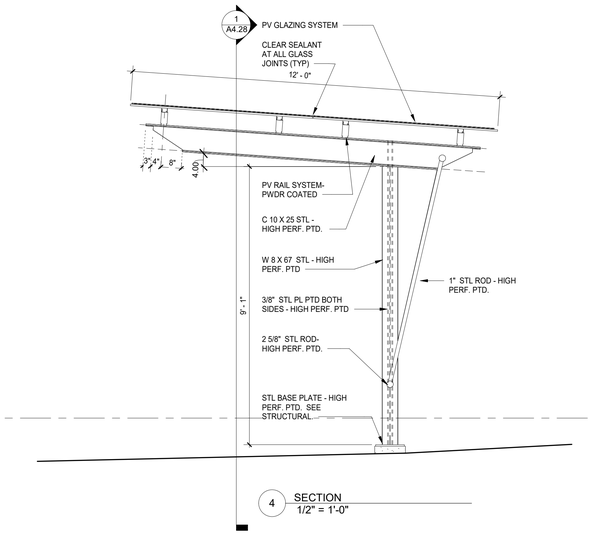
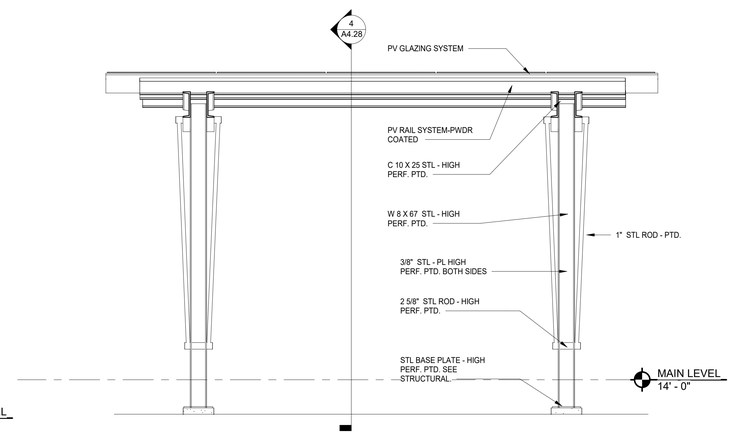


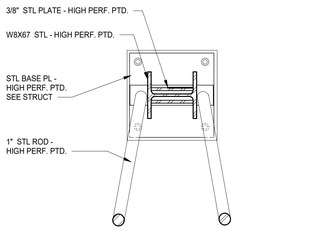
6 PERSPECTIVE



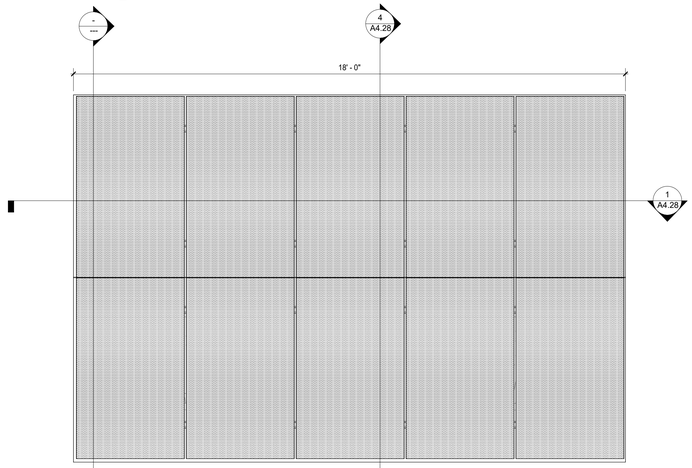
4 SECTION
1/2" = 1'-0"



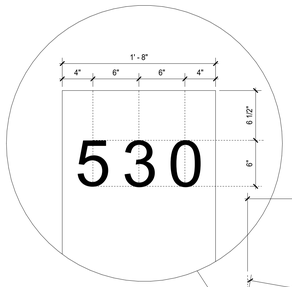
1 Detail 38
1/2" = 1'-0"

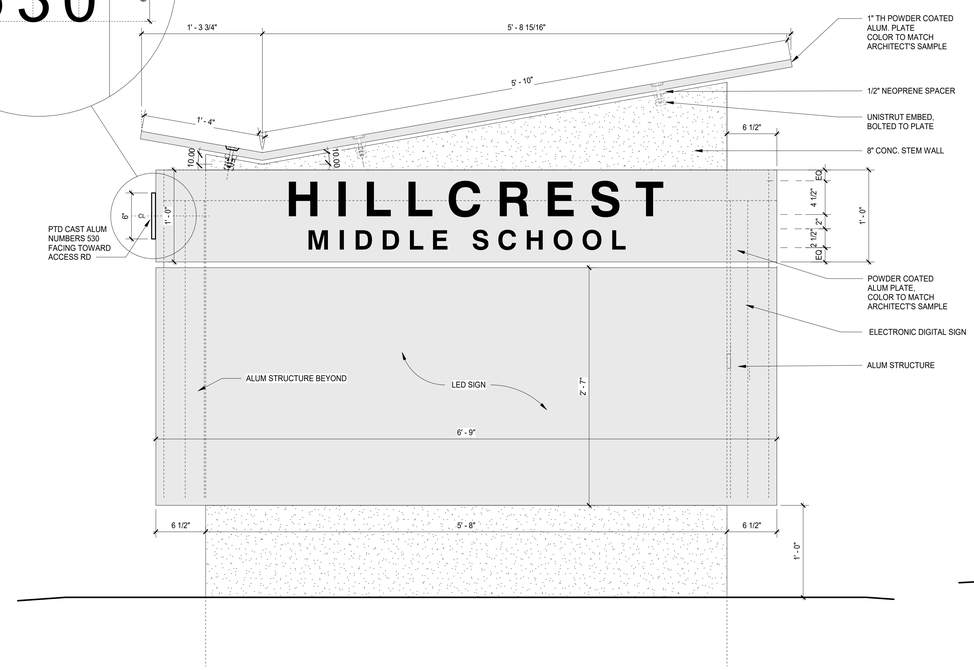


5 COLUMN DTL
1 1/2" = 1'-0"

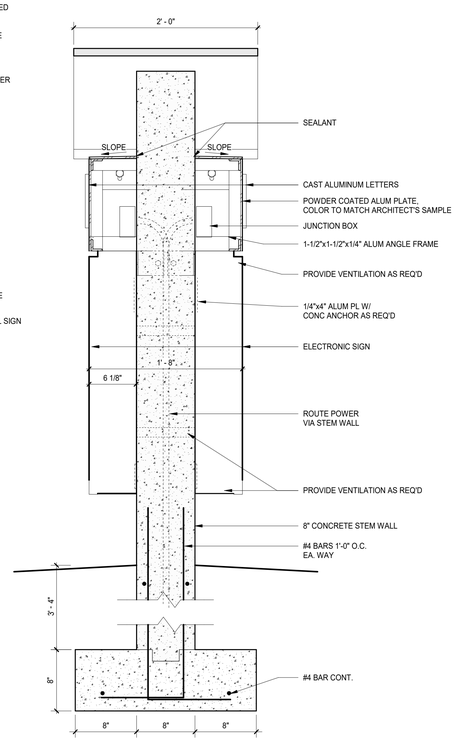


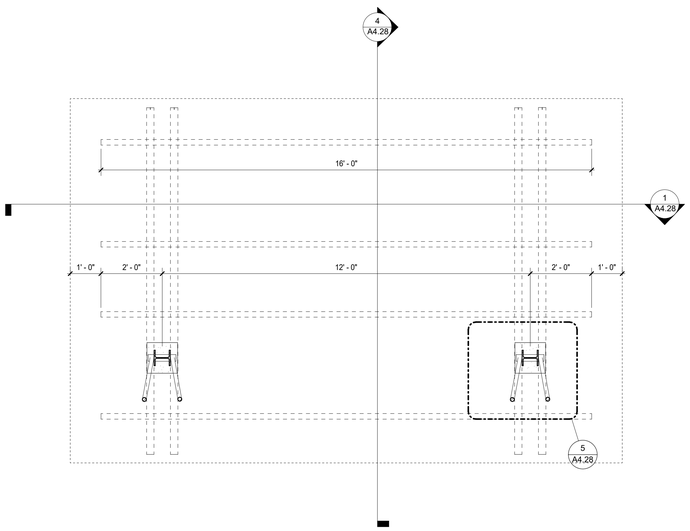
2 PV CANOPY PLAN 12X18
1/2" = 1'-0"





7 SCHOOL DIGITAL SIGN final2
1 1/2" = 1'-0"





3 FLOOR PLAN
1/2" = 1'-0"

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One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970

ARCHITECTURE | PLANNING | INTERIORS

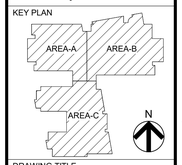
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

CANOPY (2) FREE STANDING AND DIGITAL SIGN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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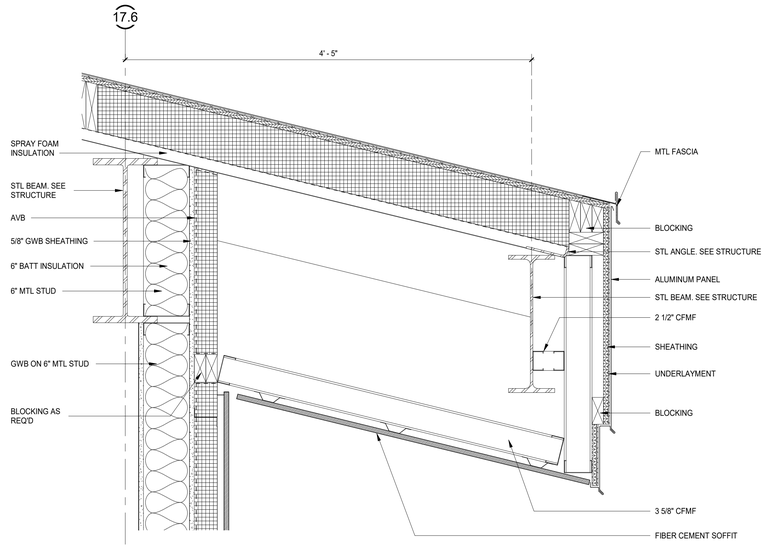
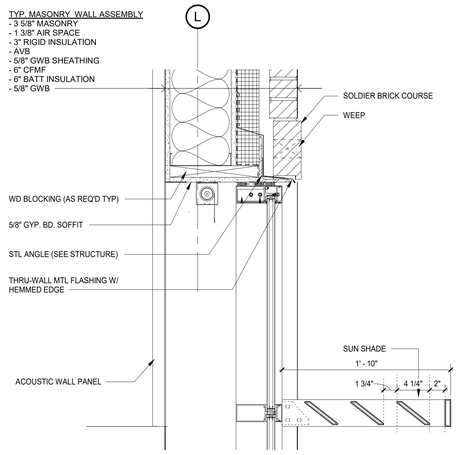


3 ROOF OVERHANG @ 17.6
1 1/2" = 1'-0"



2 DETAIL @ BAND A134
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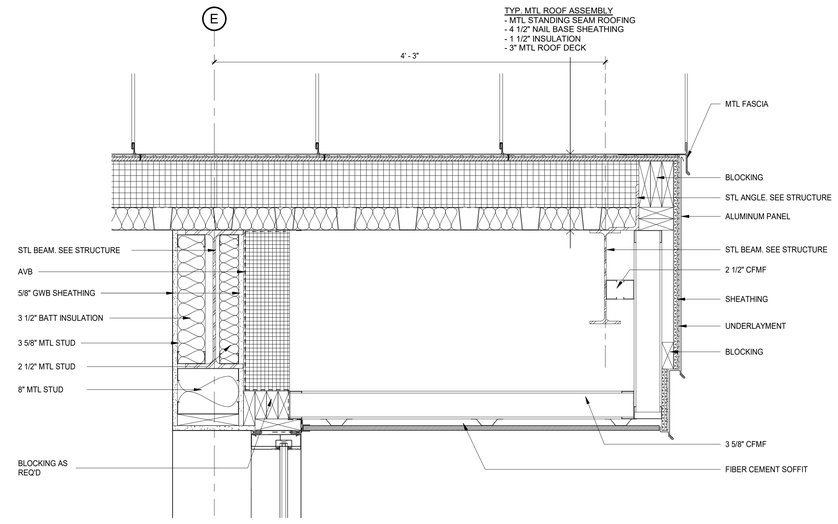
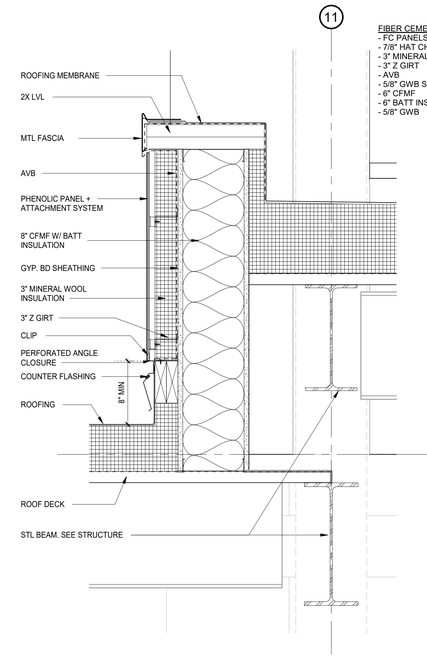
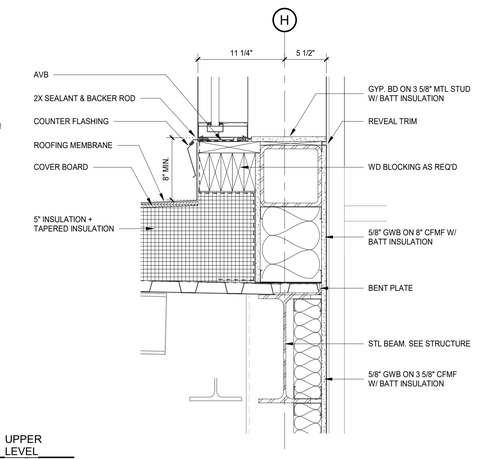


1 ROOF OVERHANG @ CORRIDOR C101
1 1/2" = 1'-0"

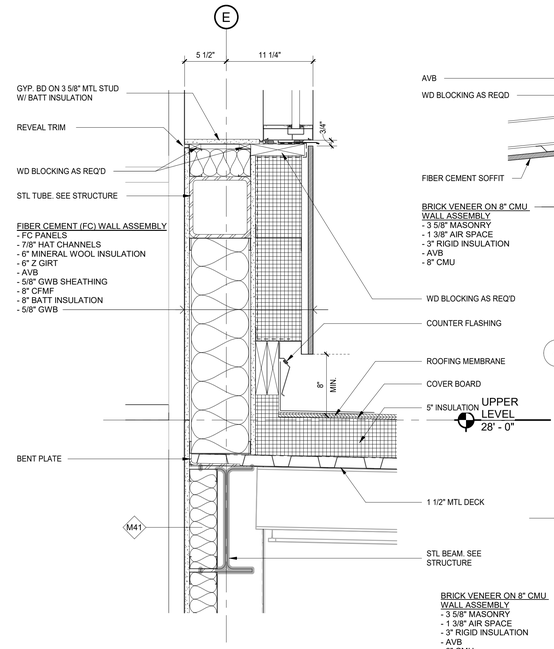


8 DETAIL @ CORRIDOR C103
1 1/2" = 1'-0"

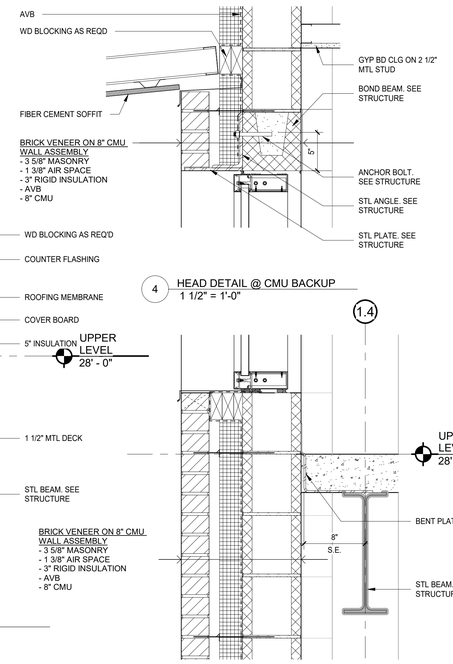
7 DETAIL @ FLEX 203
1 1/2" = 1'-0"



6 SILL DETAIL @ CORRIDOR C101 - 2
1 1/2" = 1'-0"

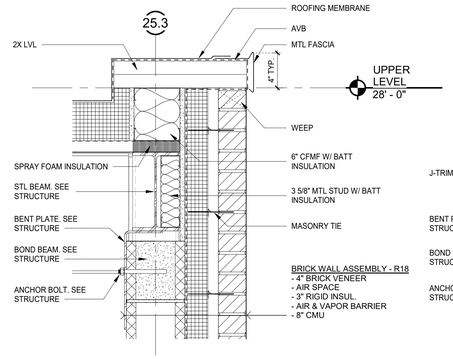


5 SILL DETAIL @ CORRIDOR C101 - 1
1 1/2" = 1'-0"

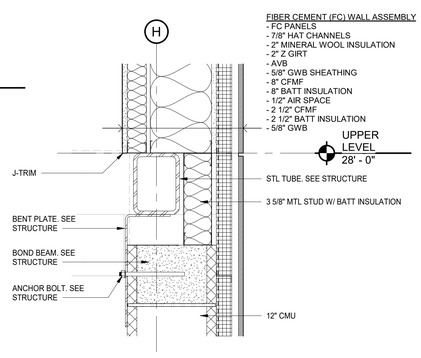


4 HEAD DETAIL @ CMU BACKUP
1 1/2" = 1'-0"

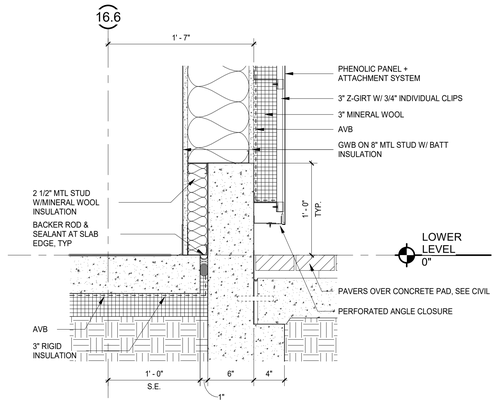
9 SILL DETAIL @ CMU BACKUP
1 1/2" = 1'-0"



13 PARAPET DETAIL @ BRICK/CMU WALL
1 1/2" = 1'-0"



12 DETAIL @ GRIDLINE H
1 1/2" = 1'-0"



11 DETAIL @ PHENOLIC WALL BASE-2
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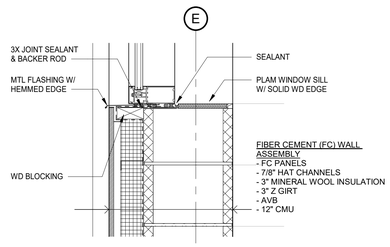

10 SILL DETAIL @ AUX GYM
1 1/2" = 1'-0"

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Hartford, CT 06106
860.547.1970
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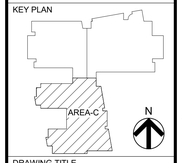
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

SECTION DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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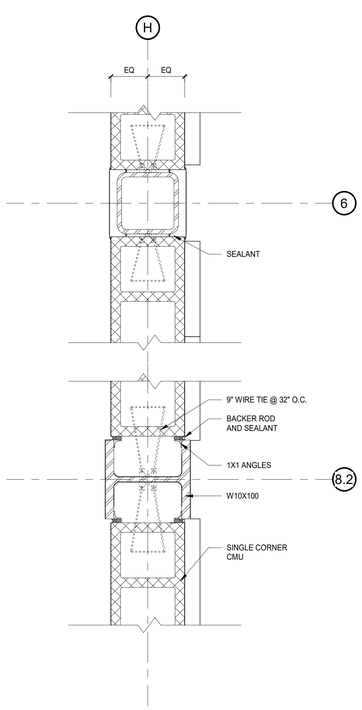

4 PLAN DETAIL COLUMN GRID H, 8.2
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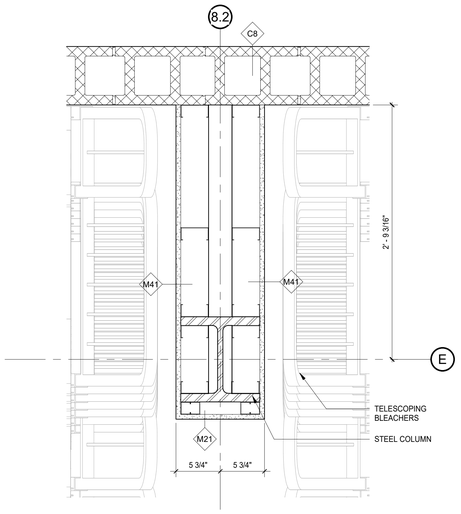

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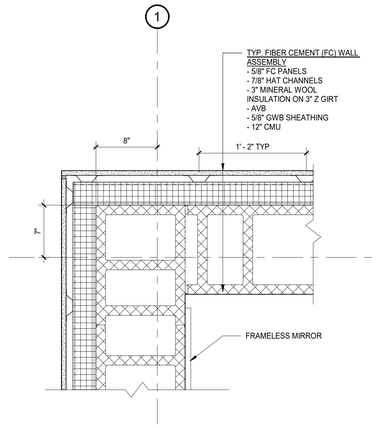
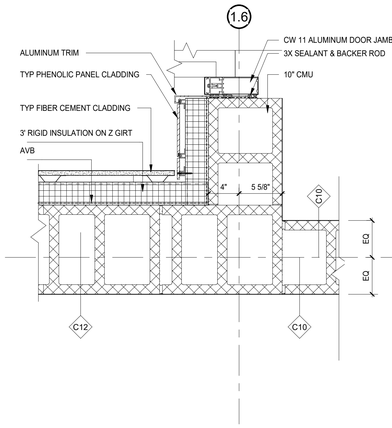
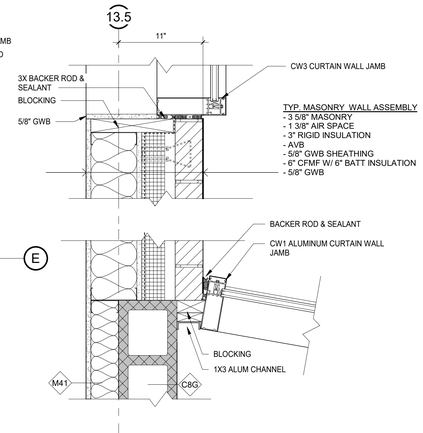
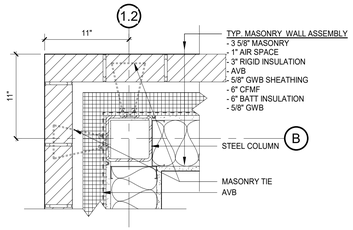


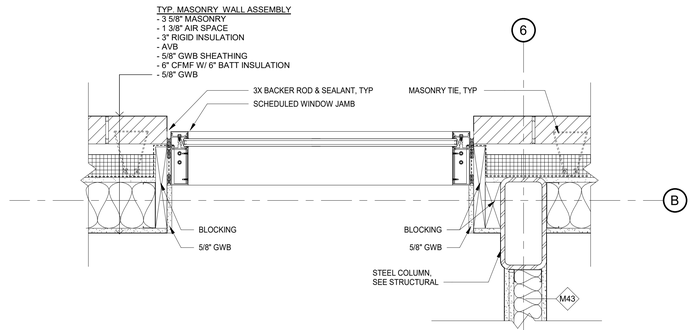




2 PLAN DETAIL
1 1/2" = 1'-0"

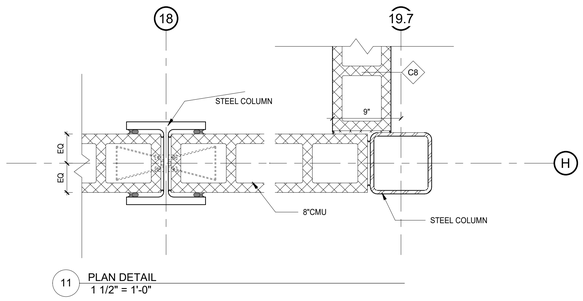
1 PLAN DETAIL
1 1/2" = 1'-0"





6 PLAN DETAIL
1 1/2" = 1'-0"

5 PLAN DETAIL
1 1/2" = 1'-0"



11 PLAN DETAIL
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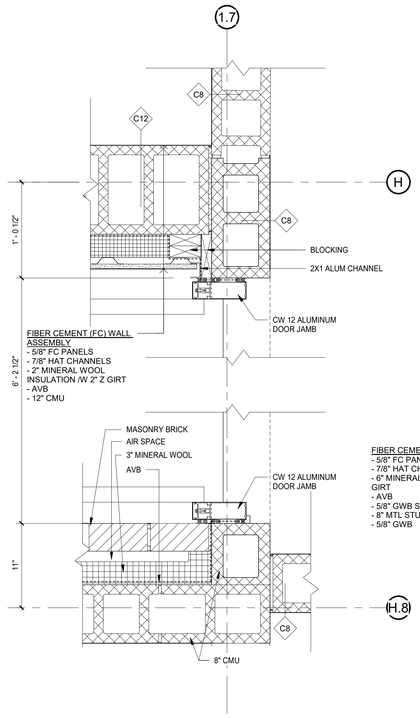

10 PLAN DETAIL
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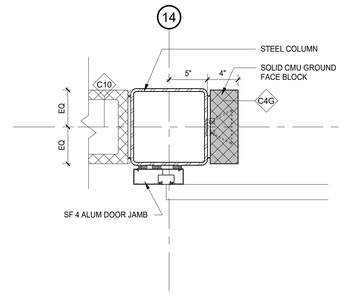
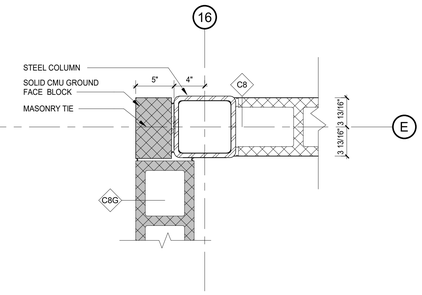
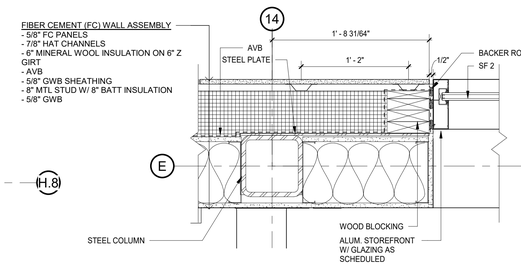
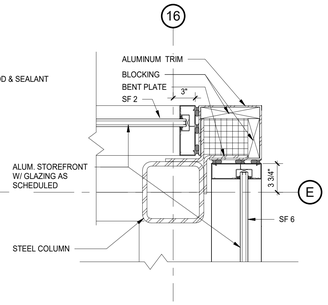




7 PLAN DETAIL
1 1/2" = 1'-0"





9 PLAN DETAIL @ CLERESTORY
1 1/2" = 1'-0"

8 PLAN DETAIL @ CLERESTORY
1 1/2" = 1'-0"

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Hartford, CT 06106
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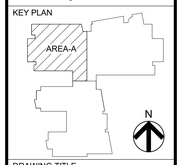
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

PLAN DETAILS - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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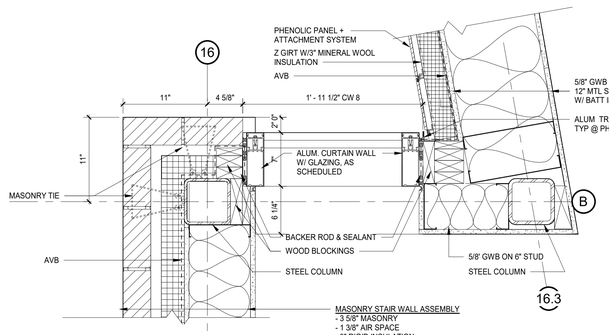

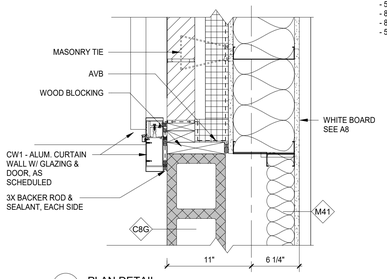

4 PLAN DETAIL
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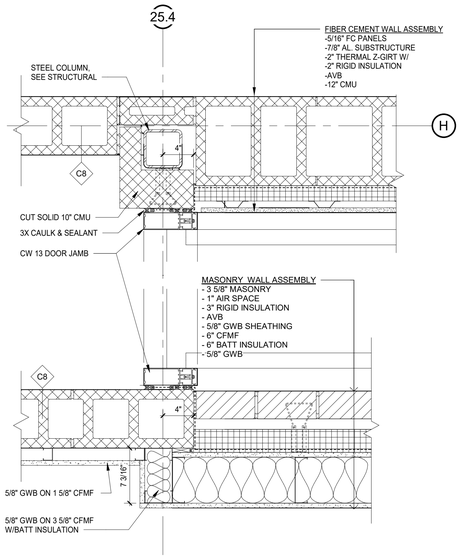

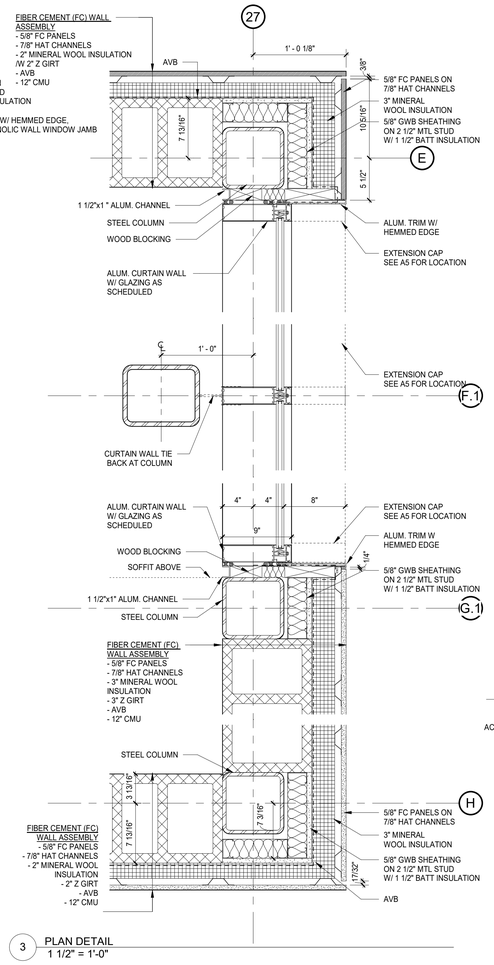

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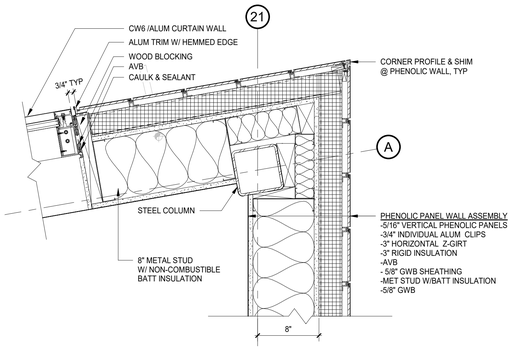

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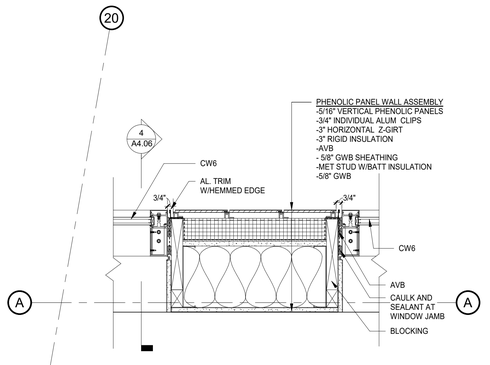

1 PLAN DETAIL
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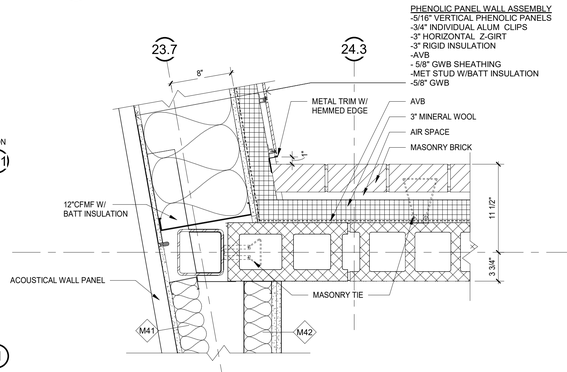

6 PLAN DETAIL B/23.7
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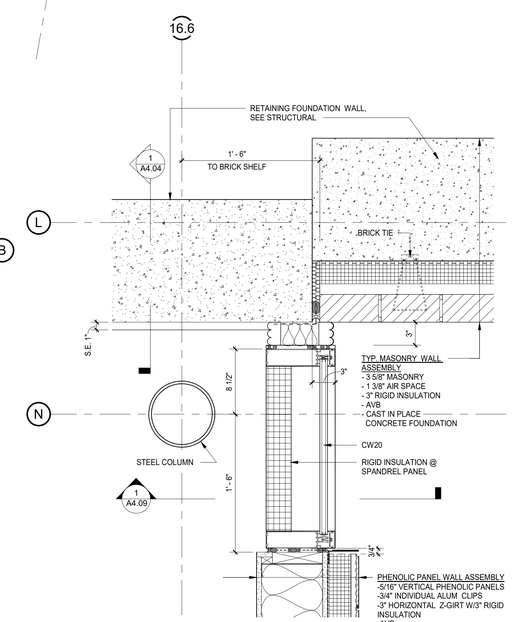

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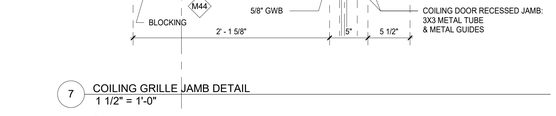

7 COILING GRILLE JAMB DETAIL
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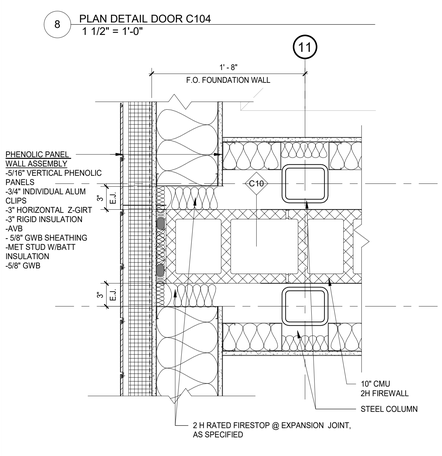

12 PLAN DETAIL
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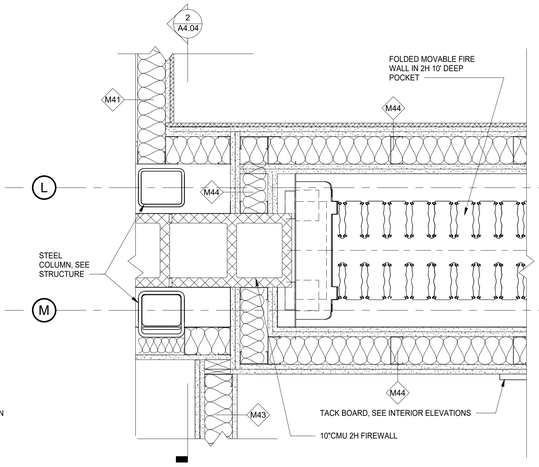
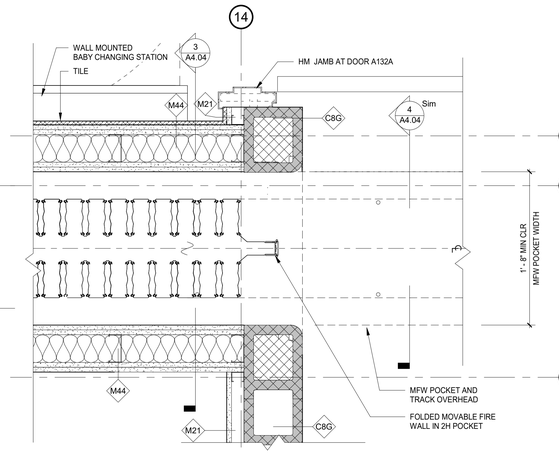
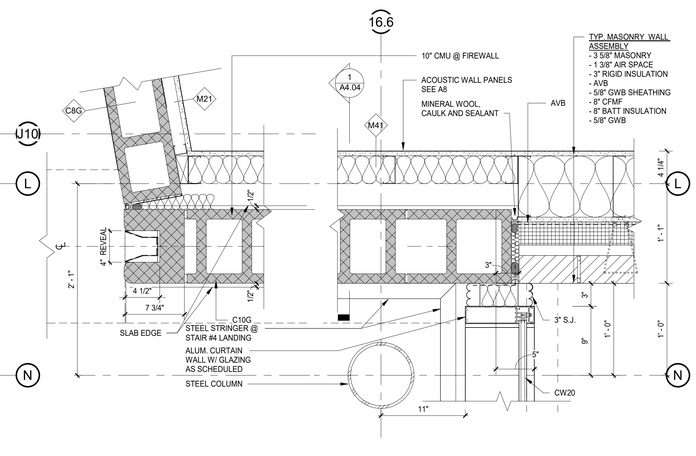


11 PLAN DETAIL
1 1/2" = 1'-0"



10 PLAN DETAIL
1 1/2" = 1'-0"



9 PLAN DETAIL
1 1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

PLAN DETAILS - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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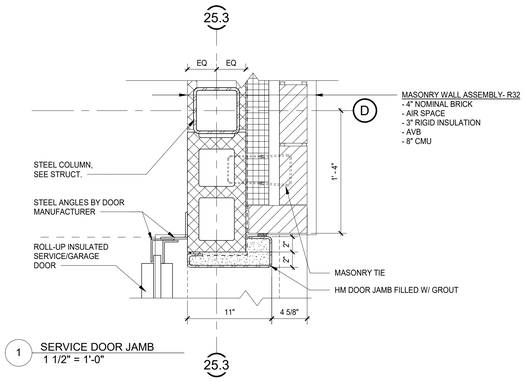
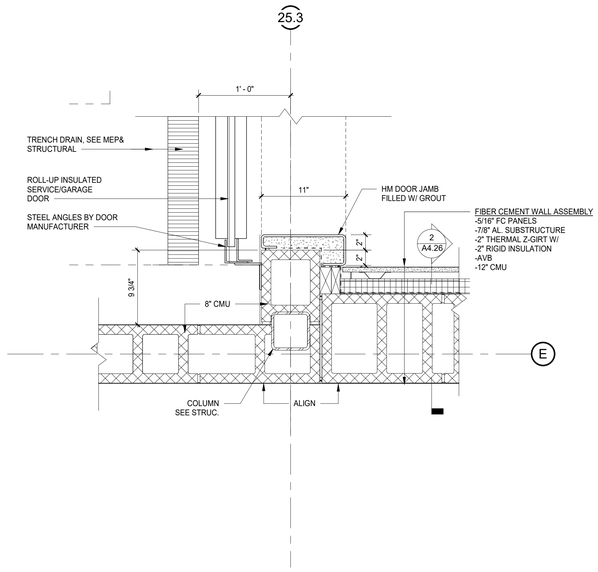
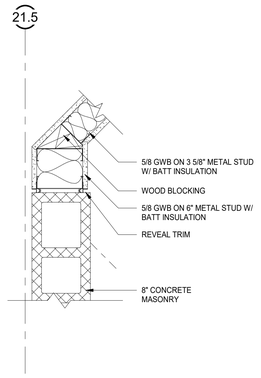


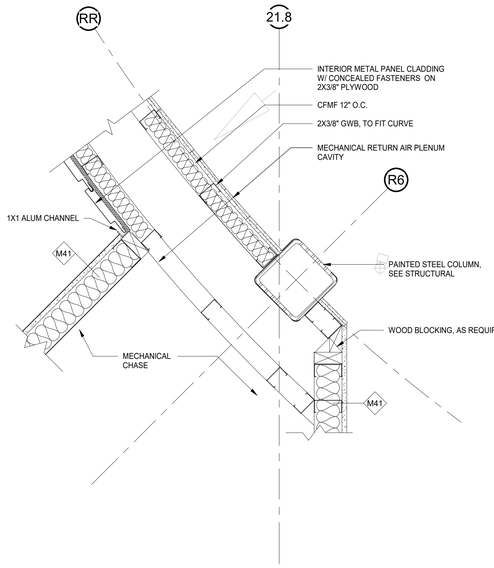
1 SERVICE DOOR JAMB
1 1/2" = 1'-0"



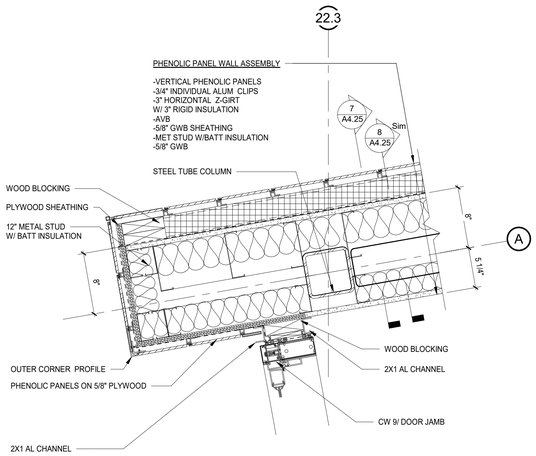
2 SERVICE DOOR JAMB & CAFE CMU TRANSITION
1 1/2" = 1'-0"



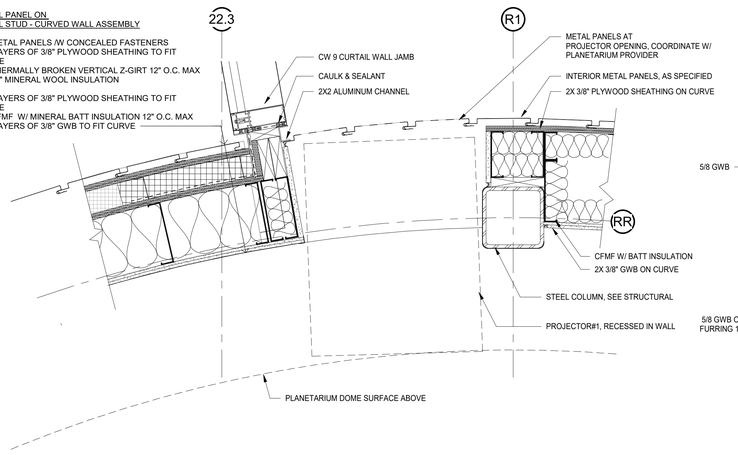
3 PD PLANETARIUM CMU TO GWB
1 1/2" = 1'-0"



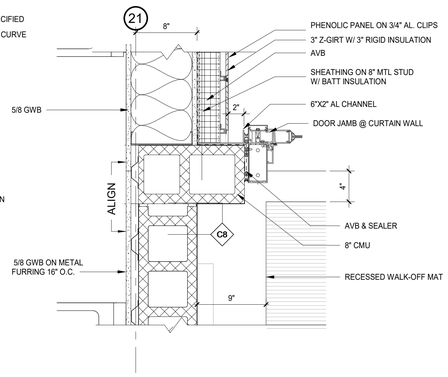
4 INTERIOR METAL PANEL CLADDING_ PLANETARIUM
1 1/2" = 1'-0"



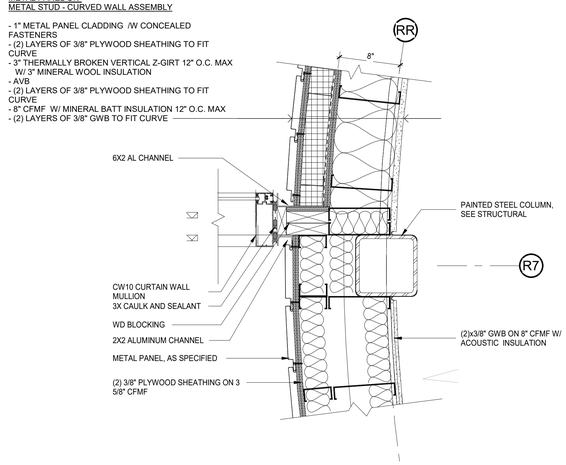
5 PLAN DETAIL PHENOLIC PANEL & CW
1 1/2" = 1'-0"



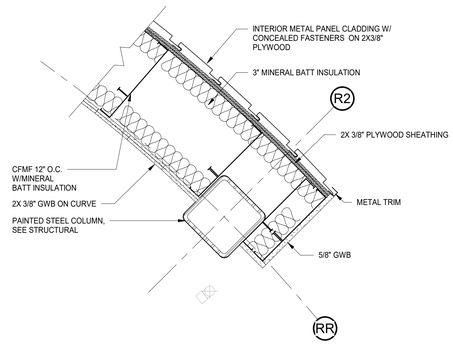
9 PD-011-CW-MPW PLANETARIUM
1 1/2" = 1'-0"



8 PLAN DETAIL PHENOLIC PANEL & CW
1 1/2" = 1'-0"



7 PLAN DETAIL - METAL PANEL & CURTAIN WALL
1 1/2" = 1'-0"



6 PLAN DETAIL - INTERIOR METAL PANEL TERMINATION
1 1/2" = 1'-0"

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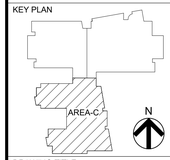
Project Status

KEY PLAN



DRAWING TITLE

PLAN DETAILS - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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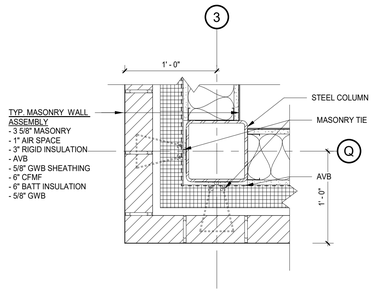

5 PLAN DETAIL
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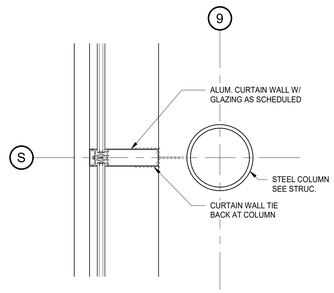

4 PLAN DETAIL
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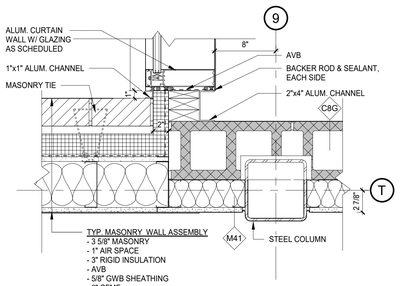

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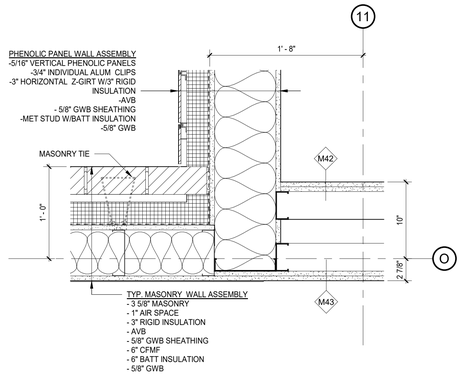

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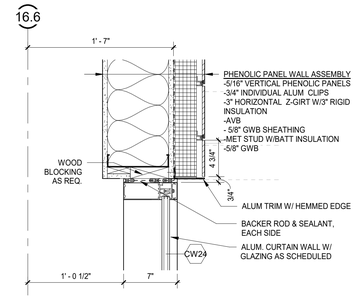
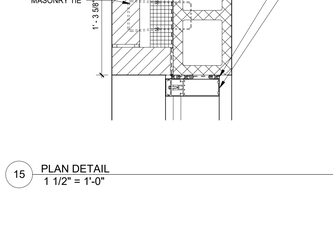
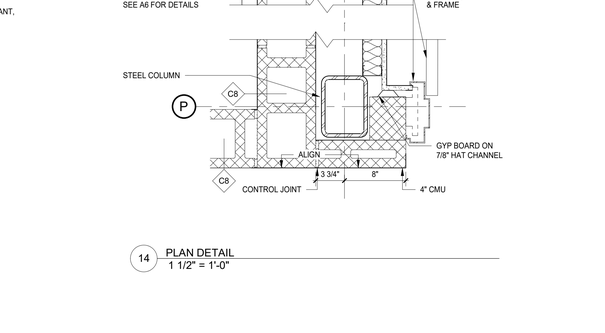
1 1/2" = 1'-0"



1 PLAN DETAIL
1 1/2" = 1'-0"



9 PLAN DETAIL
1 1/2" = 1'-0"



8 PLAN DETAIL
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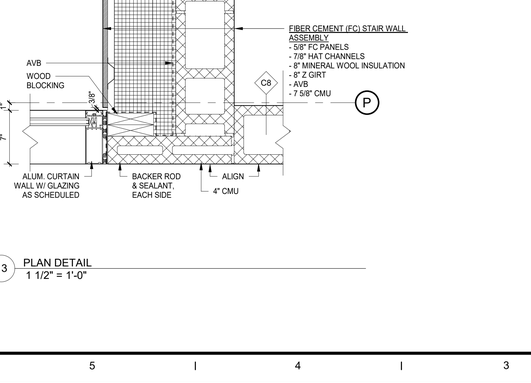
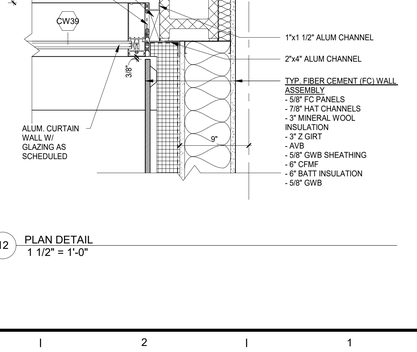
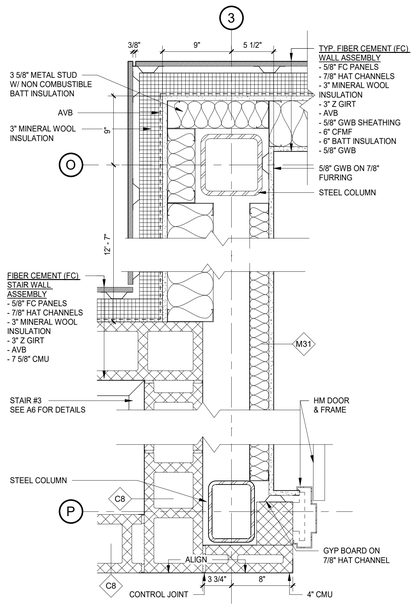


7 PLAN DETAIL
1 1/2" = 1'-0"

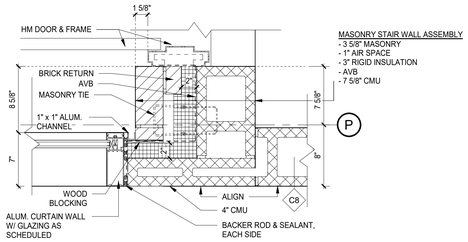


6 PLAN DETAIL
1 1/2" = 1'-0"

15 PLAN DETAIL
1 1/2" = 1'-0"

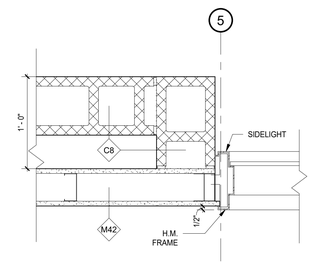


14 PLAN DETAIL
1 1/2" = 1'-0"



13 PLAN DETAIL
1 1/2" = 1'-0"

11 PLAN DETAIL
1 1/2" = 1'-0"



10 PLAN DETAIL
1 1/2" = 1'-0"

12 PLAN DETAIL
1 1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

PLAN DETAILS - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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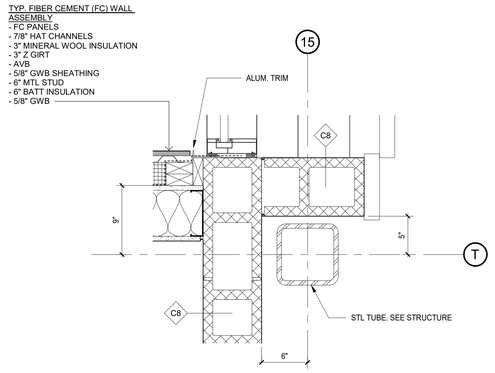
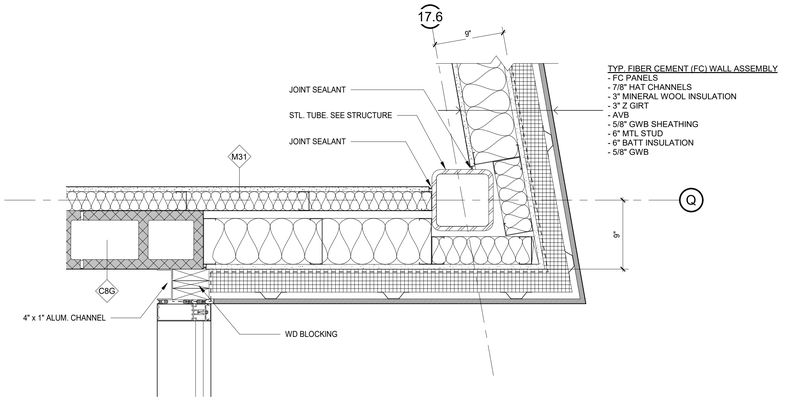
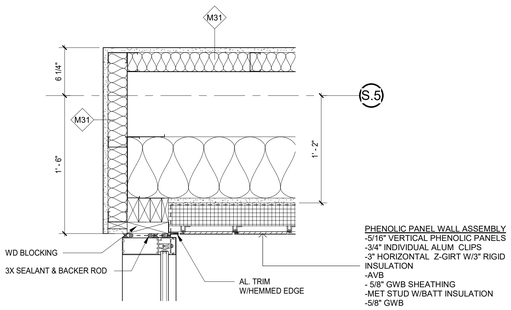


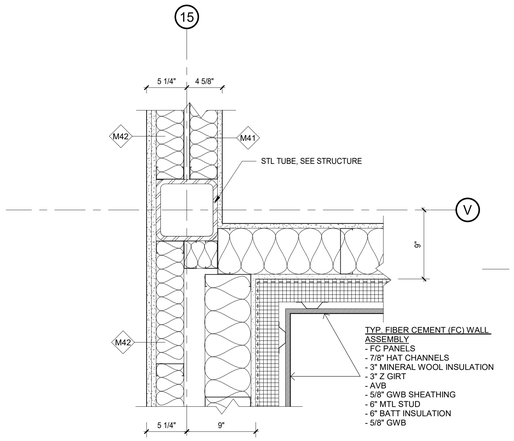
3 PLAN DETAIL @ 15 & T
1 1/2" = 1'-0"



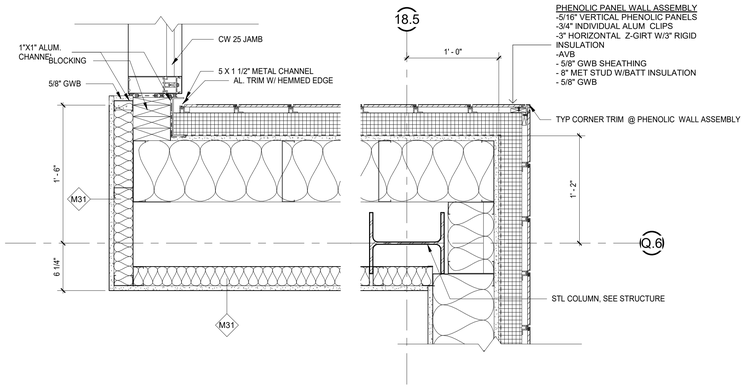
2 PLAN DETAIL @ 17.7 & Q
1 1/2" = 1'-0"



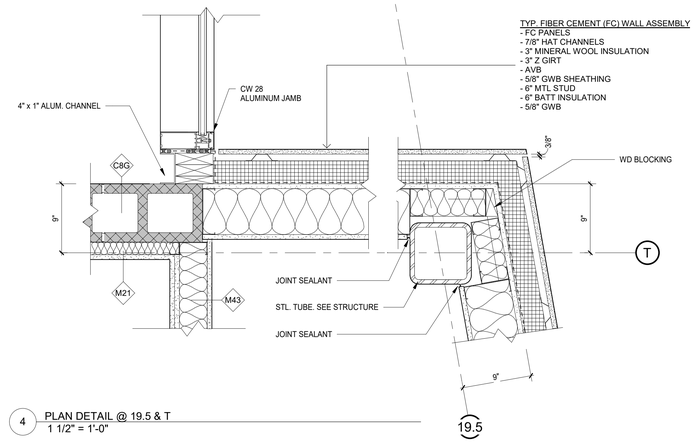
1 PD-008-CW JAMB B041
1 1/2" = 1'-0"



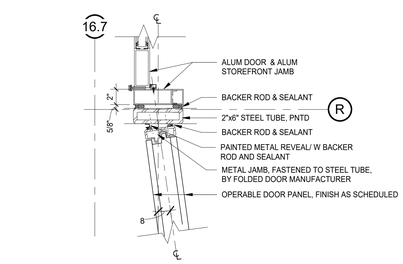
6 PLAN DETAIL @ 15 & V
1 1/2" = 1'-0"



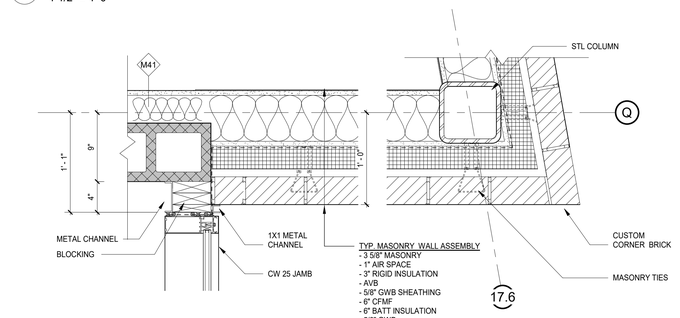
5 NE CORNER OF B138
1 1/2" = 1'-0"



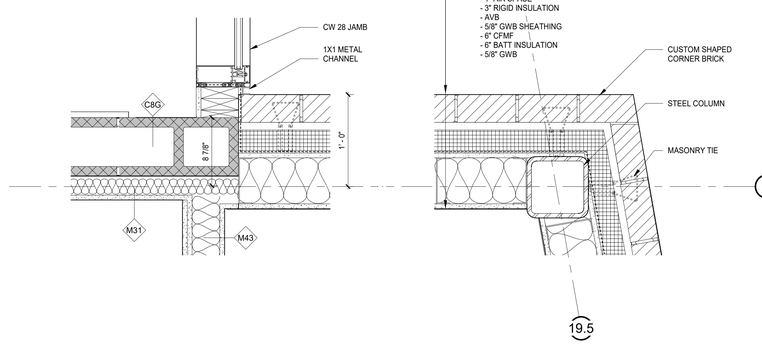
4 PLAN DETAIL @ 19.5 & T
1 1/2" = 1'-0"



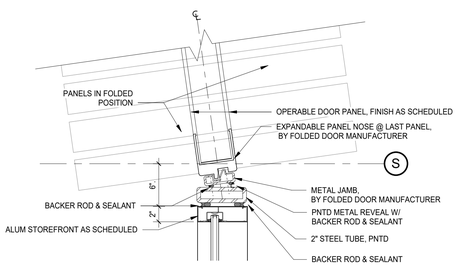
12 PLAN DETAIL@FOLDED PARTITION
1 1/2" = 1'-0"



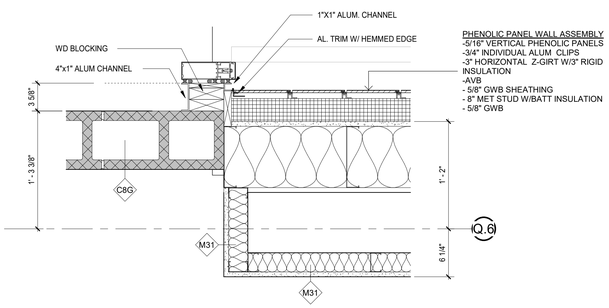
11 PD-009-CW DOOR JAMB S001
1 1/2" = 1'-0"



10 PD-009-CW JAMB B041
1 1/2" = 1'-0"



9 PLAN DETAIL@FOLDED PARTITION NORTH
1 1/2" = 1'-0"



8 PD-010-CW JAMB S001
1 1/2" = 1'-0"

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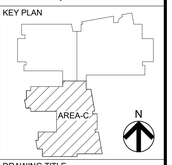

DRAWING TITLE

PLAN DETAILS - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

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3	03/16/2026	50% CD
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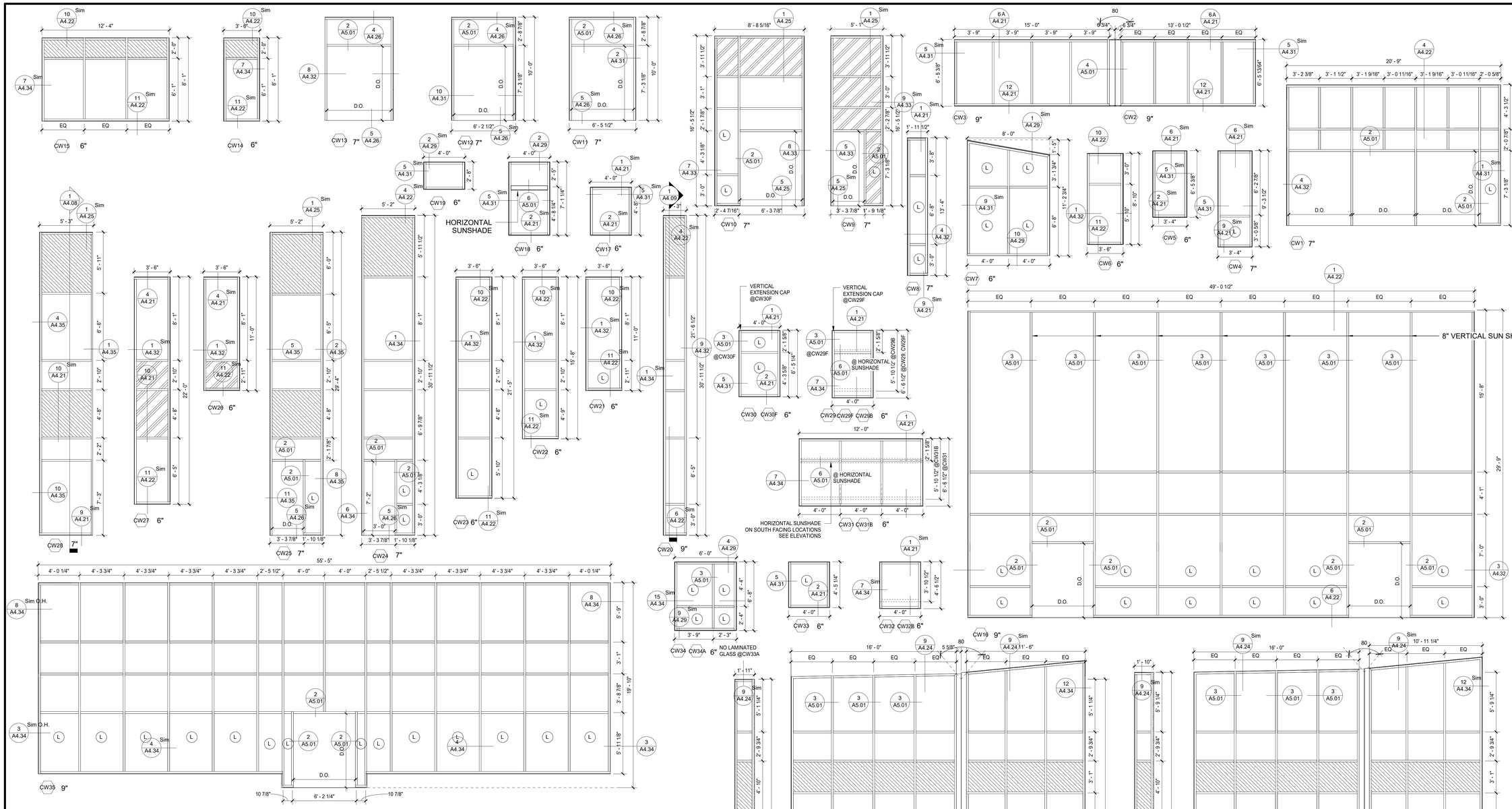
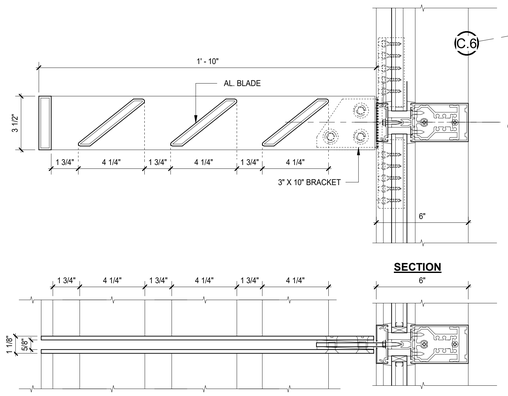


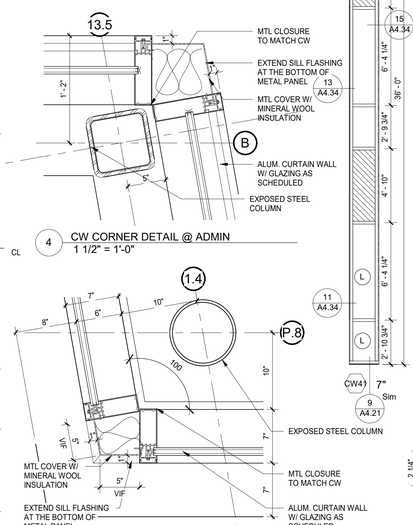
CURTAIN WALL / WINDOW LEGEND

- SPANDREL GLASS (IG-2)
- METAL PANEL INFILL
- FROSTED GLASS
- (L) LAMINATED GLASS (IG-3)
- (F) FIRE RATED GLASS (GL-2)
- (TF) TRANSPARENT GLAZING FILM

- (IG-1), TYPICAL EXTERIOR GLAZING UNLESS OTHERWISE NOTED.
- ALL OPENINGS SHALL BE FIELD VERIFIED.
- ALL WOOD BLOCKING USED AT JAMB,SILL AND HEAD OF WINDOW, LOUVER AND CURTAIN WALL TO BE FIRE RETARDANT TREATED WOOD (FRTW)
- ALL DIMENSIONS ARE R.O.
- ALL EXTERIOR DOUBLE DOORS TO RECEIVE REMOVABLE DIVIDER MULLIONS. MULLION WIDTH IS INCLUDED IN DOOR OPENING.
- PROVIDE WINDOW NUMBER DECAL ON EXTERIOR WINDOWS AND CWs,ONE FOR EACH SPACE.

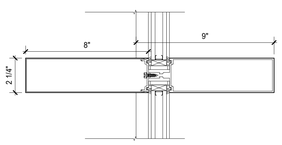


6 C.W SUN SHADE DETAIL
3" = 1'-0"

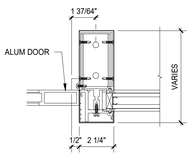


4 CW CORNER DETAIL @ ADMIN
1 1/2" = 1'-0"

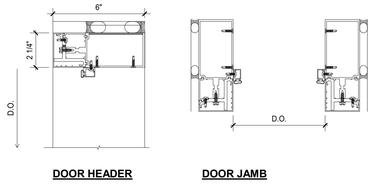
5 CW CORNER DETAIL @ BREAK OUT
1 1/2" = 1'-0"



3 CW FACECAP 8IN VERTICAL
3" = 1'-0"



2 CW DOOR JAMB/HEAD DETAIL
3" = 1'-0"



1 CW DOOR HEAD / JAMB DETAILS (TYP)
3" = 1'-0"

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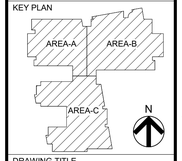
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

CURTAIN WALL SCHEDULE AND DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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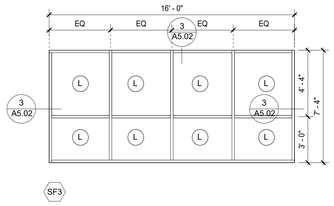
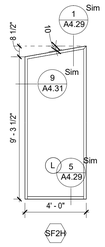
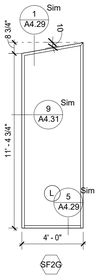
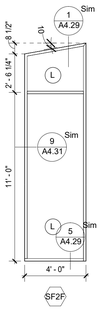
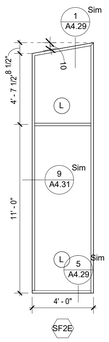
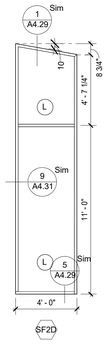


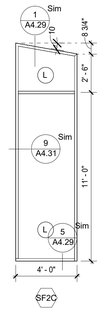


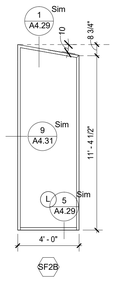


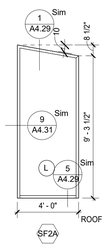


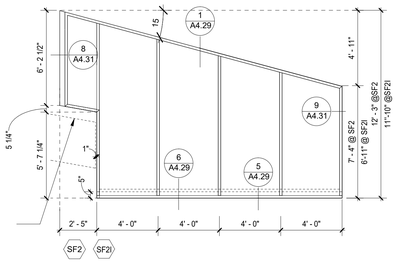


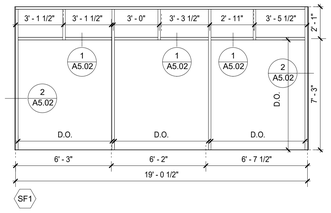


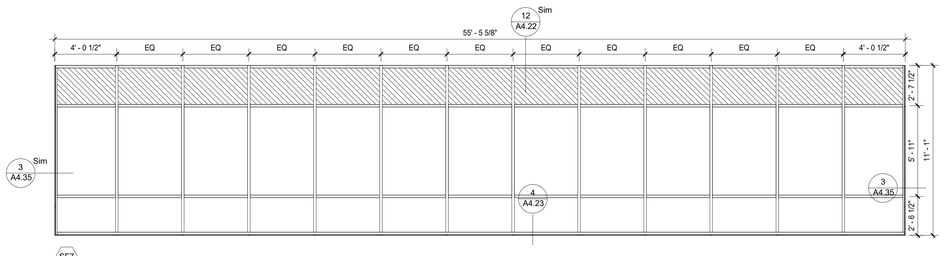


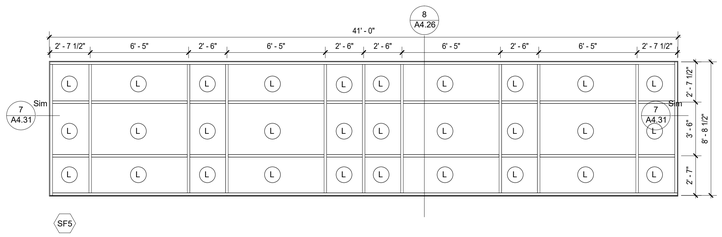


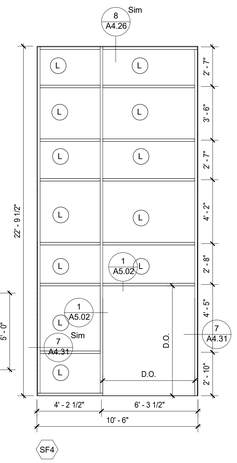


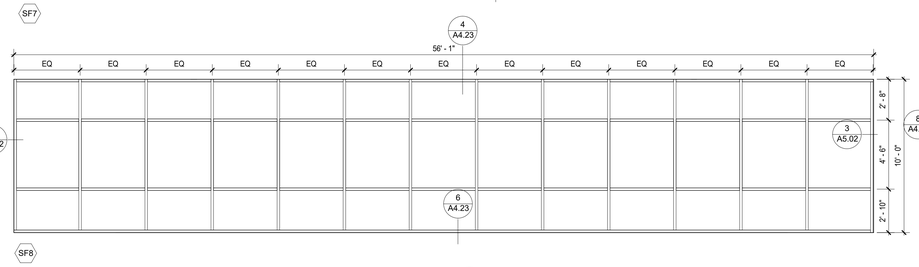


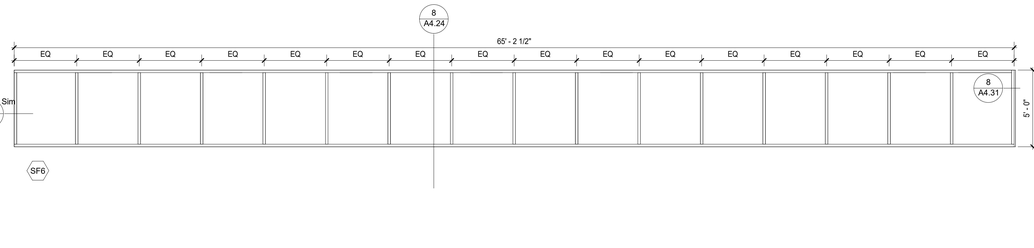


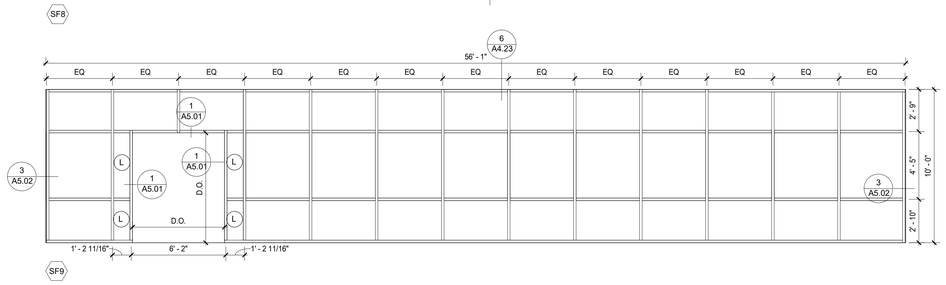


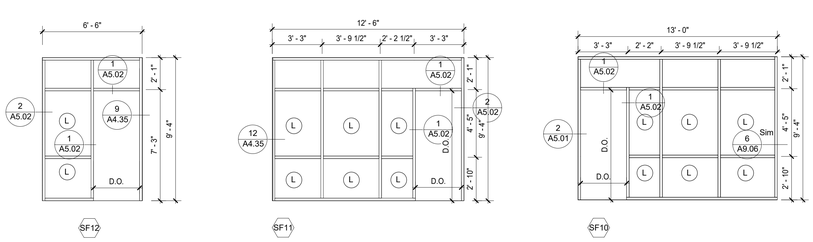


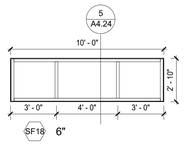


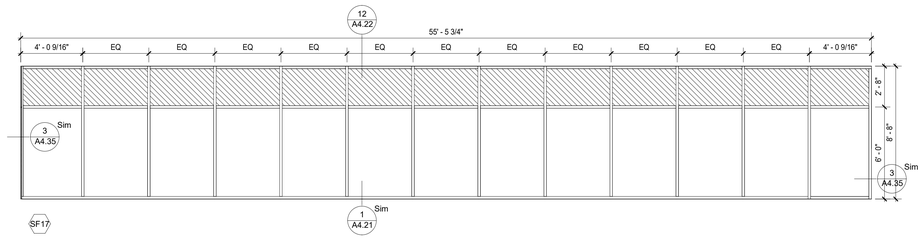


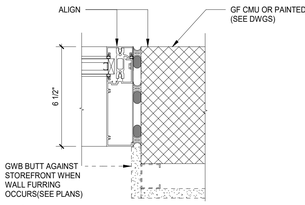




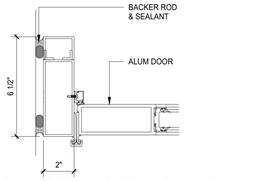








3 SF JAMB, HEAD & SILL DETAIL AT CMU (TYP)
3" = 1'-0"



2 SF ALUM. DOOR JAMB DETAIL AT WALL (TYP)
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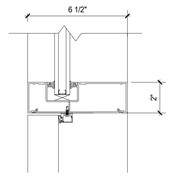

1 SF ALUM. DOOR HEAD/JAMB DETAILS (TYP)
3" = 1'-0"

STOREFRONT LEGEND

- ALL OPENINGS SHALL BE FIELD VERIFIED.
- (T) TEMPERED GLASS (GL-1)
- (L) LAMINATED GLASS (GL-3)

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STOREFRONT SCHEDULE AND DETAILS

STATE PROJ. NO.	144-0108N
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ISSUE DATES

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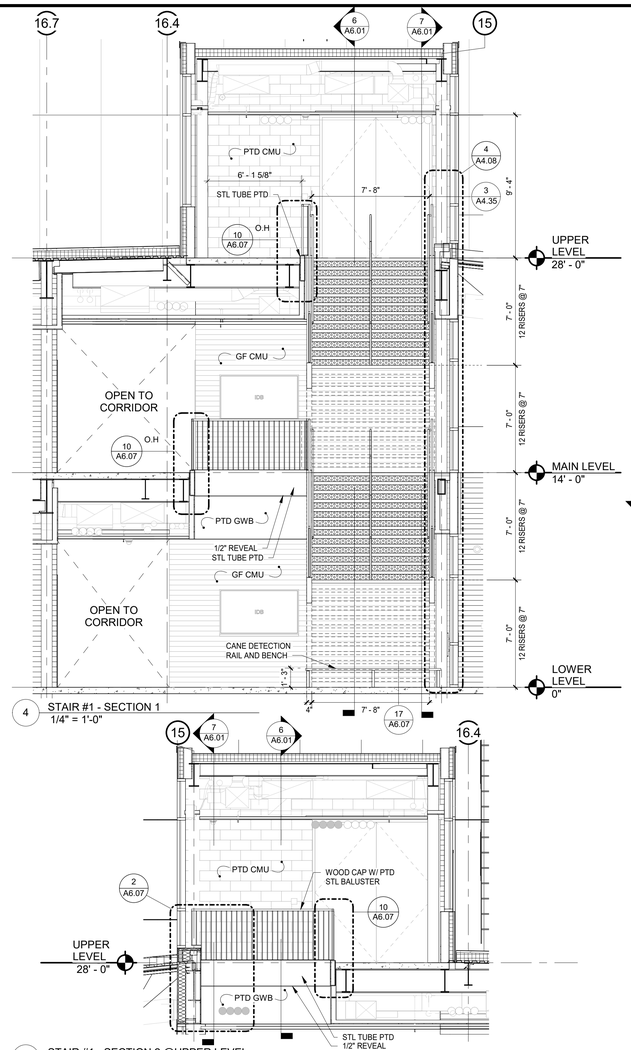
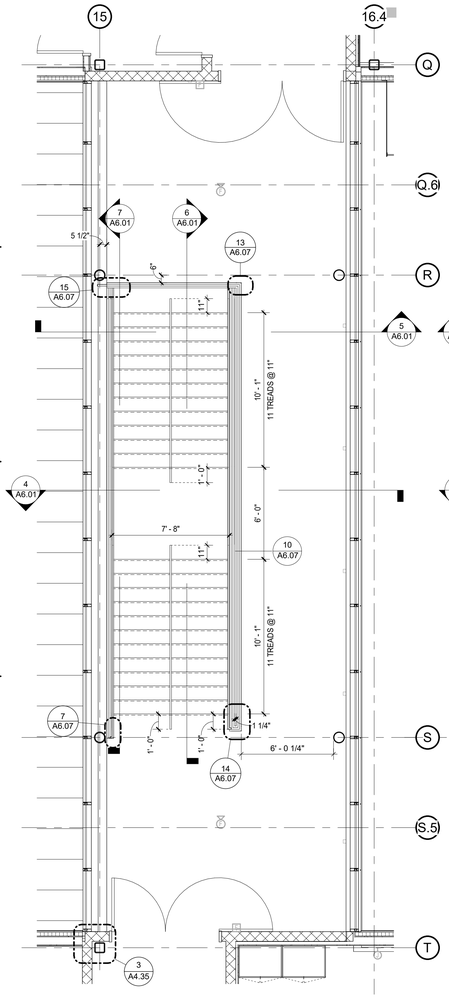
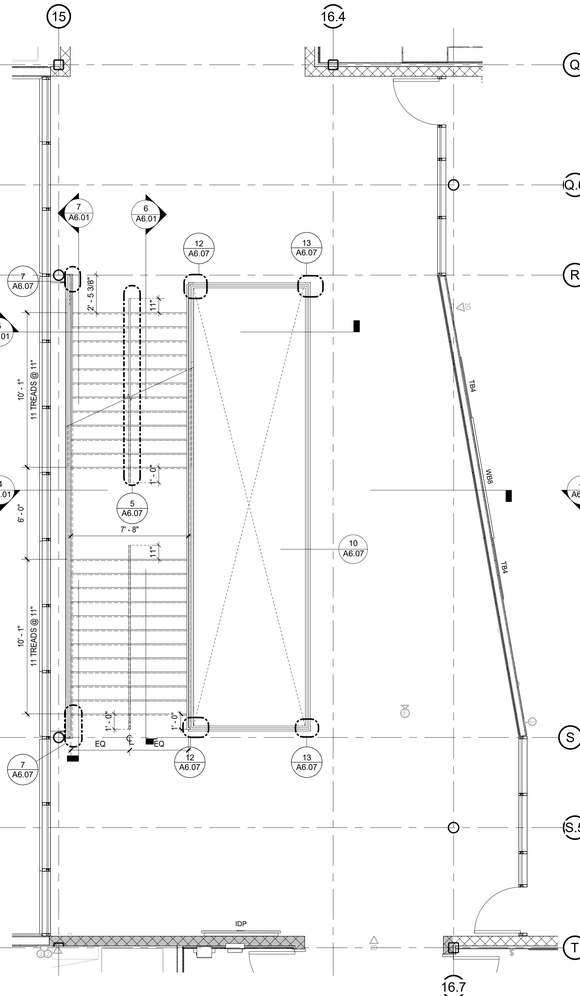


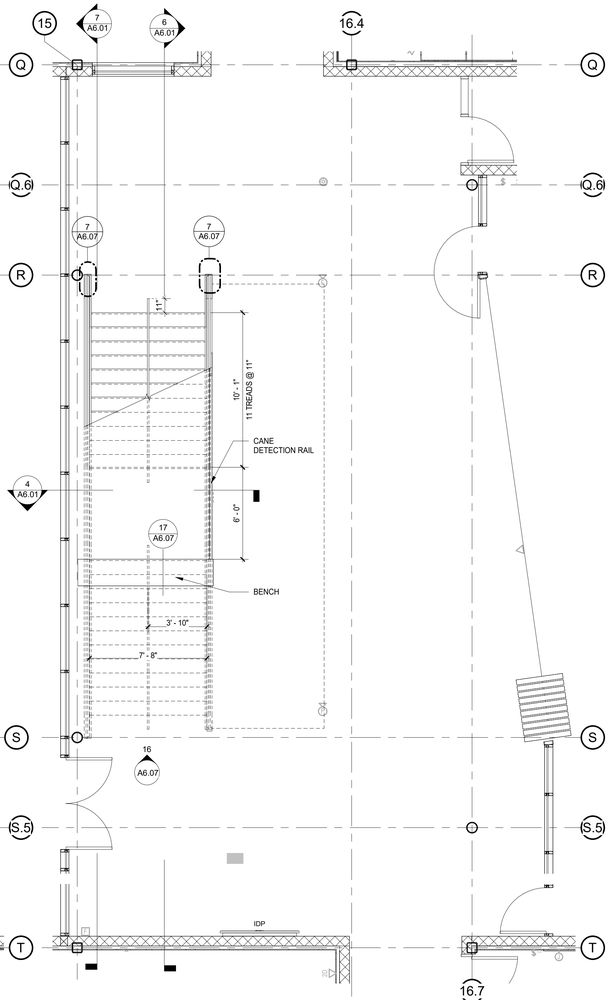
4 STAIR #1 - SECTION 1
1/4" = 1'-0"



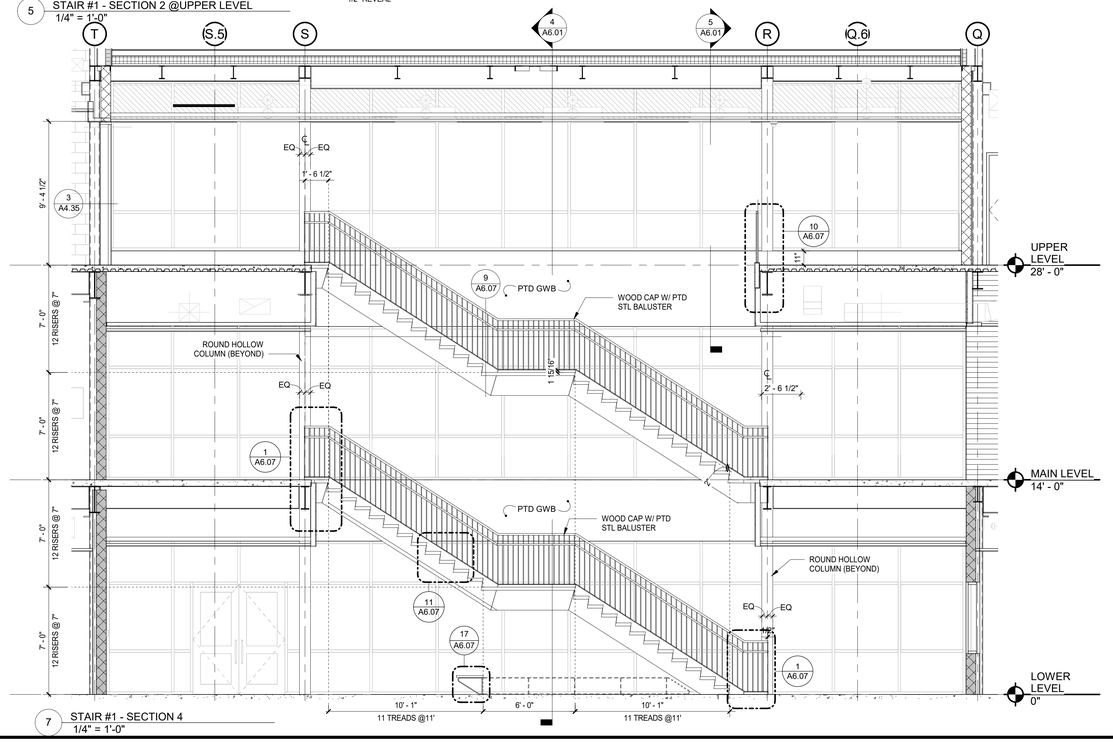
3 STAIR #1 - UPPER LEVEL
1/4" = 1'-0"



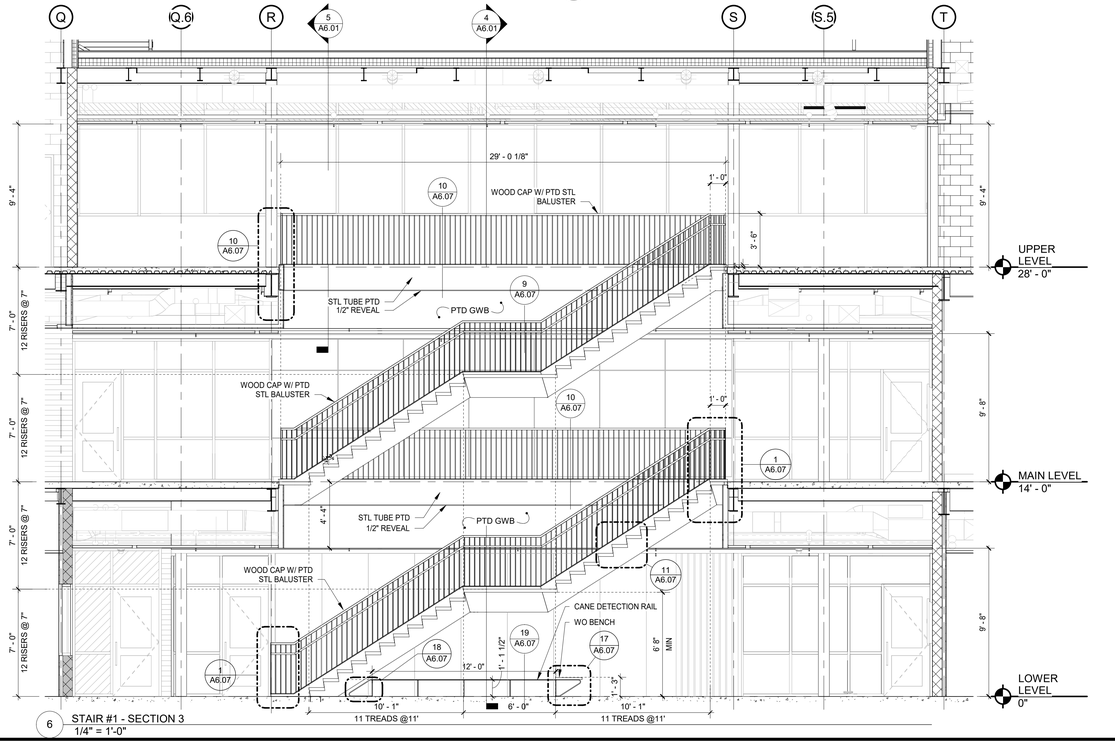
2 STAIR #1 - MAIN LEVEL
1/4" = 1'-0"



1 STAIR #1 - LOWER LEVEL
1/4" = 1'-0"



7 STAIR #1 - SECTION 4
1/4" = 1'-0"



6 STAIR #1 - SECTION 3
1/4" = 1'-0"

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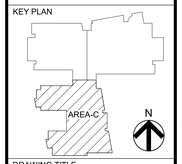
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STAIR PLANS AND SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
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DRAWN BY	Author
APPROVED BY	Approver

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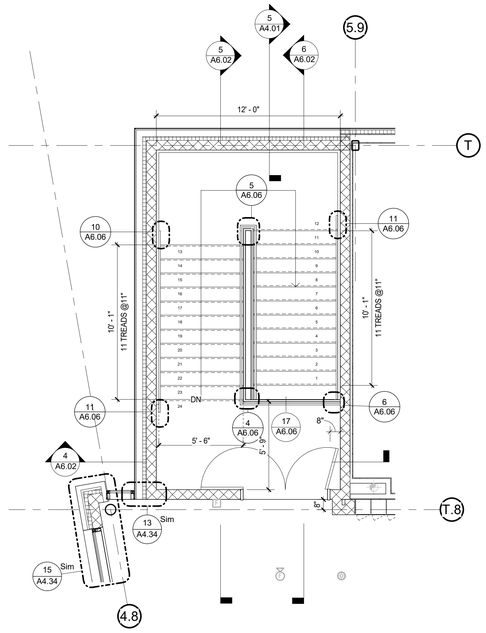
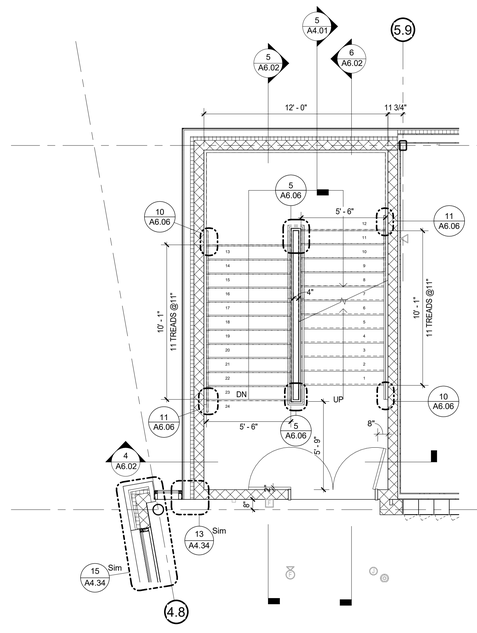
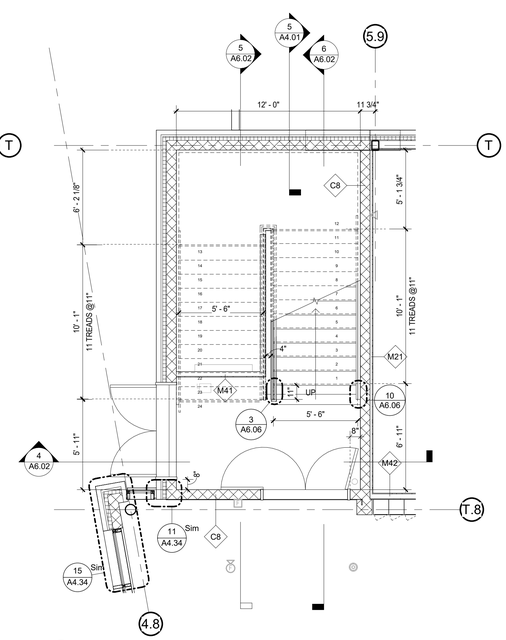


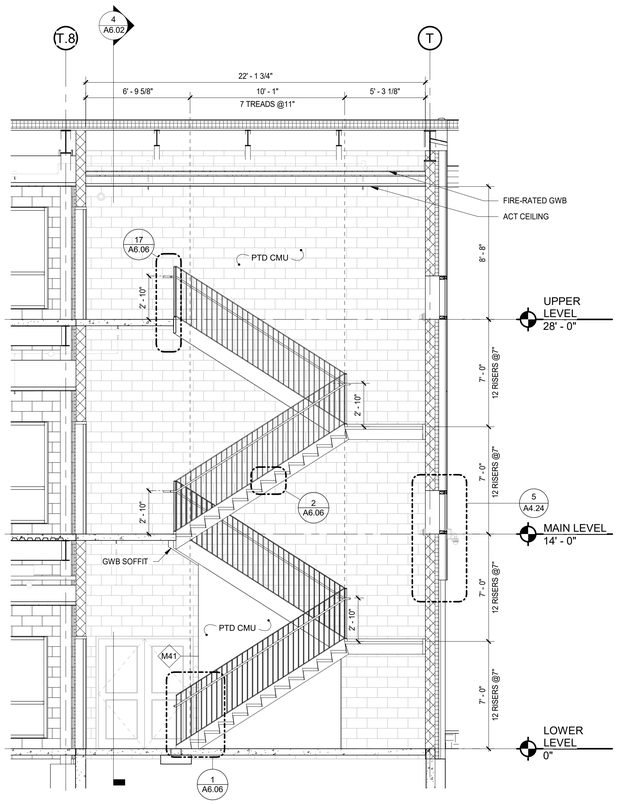
3 STAIR #2 - UPPER FLOOR PLAN
1/4" = 1'-0"



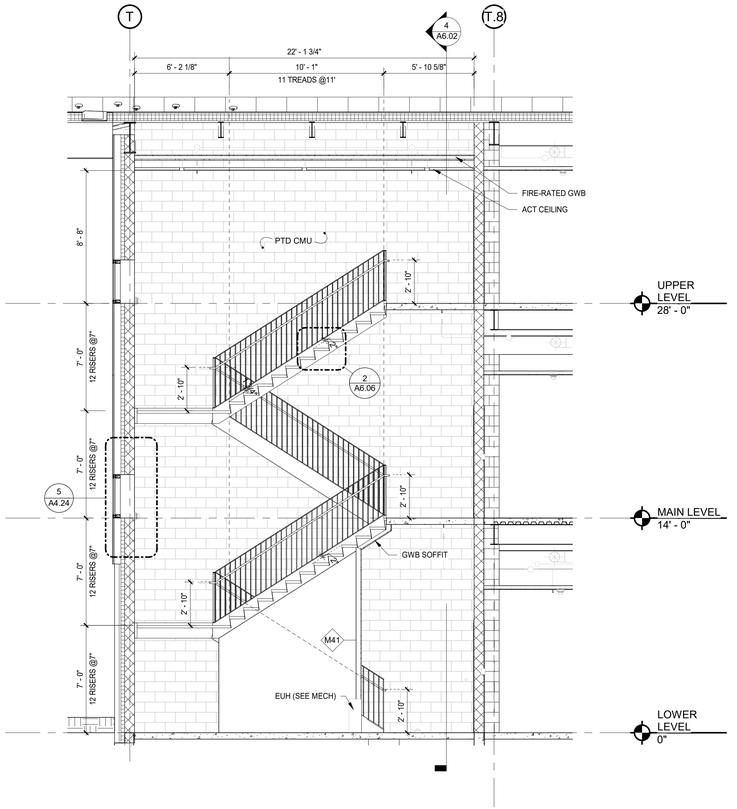
2 STAIR #2 - MAIN FLOOR PLAN
1/4" = 1'-0"



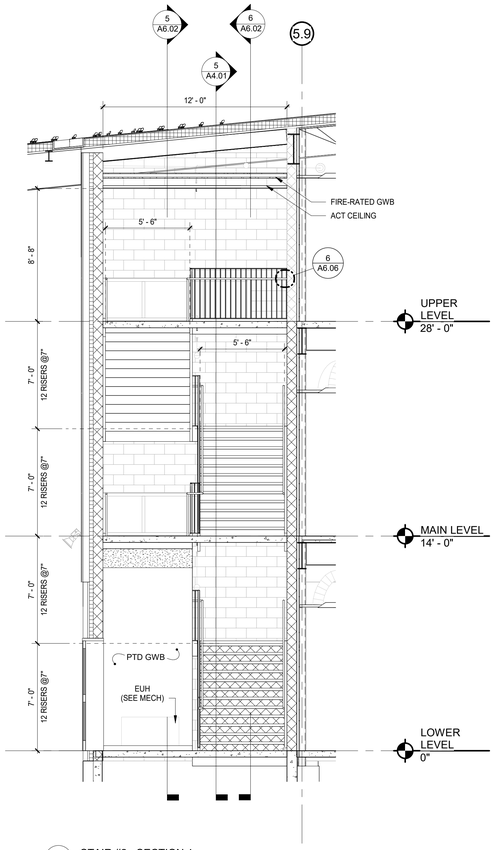
1 STAIR #2 - LOWER FLOOR PLAN
1/4" = 1'-0"



6 STAIR #2 - SECTION 3
1/4" = 1'-0"



5 STAIR #2 - SECTION 2
1/4" = 1'-0"



4 STAIR #2 - SECTION 1
1/4" = 1'-0"

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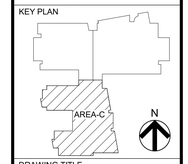

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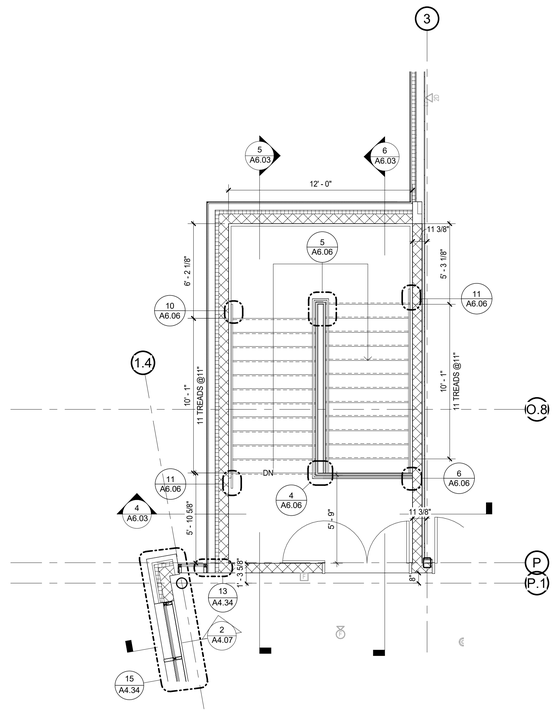

3 STAIR #3 - UPPER FLOOR PLAN
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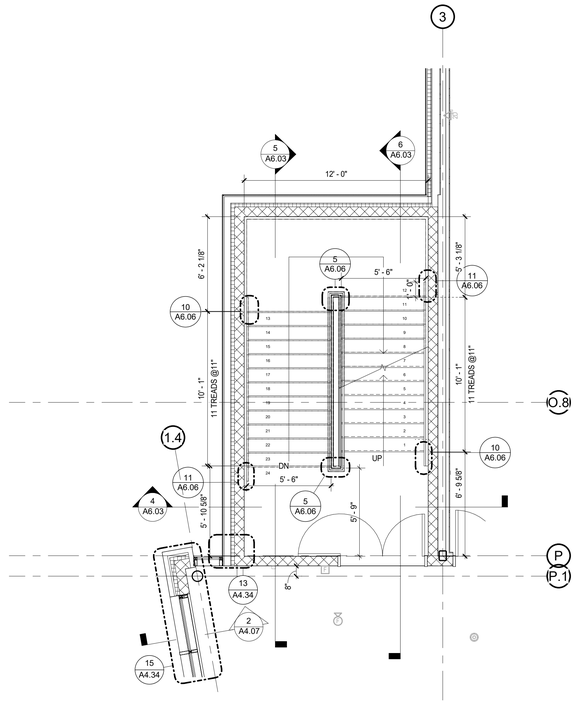

2 STAIR #3 - MAIN FLOOR PLAN
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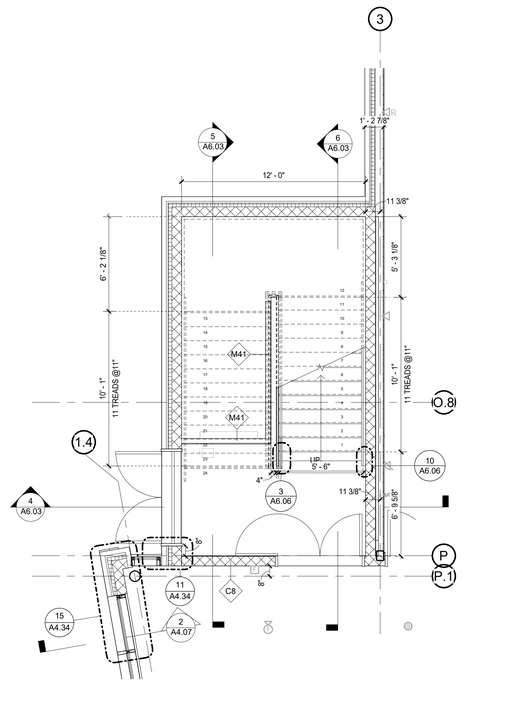
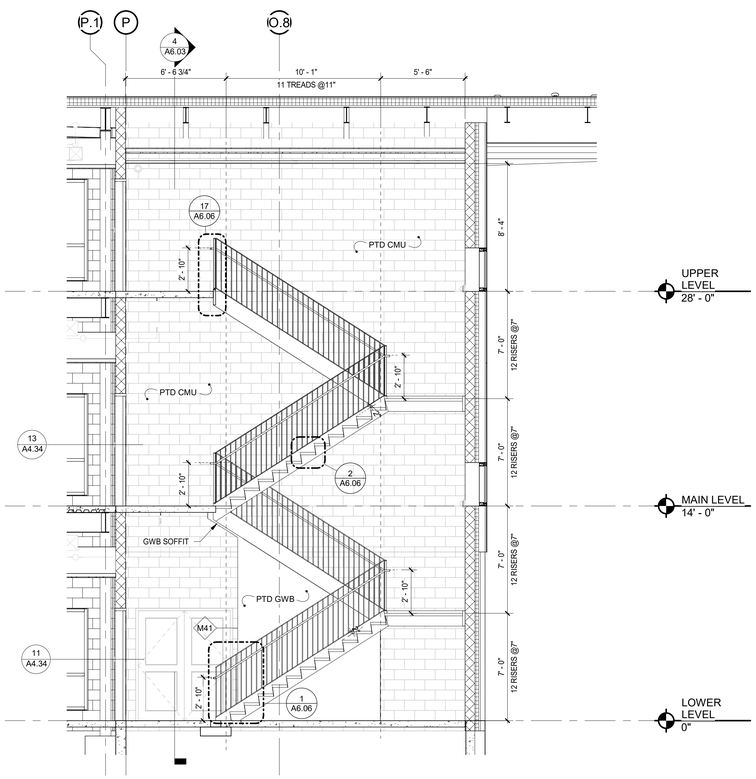
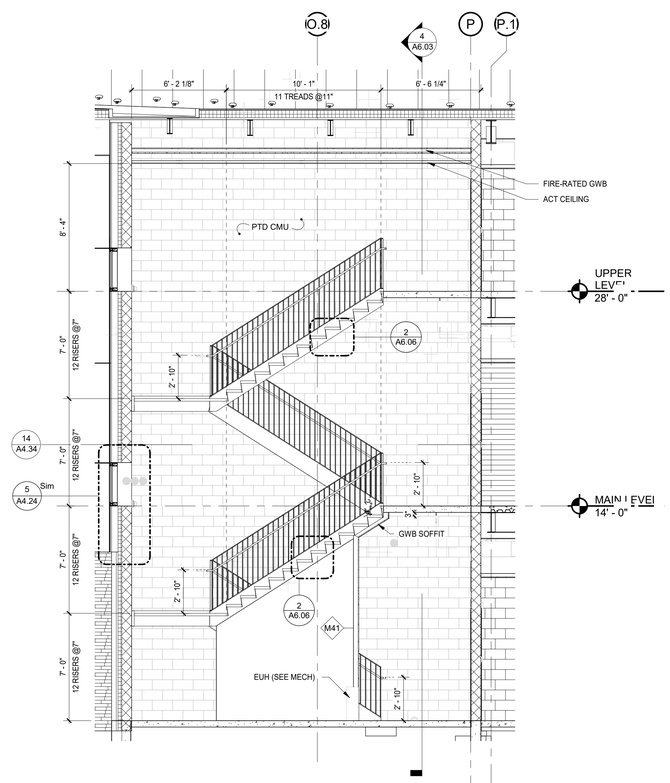


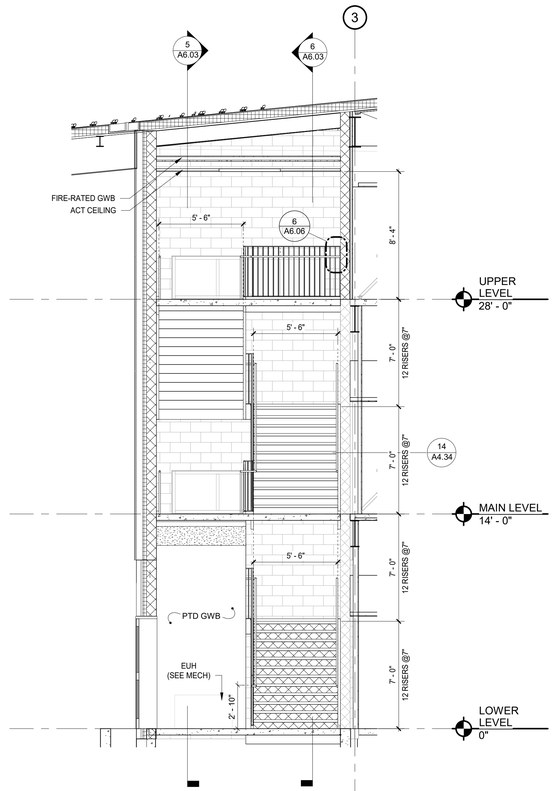
1 STAIR #3 - LOWER FLOOR PLAN
1/4" = 1'-0"



6 STAIR #3 - SECTION 3
1/4" = 1'-0"



5 STAIR #3 - SECTION 2
1/4" = 1'-0"



4 STAIR #3 - SECTION 1
1/4" = 1'-0"

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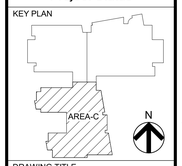
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STAIR PLANS AND SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A6.03

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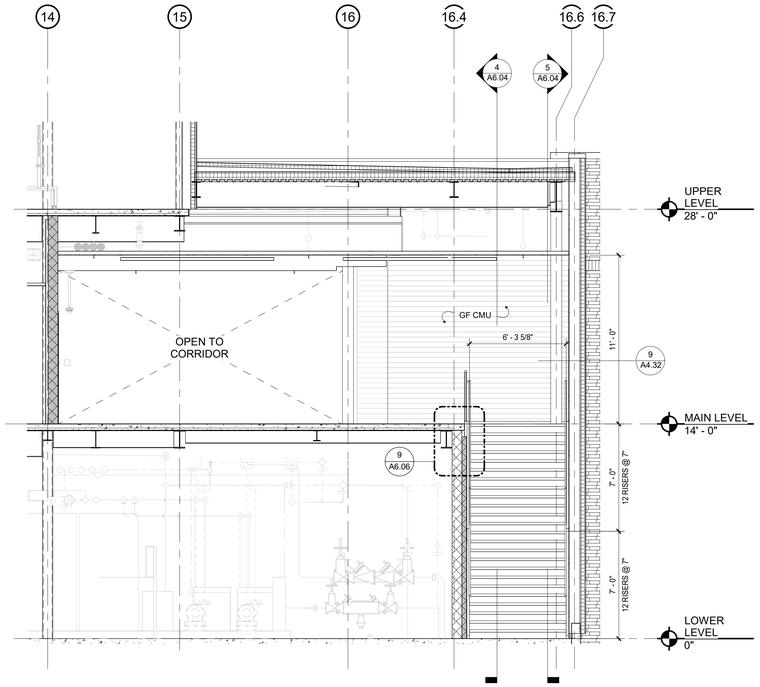
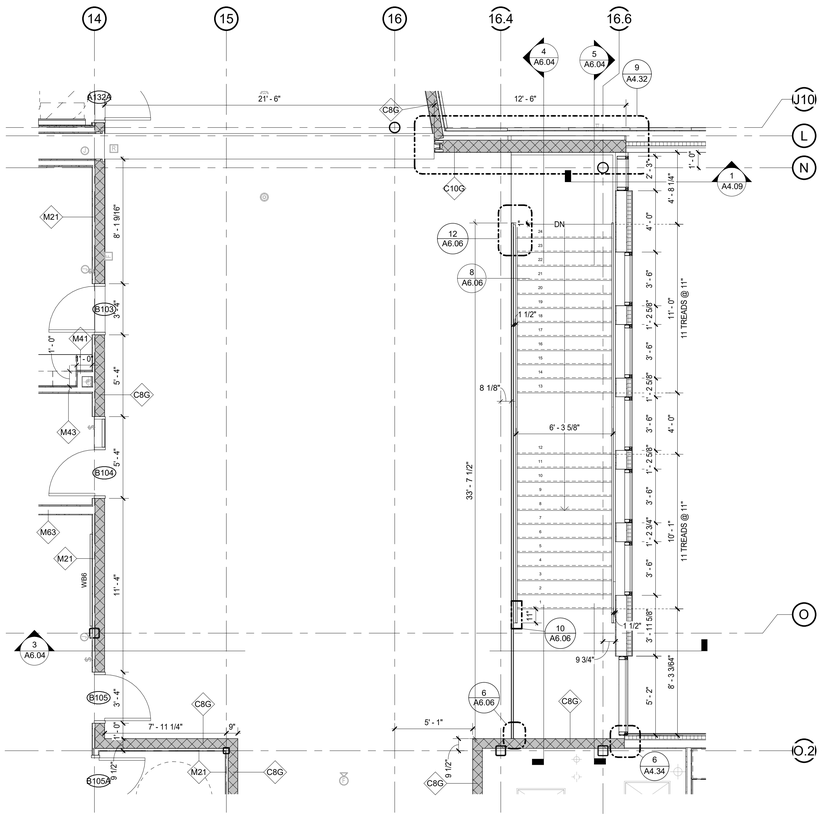
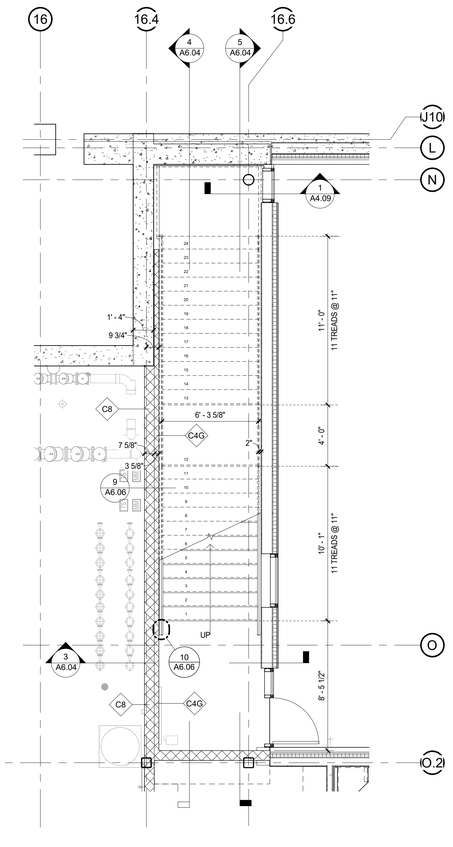


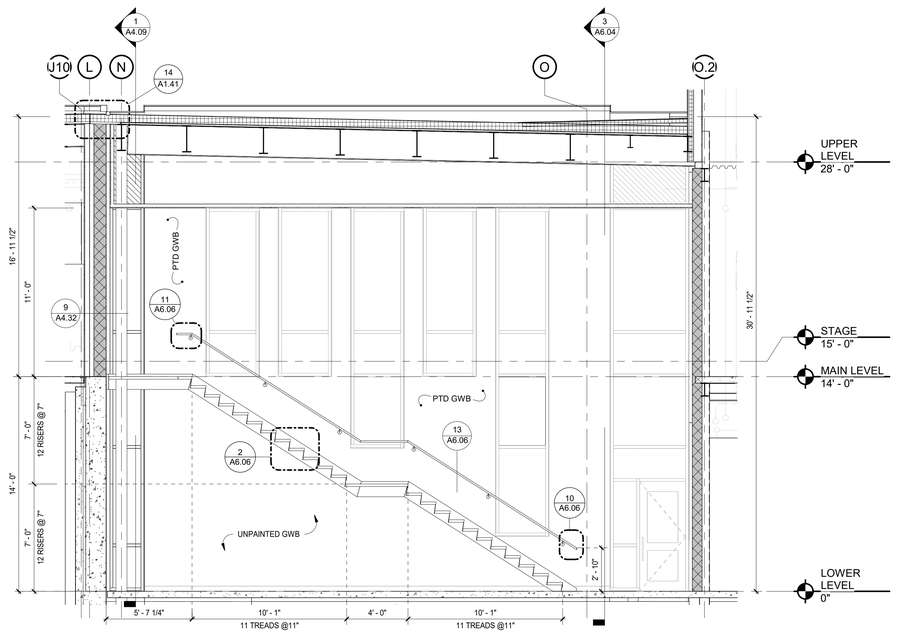
3 STAIR #4 - SECTION 1
1/4" = 1'-0"



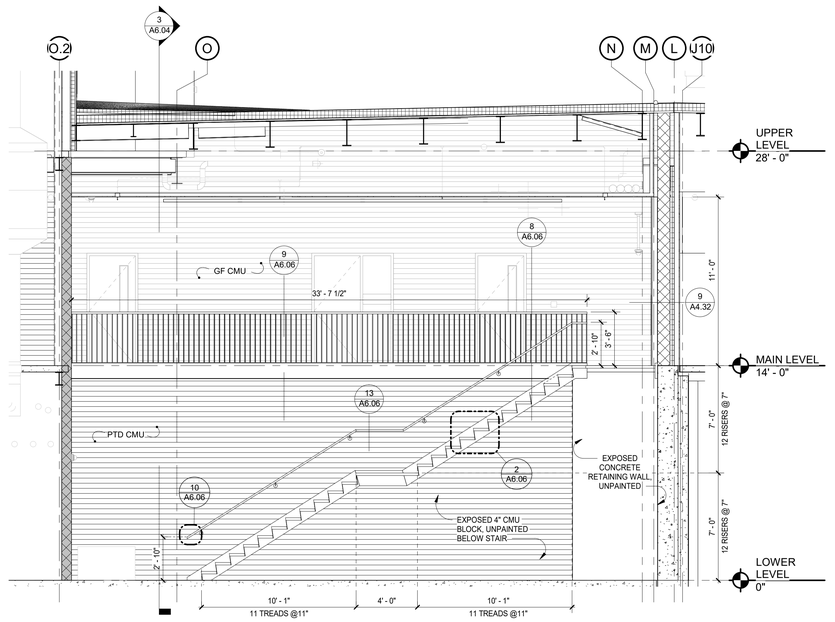
2 STAIR #4 - MAIN LEVEL
1/4" = 1'-0"



1 STAIR #4 - LOWER LEVEL
1/4" = 1'-0"



5 STAIR #4 - SECTION 3
1/4" = 1'-0"



4 STAIR #4 - SECTION 2
1/4" = 1'-0"

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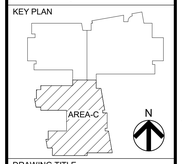
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STAIR PLANS AND SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
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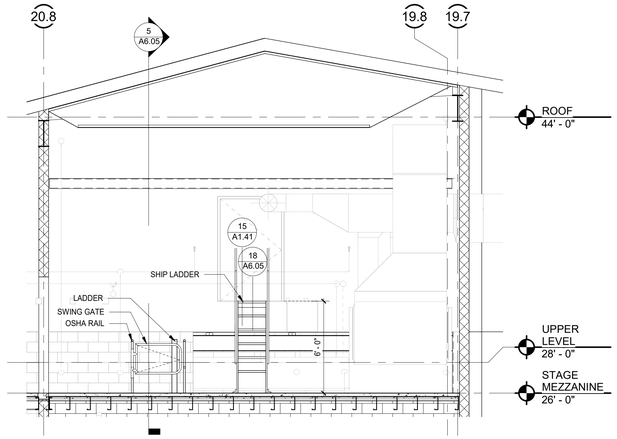
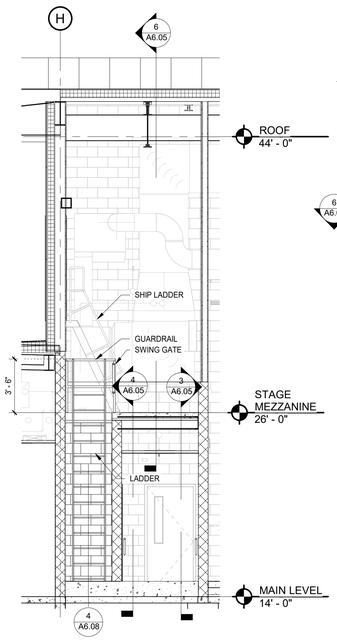
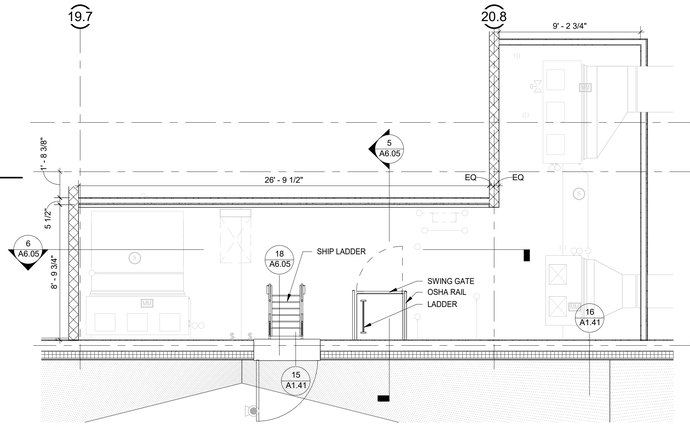


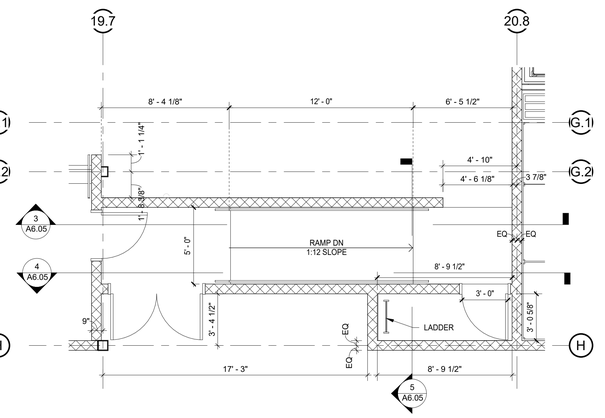
6 M140 MEZZ - SECTION 4
1/4" = 1'-0"



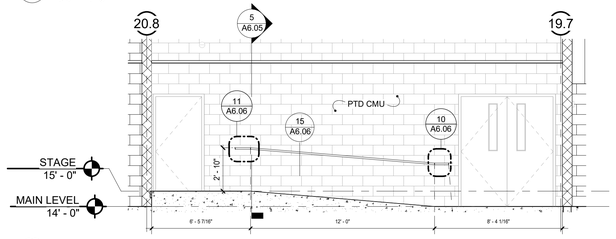
5 A139 STAGE ACCESS - SECTION 3
1/4" = 1'-0"



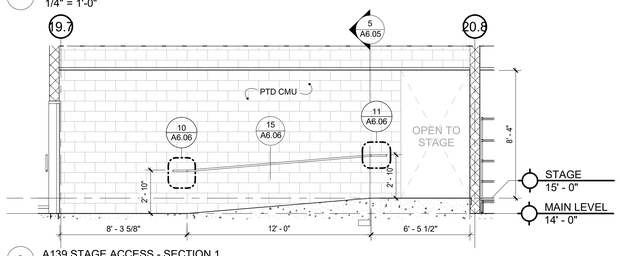
2 M140 MEZZ - PLAN
1/4" = 1'-0"



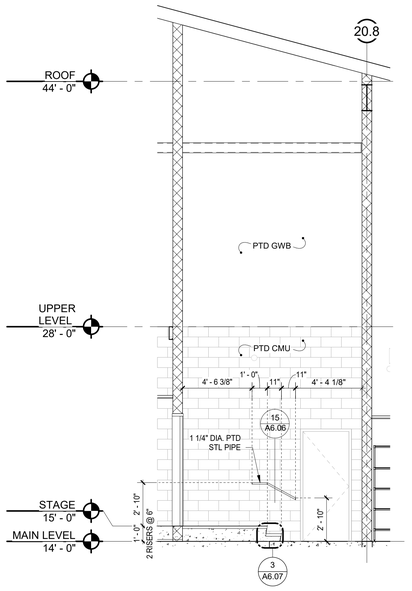
1 A139 STAGE ACCESS - PLAN
1/4" = 1'-0"



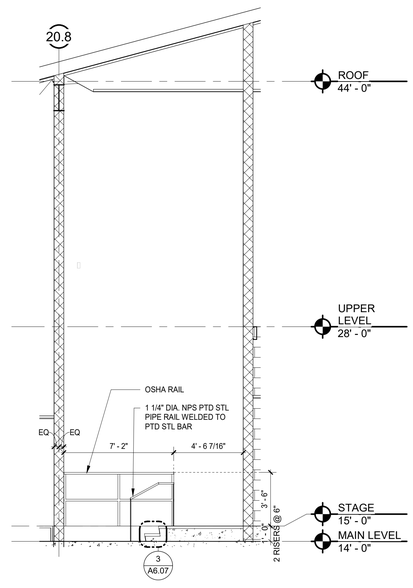
4 A139 STAGE ACCESS - SECTION 2
1/4" = 1'-0"



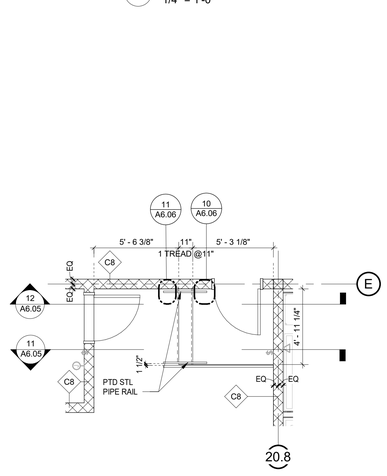
3 A139 STAGE ACCESS - SECTION 1
1/4" = 1'-0"



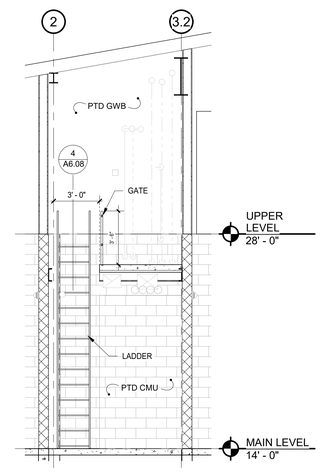
12 A139 PLATFORM - SECTION 2
1/4" = 1'-0"



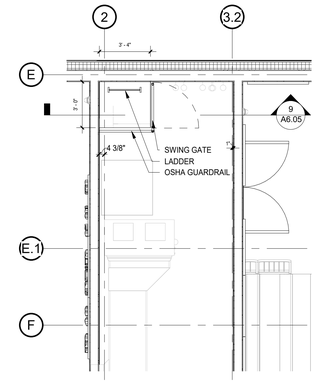
11 A139 PLATFORM - SECTION 1
1/4" = 1'-0"



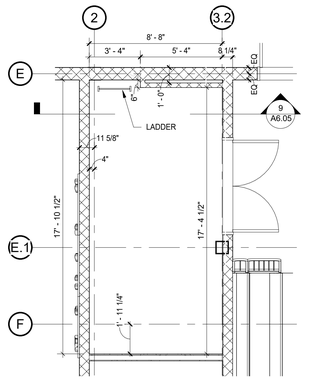
10 A139 PLATFORM - STAIR
1/4" = 1'-0"



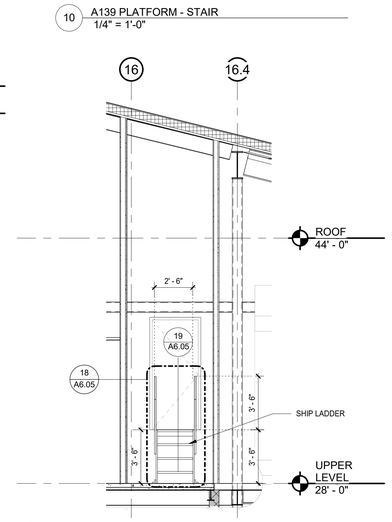
9 A121A + M142 - MEZZ ACCESS - SECTION
1/4" = 1'-0"



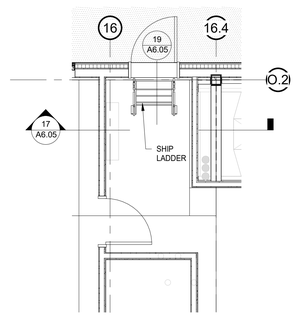
8 M142 - MEZZ LEVEL - PLAN
1/4" = 1'-0"



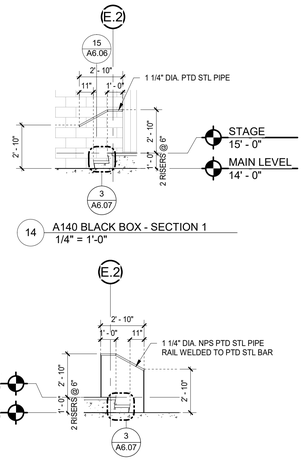
7 A121A - CHAIR ST ACCESS - PLAN
1/4" = 1'-0"



17 B203A - MECH/ELEC
1/4" = 1'-0"

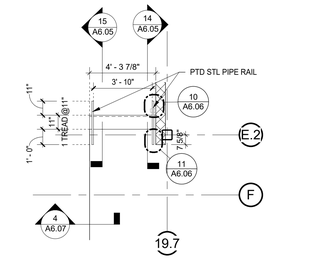


16 B203A - MECH/ELEC
1/4" = 1'-0"

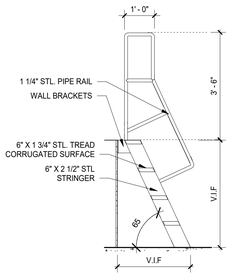


15 A140 BLACK BOX - SECTION 2
1/4" = 1'-0"

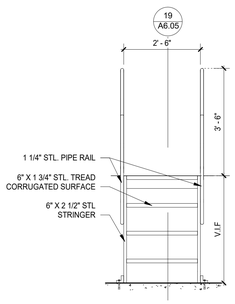
14 A140 BLACK BOX - SECTION 1
1/4" = 1'-0"



13 A140 BLACK BOX - STAIR TYP.
1/4" = 1'-0"



19 SHIP LADDER TYP. - SECTION
1/2" = 1'-0"



18 SHIP LADDER TYP.
1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STAIR PLANS AND SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
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DRAWN BY	Author
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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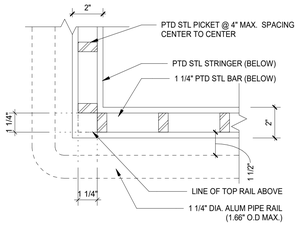
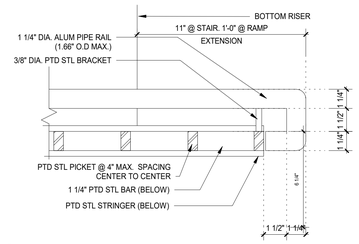
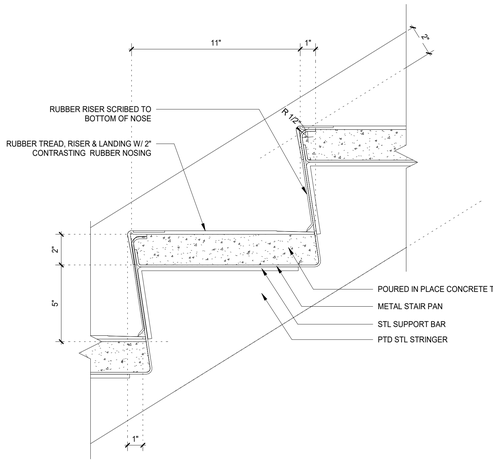


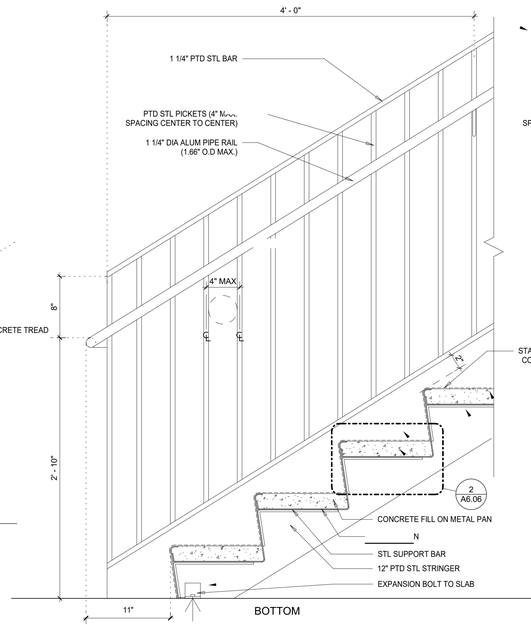
4 ST-GUARDRAIL DETAIL 5
3" = 1'-0"



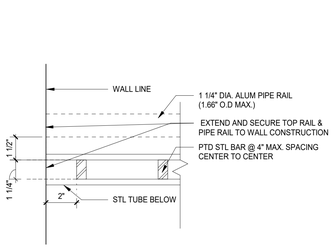
3 ST-EXTENSION @ BOTTOM OF STAIR - DETAIL1
3" = 1'-0"



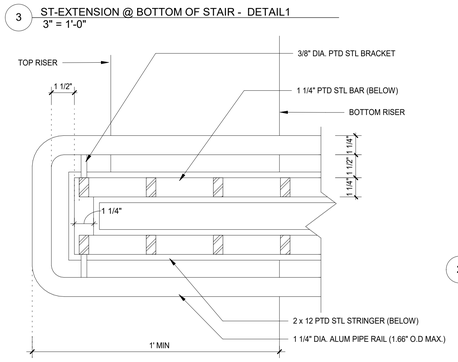
2 ST-NOSING DETAIL
3" = 1'-0"



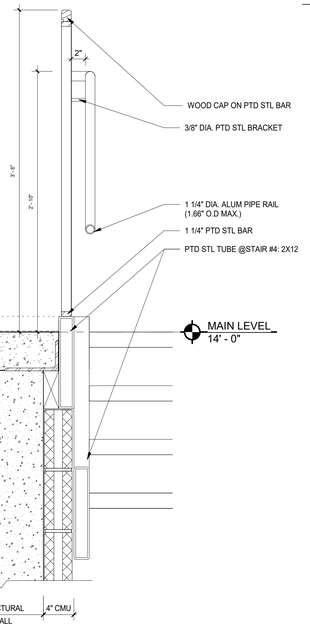
1 ST-STAIR DETAIL1
1 1/2" = 1'-0"



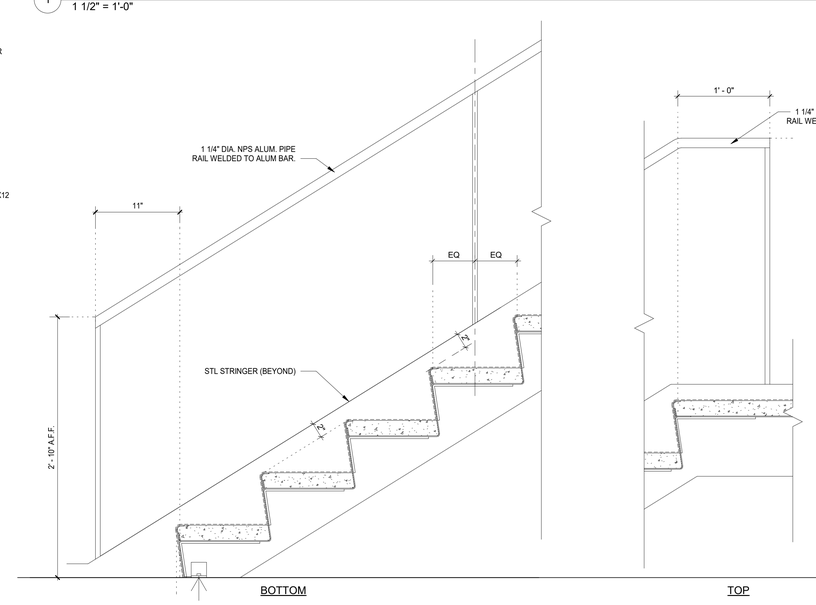
6 ST-GUARDRAIL DETAIL 6
3" = 1'-0"



5 ST-GUARDRAIL DETAIL1
3" = 1'-0"



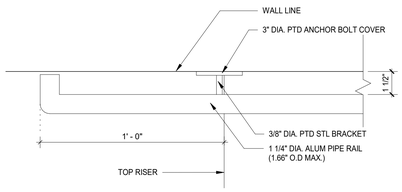
8 ST-GUARDRAIL DETAIL 1 @ STAIR #4
1 1/2" = 1'-0"



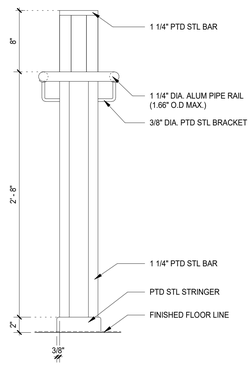
7 ST-STAIR #4 DETAIL
1 1/2" = 1'-0"

10 ST-EXTENSION @ BOTTOM OF STAIR - DETAIL 2
3" = 1'-0"

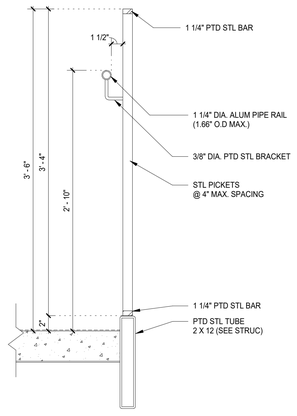
9 ST-GUARDRAIL DETAIL 2 @ STAIR #4
1 1/2" = 1'-0"



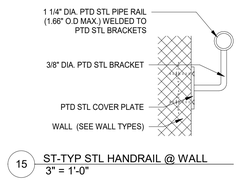
11 ST-EXTENSION @ TOP OF STAIR - DETAIL 2
3" = 1'-0"



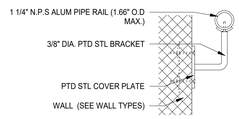
18 ST-GUARDRAIL ELEVATION @ STAIR #2&#3
1 1/2" = 1'-0"



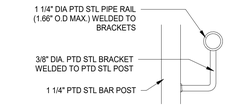
17 ST-GUARDRAIL DETAIL @ STAIR #2&#3
1 1/2" = 1'-0"



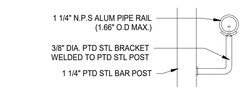
15 ST-TYP STL HANDRAIL @ WALL
3" = 1'-0"



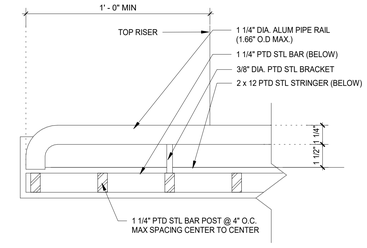
13 ST-TYP ALUM. HANDRAIL @ WALL
3" = 1'-0"



16 ST-TYP STL HANDRAIL @ STEEL POST1
3" = 1'-0"



14 ST-TYP ALUM.HANDRAIL @ STEEL POST
3" = 1'-0"



12 ST-GUARDRAIL DETAIL1 @STAIR 4
3" = 1'-0"

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OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A6.06

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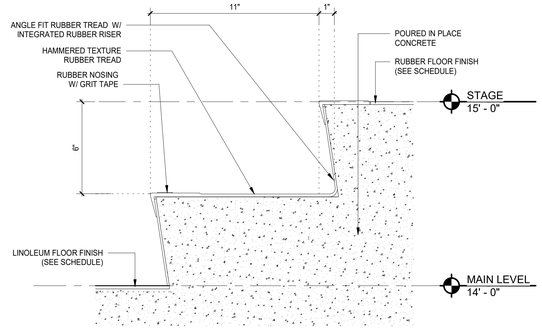
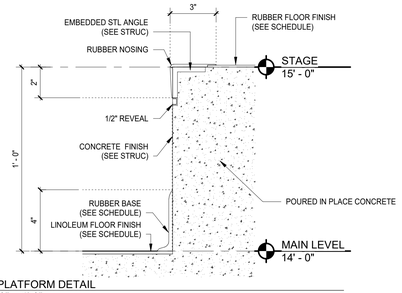
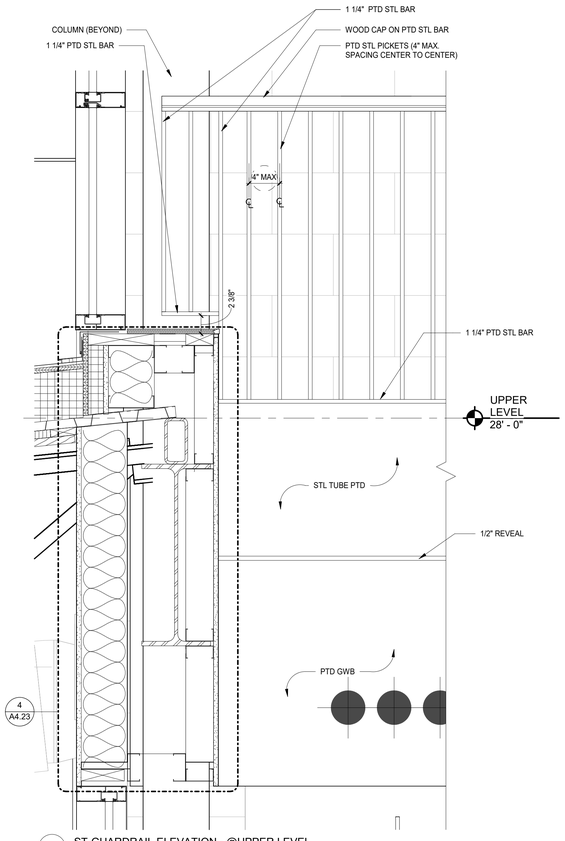


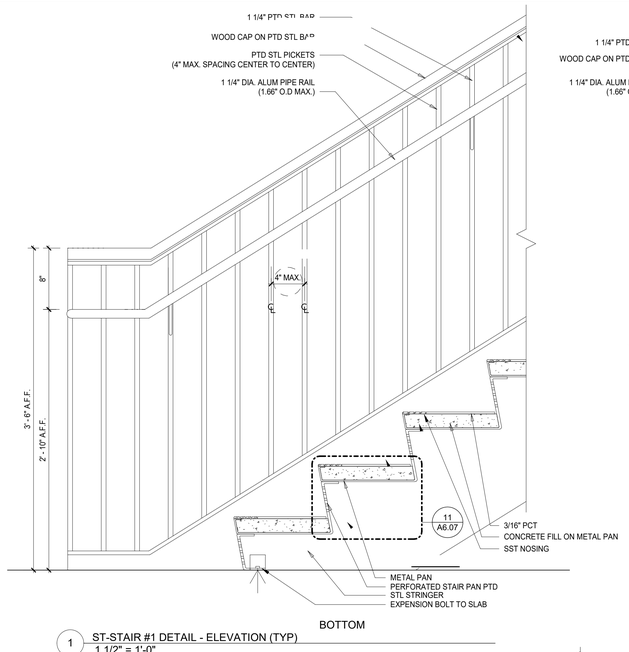
3 ST-NOSING DETAIL - PLATFORM
3" = 1'-0"



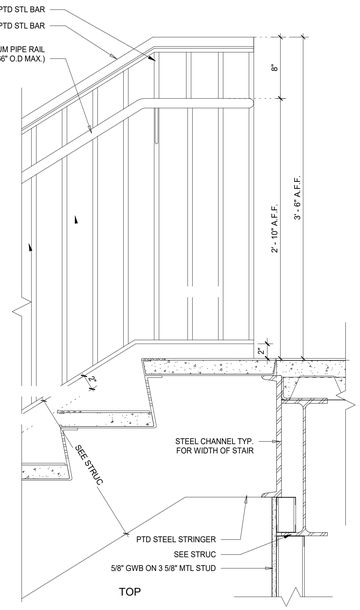
4 PLATFORM DETAIL
3" = 1'-0"

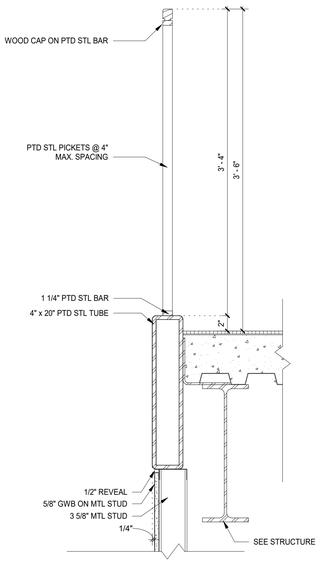


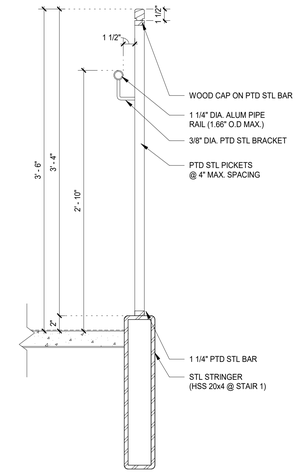
2 ST-GUARDRAIL ELEVATION - @UPPER LEVEL
1 1/2" = 1'-0"



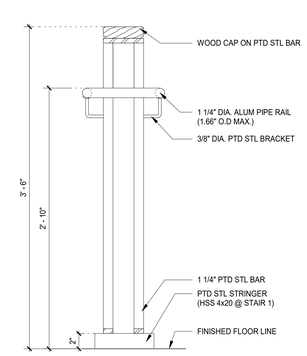
1 ST-STAIR #1 DETAIL - ELEVATION (TYP)
1 1/2" = 1'-0"



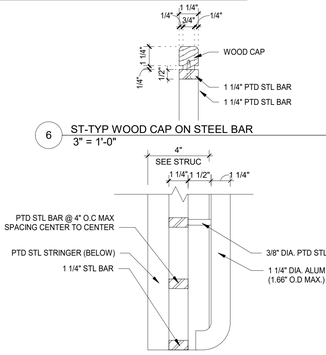




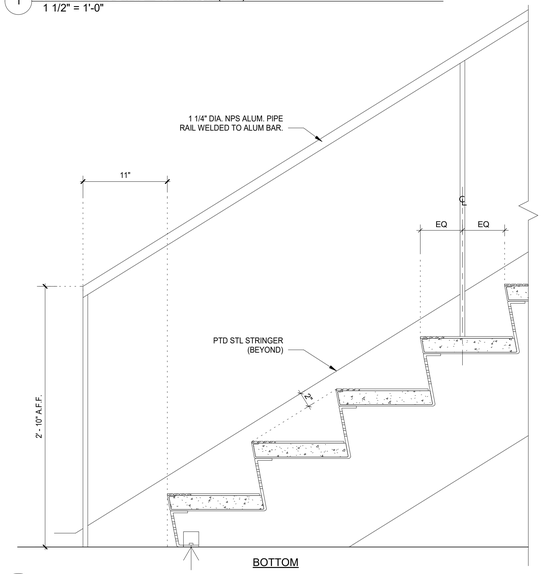
9 ST-GUARDRAIL DETAIL - @ STAIR #1
1 1/2" = 1'-0"



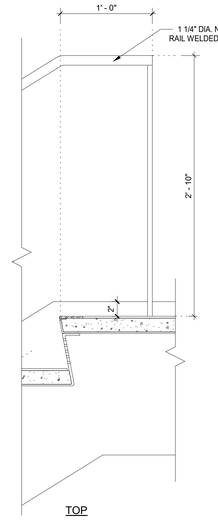
8 ST-GUARDRAIL ELEVATION - @ LANDING
1 1/2" = 1'-0"

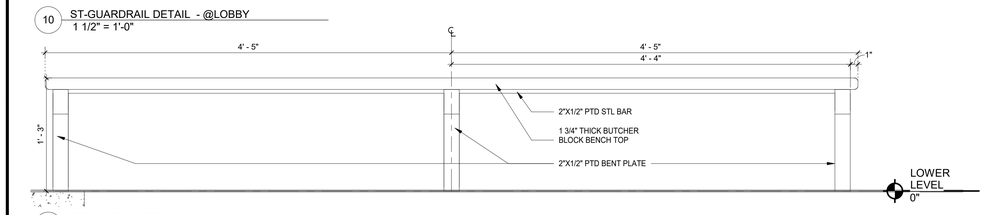


6 ST-TYP WOOD CAP ON STEEL BAR
3" = 1'-0"

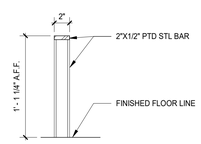


5 ST-STAIR #1 DETAIL - INTERMEDIA HANDRAIL ELEVATION
1 1/2" = 1'-0"

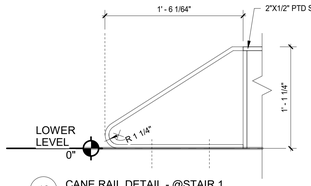




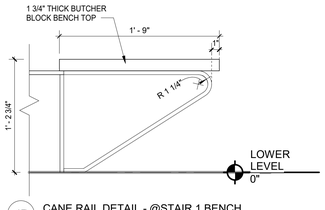
16 BENCH ELEVATION
1 1/2" = 1'-0"



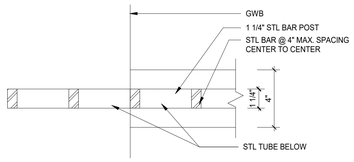
19 CANE RAIL SECTION
1 1/2" = 1'-0"



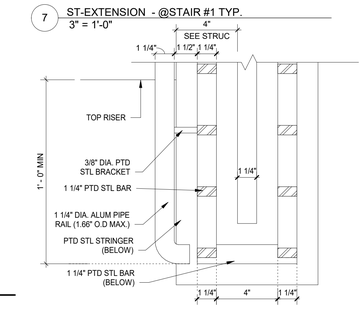
18 CANE RAIL DETAIL - @STAIR 1
1 1/2" = 1'-0"



17 CANE RAIL DETAIL - @STAIR 1 BENCH
1 1/2" = 1'-0"

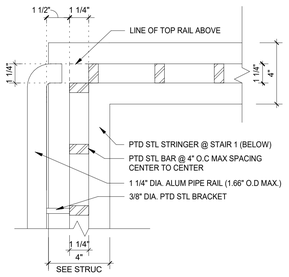


15 ST-GUARDRAIL - @UPPER LEVEL
3" = 1'-0"

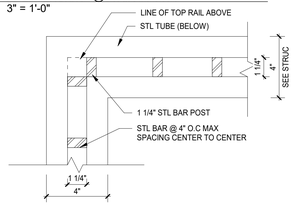


7 ST-EXTENSION - @STAIR #1 TYP.
3" = 1'-0"

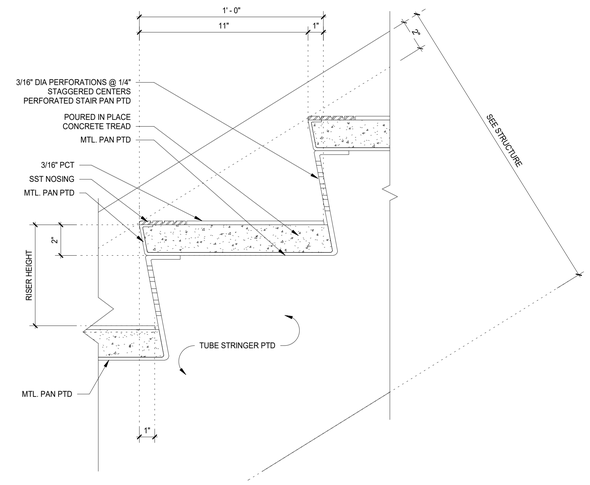
14 ST-EXTENSION - @STAIR #1 UPPER LEVEL
3" = 1'-0"



12 ST-EXTENSION - @STAIR #1 TYP.
3" = 1'-0"



13 ST-GUARDRAIL - @LOBBY
3" = 1'-0"



11 ST-NOSING DETAIL W/ PERFORATED RISER
3" = 1'-0"

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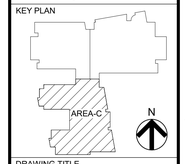
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

STAIR DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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3	03/18/2026	50% CD
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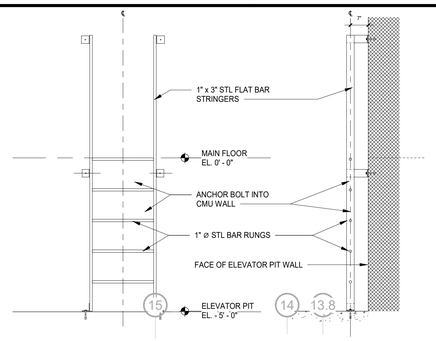
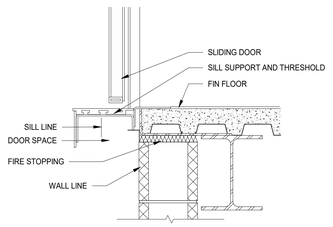
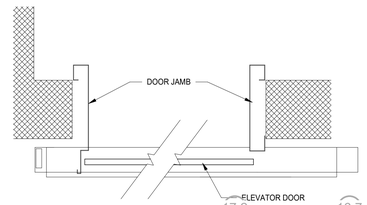


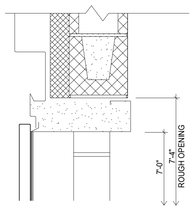
4 ELEVATOR PIT LADDER
1/2" = 1'-0"



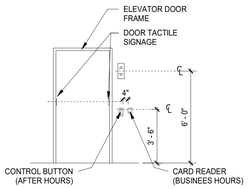
3 ELEVATOR DOOR SILL
1 1/2" = 1'-0"



2 ELEVATOR DOOR PLAN
1 1/2" = 1'-0"



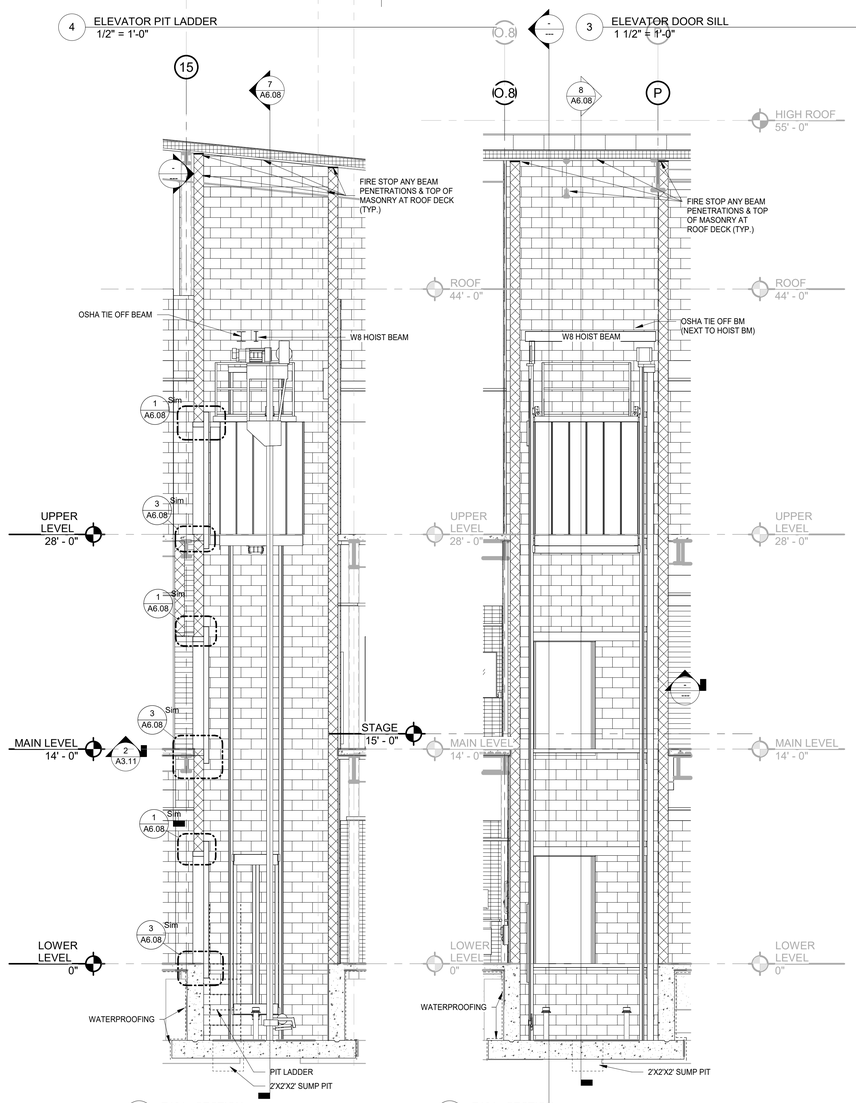
1 ELEVATOR DOOR HEAD
1 1/2" = 1'-0"



NOTE

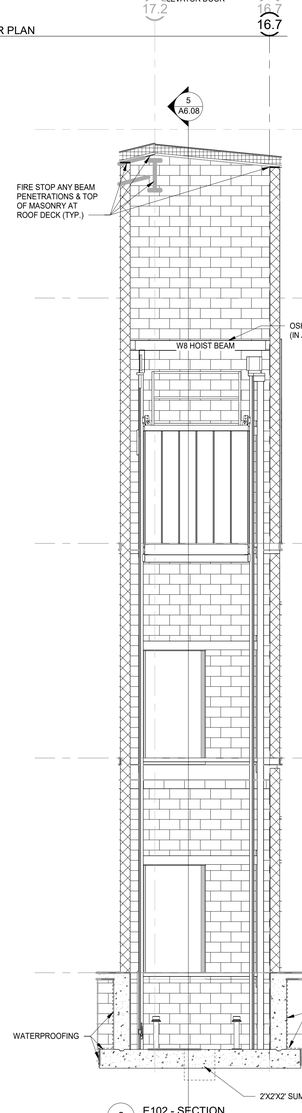
1. 48" MIN. ABOVE THE FLOOR MEASURED TO THE BASELINE OF THE LOWEST TACTILE CHARACTER AND 60" MAX. ABOVE THE FLOOR, MEASURED TO THE BASELINE OF THE HIGHEST TACTILE CHARACTER

ELEVATOR SIGNAGE AND TYPICAL MOUNTING HEIGHTS



8 E101 - SECTION
1/4" = 1'-0"

7 E101 - SECTION
1/4" = 1'-0"



6 E102 - SECTION.
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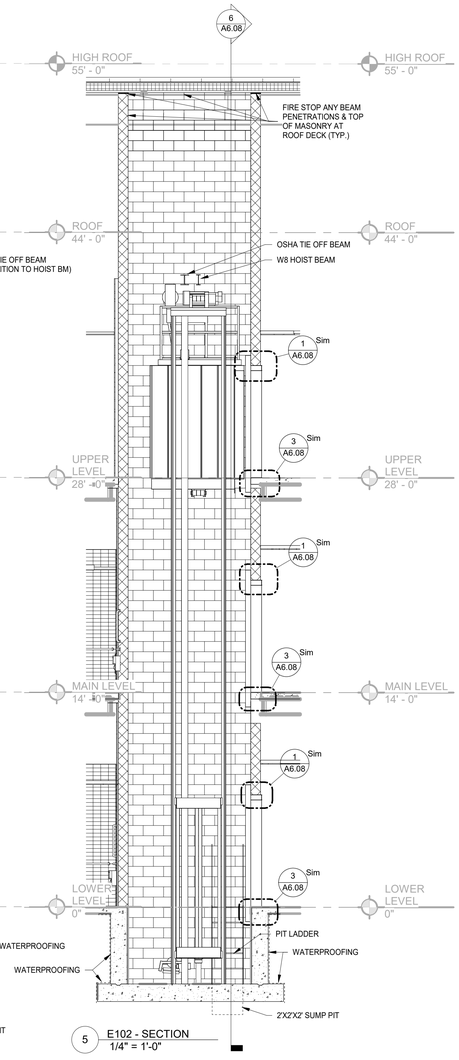

5 E102 - SECTION
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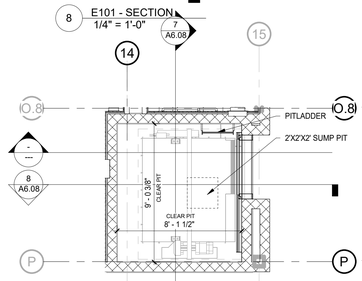
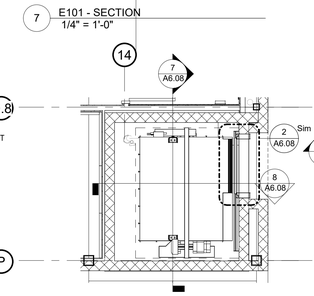
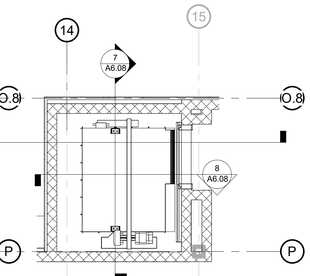


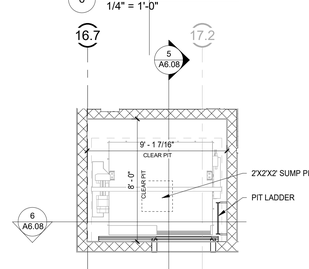
14 ELEVATOR 1 - E101- PIT - LOWER LEVEL
1/4" = 1'-0"



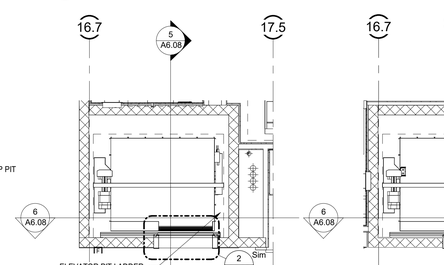
13 ELEVATOR 1 - E101- MAIN LEVEL
1/4" = 1'-0"



12 ELEVATOR 1 - E101- UPPER LEVEL
1/4" = 1'-0"



11 ELEVATOR 2-E102-LOWER LEVEL PIT
1/4" = 1'-0"



10 ELEVATOR 2-E102- MAIN LEVEL
1/4" = 1'-0"

9 ELEVATOR 2-E102- UPPER LEVEL
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

ELEVATOR PLAN, SECTION AND DETAILS

STATE PROJ. NO.	144-0108N
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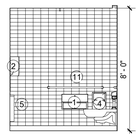
5/19/2026 10:30:18 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt

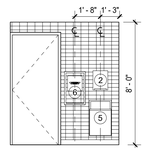
TOILET ACCESSORIES KEY

1	TOILET PAPER DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
2	PAPER TOWEL DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
3	SOAP DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
4	SANITARY NAPKIN DISPOSAL
5	RECESSED WASTE RECEPTACLE
6	SEMI-RECESSED HAND DRYER
7	24" x 36" MIRROR (WITH FRAME)
8	90" x 36" MIRROR (FRAMELESS)
9	60" x 36" MIRROR (FRAMELESS)
10	24" x 64" MIRROR (FRAMELESS)
11	GRAB BARS
12	CHANGING STATION
13	TOWEL HOOK

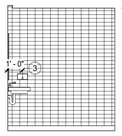
NOTE: REFER TO GENERAL INFORMATION SHEET A0.01 FOR FIXTURE LOCATION AND HEIGHT.



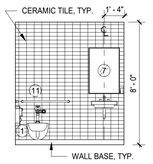
9 A111 WEST
1/4" = 1'-0"



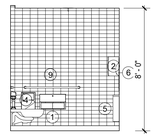
8 A111 SOUTH
1/4" = 1'-0"



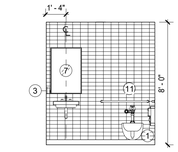
7 A111 EAST
1/4" = 1'-0"



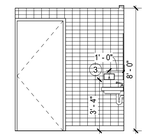
6 A111 NORTH
1/4" = 1'-0"



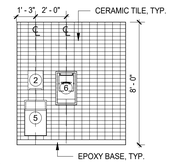
5 A110 WEST
1/4" = 1'-0"



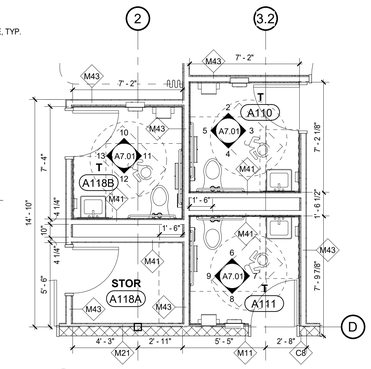
4 A110 SOUTH
1/4" = 1'-0"



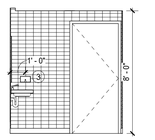
3 A110 EAST
1/4" = 1'-0"



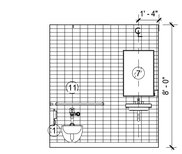
2 A110 NORTH
1/4" = 1'-0"



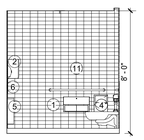
1 A110, A111, A118B TOILET - PLAN
1/4" = 1'-0"



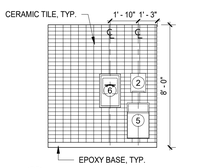
13 A118B WEST
1/4" = 1'-0"



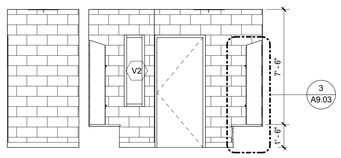
12 A118B SOUTH
1/4" = 1'-0"



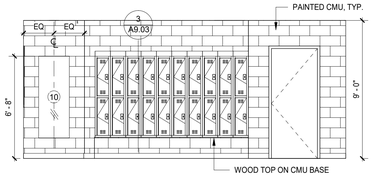
11 A118B EAST
1/4" = 1'-0"



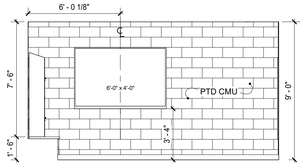
10 A118B NORTH
1/4" = 1'-0"



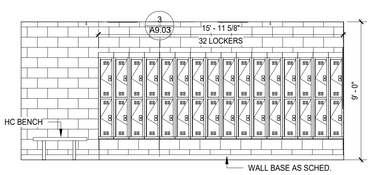
16 A123 EAST
1/4" = 1'-0"



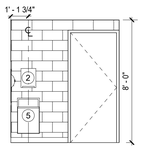
15 A123 NORTH
1/4" = 1'-0"



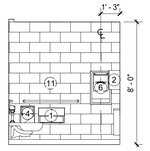
18 A123 WEST
1/4" = 1'-0"



17 A123 SOUTH
1/4" = 1'-0"



22 A123A WEST
1/4" = 1'-0"



21 A123A SOUTH
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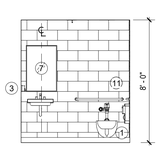

20 A123A EAST
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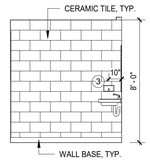
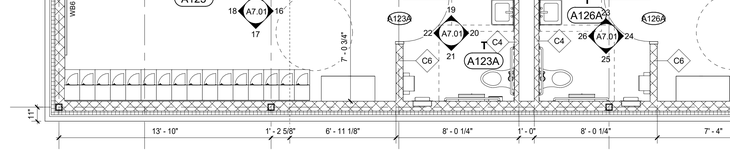
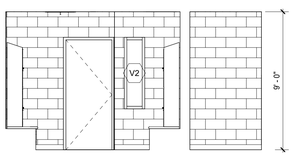


19 A123A NORTH
1/4" = 1'-0"



14 A123, A126 CHANGING RM - PLAN
1/4" = 1'-0"



30 A126 WEST
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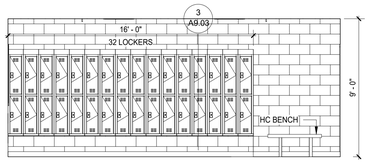

29 A126 SOUTH
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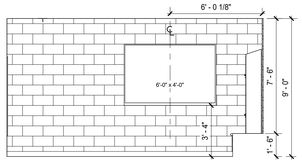

28 A126 EAST
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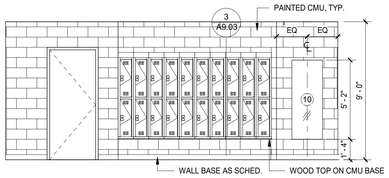
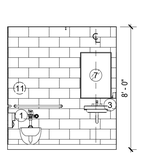


27 A126 NORTH
1/4" = 1'-0"



26 A126A WEST
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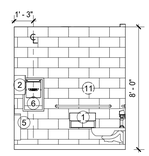

25 A126A SOUTH
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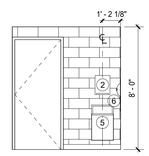

24 A126A EAST
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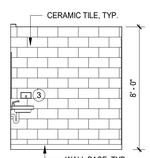

23 A126A NORTH
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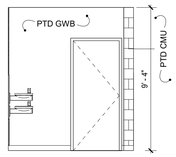

36 A131 ENTRY - WEST
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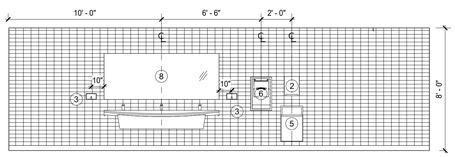

35 A131 WEST
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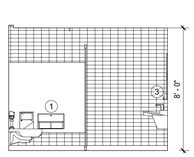

34 A131 SOUTH
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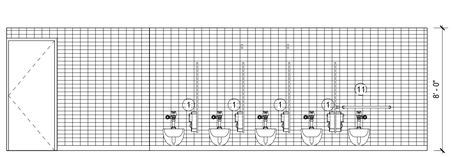

33 A131 EAST
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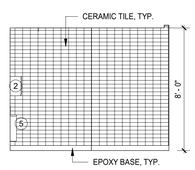

32 A131 NORTH
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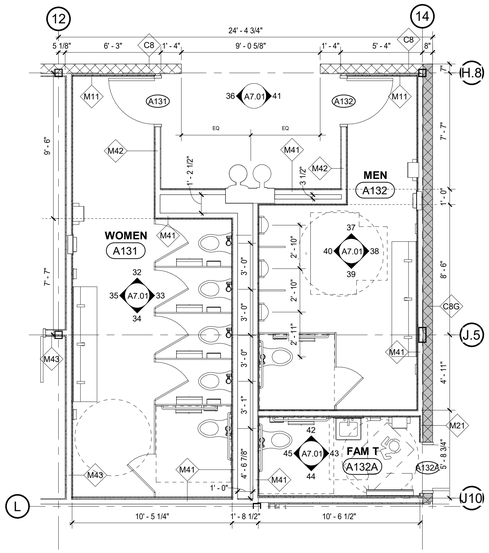

31 A131, A132, A132A TOILET - PLAN
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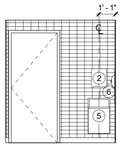

50 A138B WEST
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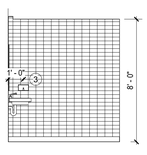

49 A138B SOUTH
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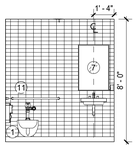

48 A138B EAST
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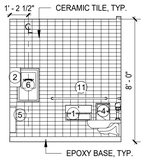

47 A138B NORTH
1/4" = 1'-0"

46 A136A, A138B TOILET - PLAN
1/4" = 1'-0"

45 A132A - WEST
1/4" = 1'-0"

44 A132A - SOUTH
1/4" = 1'-0"

43 A132A - EAST
1/4" = 1'-0"

42 A132A - NORTH
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

TOILET PLANS AND ELEVATIONS

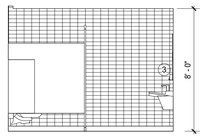
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

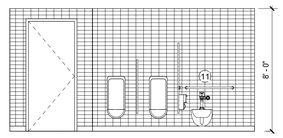
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A7.01

5/18/2026 2:08:22 PM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



5 A145 WEST
1/4" = 1'-0"



4 A145 SOUTH
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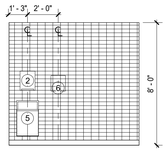

3 A145 EAST
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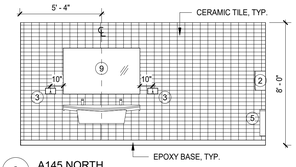

2 A145 NORTH
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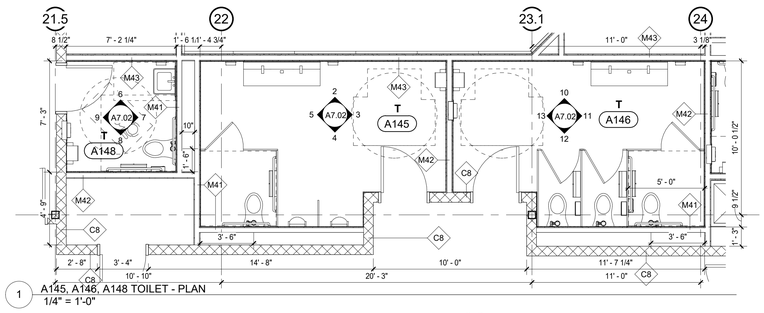

1 A145, A146, A148 TOILET - PLAN
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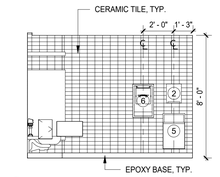

13 A146 WEST
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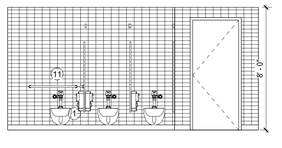

12 A146 SOUTH
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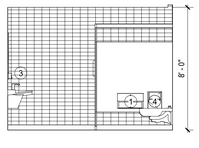

11 A146 EAST
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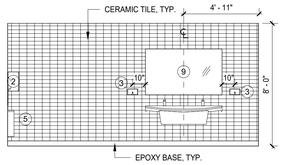

10 A146 NORTH
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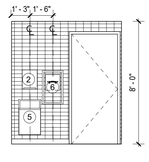

9 A148 WEST
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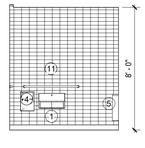

8 A148 SOUTH
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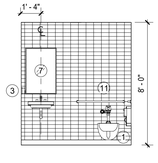

7 A148 EAST
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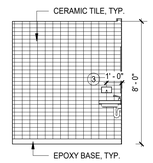

6 A148 NORTH
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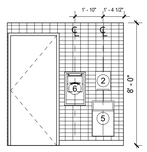

23 B105B WEST
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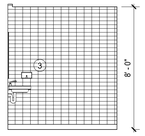

22 B105B SOUTH
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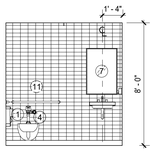

21 B105B EAST
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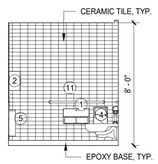

20 B105B NORTH
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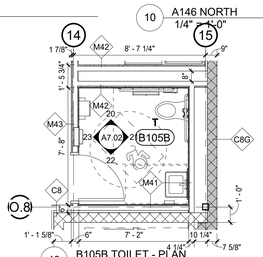
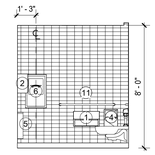
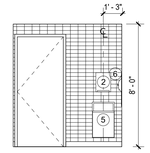


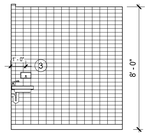
19 B105B TOILET - PLAN
1/4" = 1'-0"



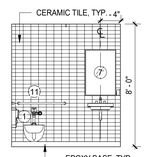
18 A146A WEST
1/4" = 1'-0"



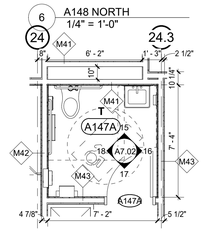
17 A147A SOUTH
1/4" = 1'-0"



16 A147A EAST
1/4" = 1'-0"

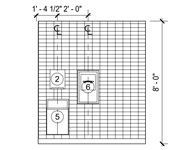


15 A147A NORTH
1/4" = 1'-0"

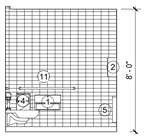


14 A147A TOILET - PLAN
1/4" = 1'-0"

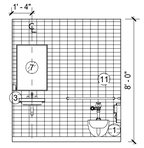
11
1
1
1



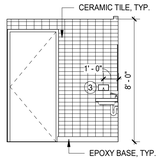
10 B122 WEST
1/4" = 1'-0"



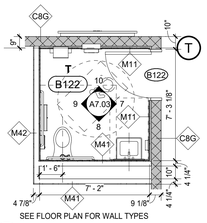
9 B122 SOUTH
1/4" = 1'-0"



8 B122 EAST
1/4" = 1'-0"

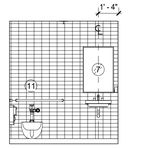


7 B122 NORTH
1/4" = 1'-0"

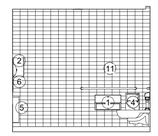


SEE FLOOR PLAN FOR WALL TYPES

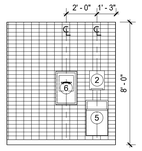
6 A118B, B122, B216 TOILET - PLAN
1/4" = 1'-0"



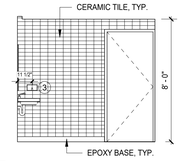
5 B119 WEST
1/4" = 1'-0"



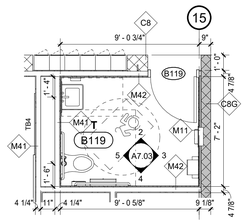
4 B119 SOUTH
1/4" = 1'-0"



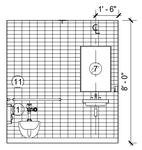
3 B119 EAST
1/4" = 1'-0"



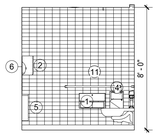
2 B119 NORTH
1/4" = 1'-0"



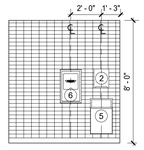
1 B119 TOILET - PLAN
1/4" = 1'-0"



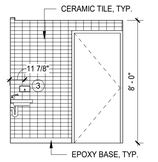
20 B017 WEST
1/4" = 1'-0"



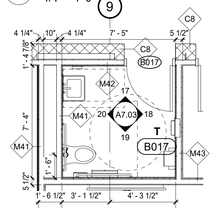
19 B017 SOUTH
1/4" = 1'-0"



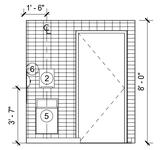
18 B017 EAST
1/4" = 1'-0"



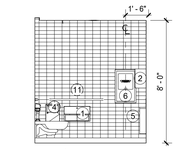
17 B017 NORTH
1/4" = 1'-0"



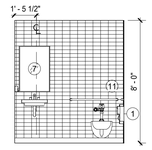
16 B017 TOILET
1/4" = 1'-0"



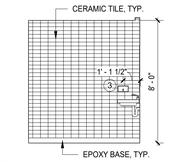
15 B039, B136 WEST
1/4" = 1'-0"



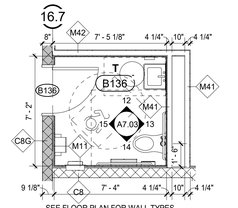
14 B039, B136 SOUTH
1/4" = 1'-0"



13 B039, B136 EAST
1/4" = 1'-0"

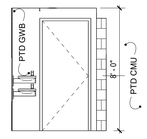


12 B039, B136 NORTH
1/4" = 1'-0"

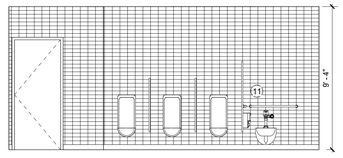


SEE FLOOR PLAN FOR WALL TYPES

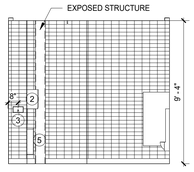
11 B006, B039, B136 TOILET - PLAN
1/4" = 1'-0"



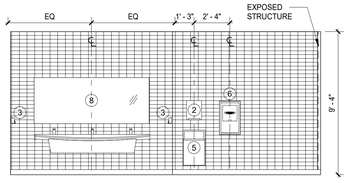
26 B007 ENTRY - EAST
1/4" = 1'-0"



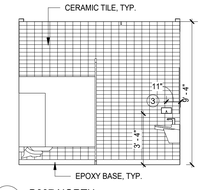
25 B007 WEST
1/4" = 1'-0"



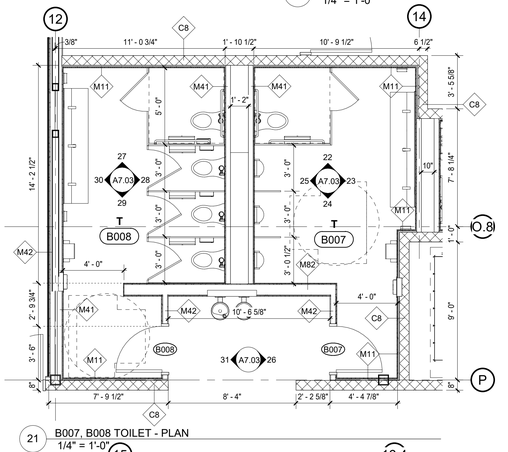
24 B007 SOUTH
1/4" = 1'-0"



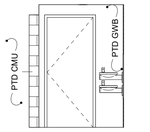
23 B007 EAST
1/4" = 1'-0"



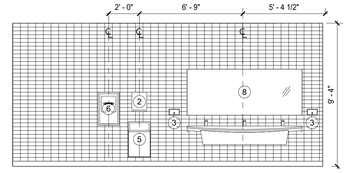
22 B007 NORTH
1/4" = 1'-0"



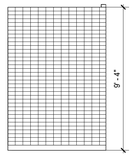
21 B007, B008 TOILET - PLAN
1/4" = 1'-0"



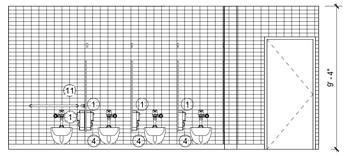
31 B008 ENTRY - WEST
1/4" = 1'-0"



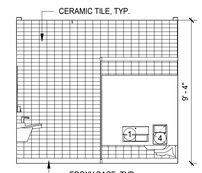
30 B008 WEST
1/4" = 1'-0"



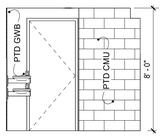
29 B008 SOUTH
1/4" = 1'-0"



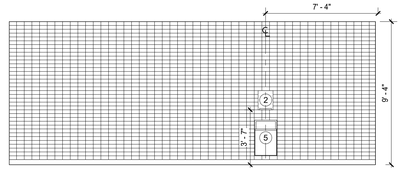
28 B008 EAST
1/4" = 1'-0"



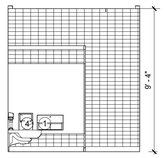
27 B008 NORTH
1/4" = 1'-0"



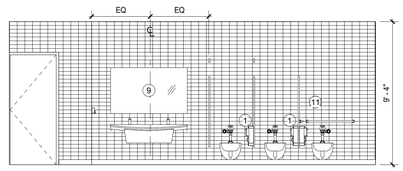
37 B034 ENTRY - WEST
1/4" = 1'-0"



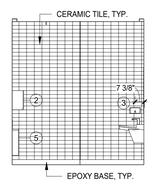
36 B034 WEST
1/4" = 1'-0"



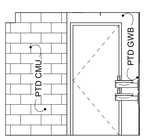
35 B034 SOUTH
1/4" = 1'-0"



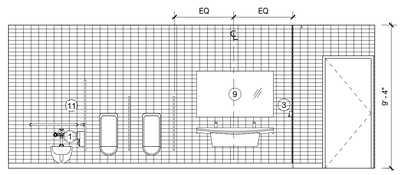
34 B034 EAST
1/4" = 1'-0"



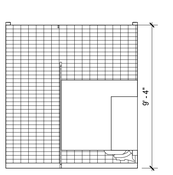
33 B034 NORTH
1/4" = 1'-0"



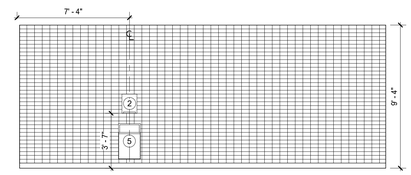
42 B035 ENTRY - EAST
1/4" = 1'-0"



41 B035 WEST
1/4" = 1'-0"



40 B035 SOUTH
1/4" = 1'-0"



39 B035 EAST
1/4" = 1'-0"

38 B035 NORTH
1/4" = 1'-0"

32 B034, B035 TOILET - PLAN
1/4" = 1'-0"

TOILET ACCESSORIES KEY

1	TOILET PAPER DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
2	PAPER TOWEL DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
3	SOAP DISPENSER - OWNER SUPPLIED, CONTRACTOR INSTALLED
4	SANITARY NAPKIN DISPOSAL
5	RECESSED WASTE RECEPTACLE
6	SEMI-RECESSED HAND DRYER
7	24" x 36" MIRROR (WITH FRAME)
8	90" x 36" MIRROR (FRAMELESS)
9	60" x 36" MIRROR (FRAMELESS)
10	24" x 64" MIRROR (FRAMELESS)
11	GRAB BARS
12	CHANGING STATION
13	TOWEL HOOK

NOTE: REFER TO GENERAL INFORMATION SHEET A0.01 FOR FIXTURE LOCATION AND HEIGHT.

51 B232A WEST
1/4" = 1'-0"

50 B232A SOUTH
1/4" = 1'-0"

49 B232A EAST
1/4" = 1'-0"

48 B232A NORTH
1/4" = 1'-0"

47 B230 WEST
1/4" = 1'-0"

46 B230 SOUTH
1/4" = 1'-0"

45 B230 EAST
1/4" = 1'-0"

44 B230 NORTH
1/4" = 1'-0"

43 B230, B232A TOILET - PLAN
1/4" = 1'-0"

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ARCHITECTURE | PLANNING | INTERIORS

PROFESSIONAL SEAL

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530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

TOILET PLANS AND ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A7.03

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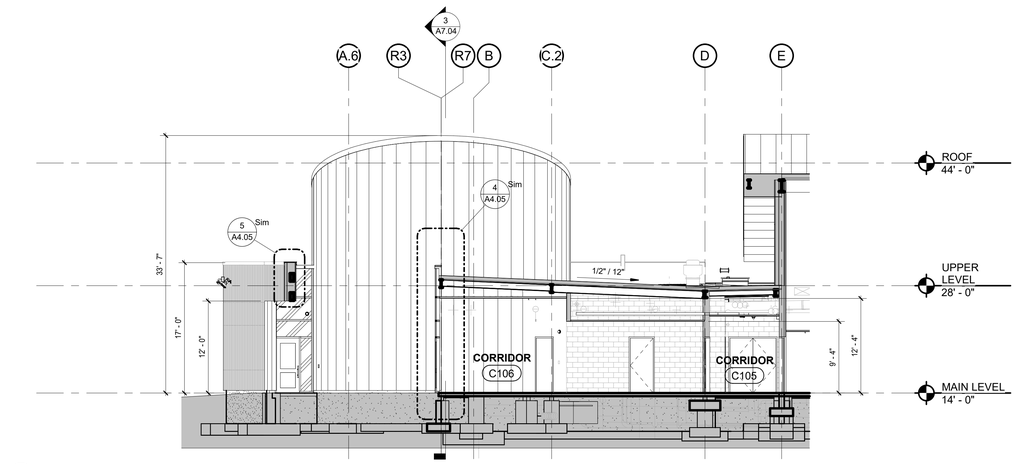
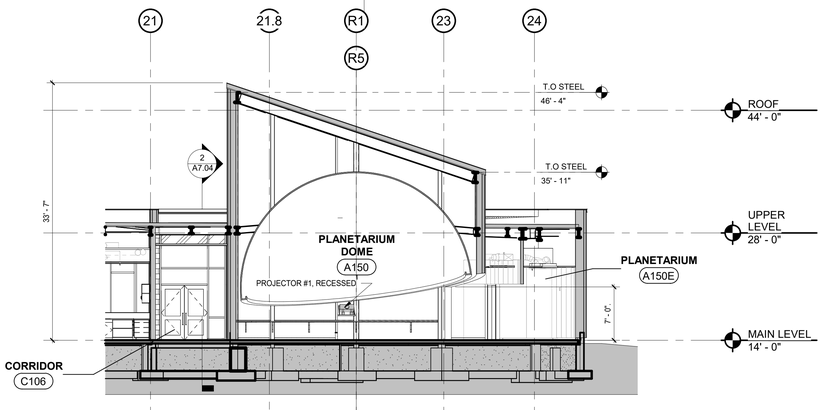
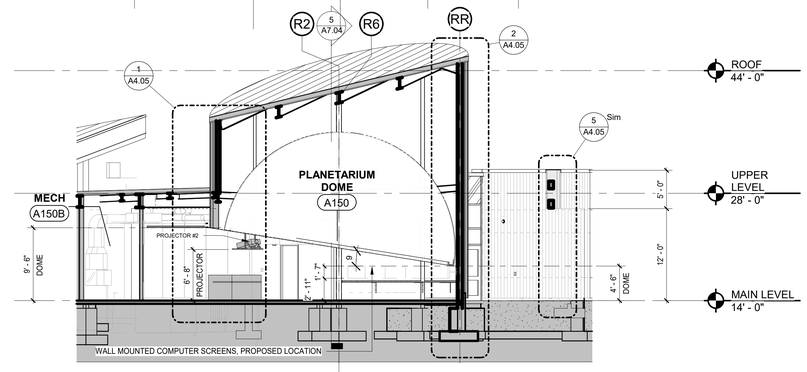


2 BUILDING SECTION THROUGH PLANETARIUM ENTRANCE
1/8" = 1'-0"



3 BUILDING SECTION PLANETARIUM
1/8" = 1'-0"



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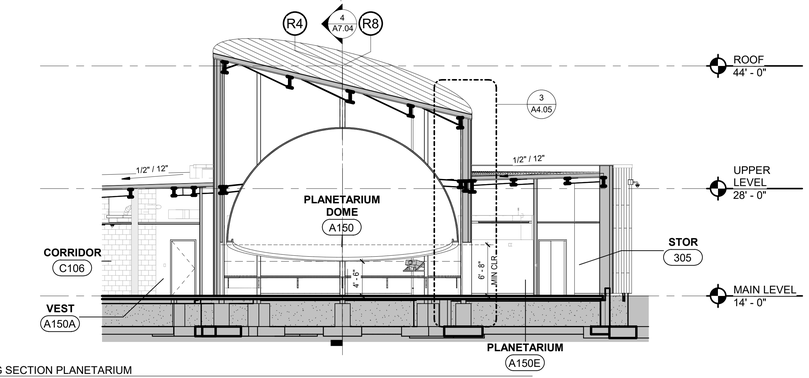
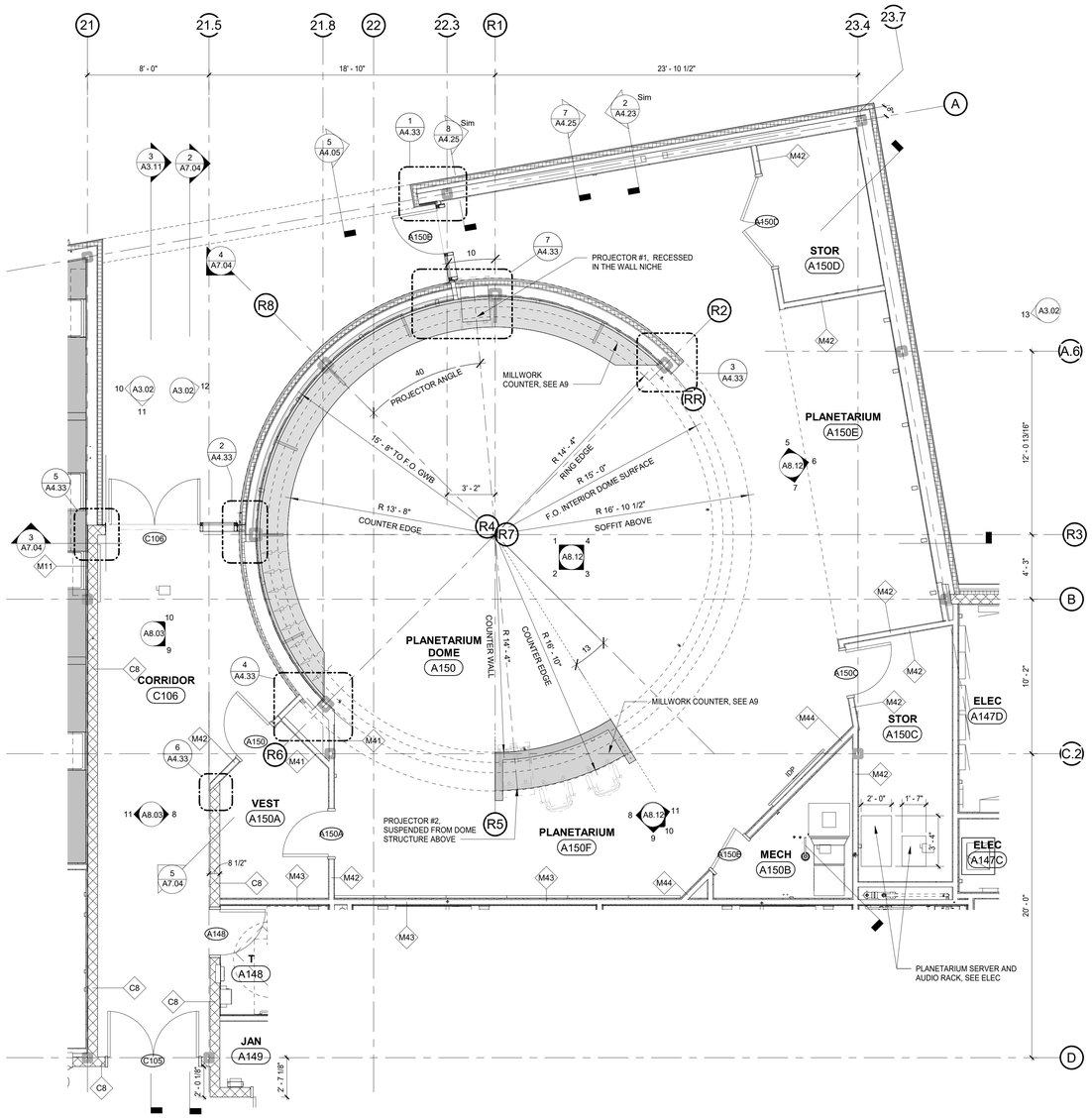
1/8" = 1'-0"



5 BUILDING SECTION PLANETARIUM
1/8" = 1'-0"



1 MAIN LEVEL - AREA B - ENLARGED PLAN - PLANETARIUM
1/4" = 1'-0"

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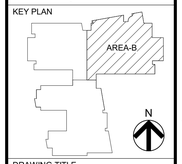
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

PLANETARIUM PLANS AND SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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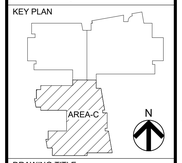

DRAWING TITLE

INTERIOR ELEVATIONS - CORRIDOR

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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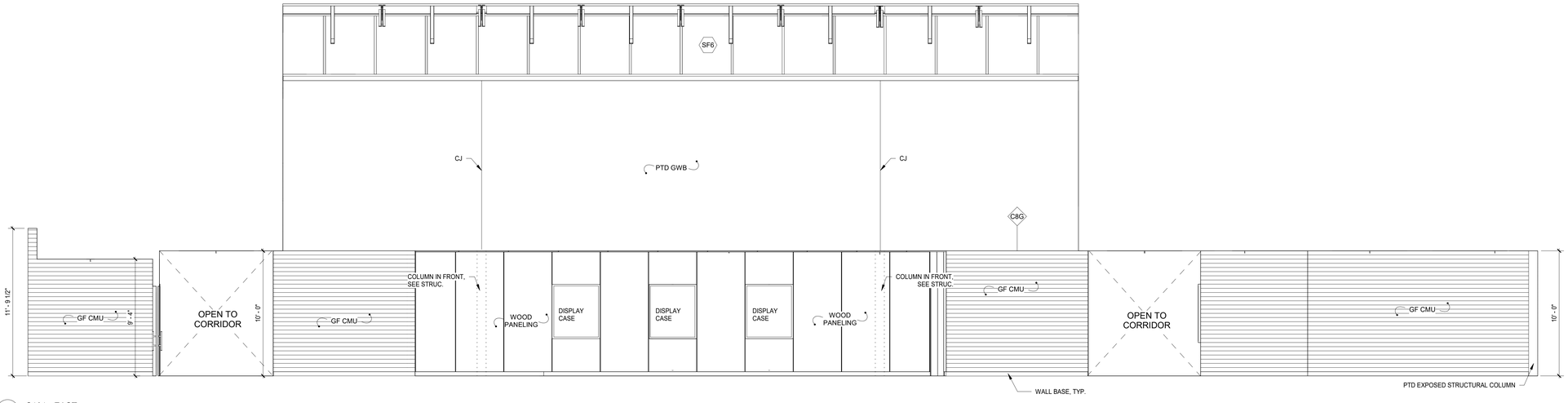
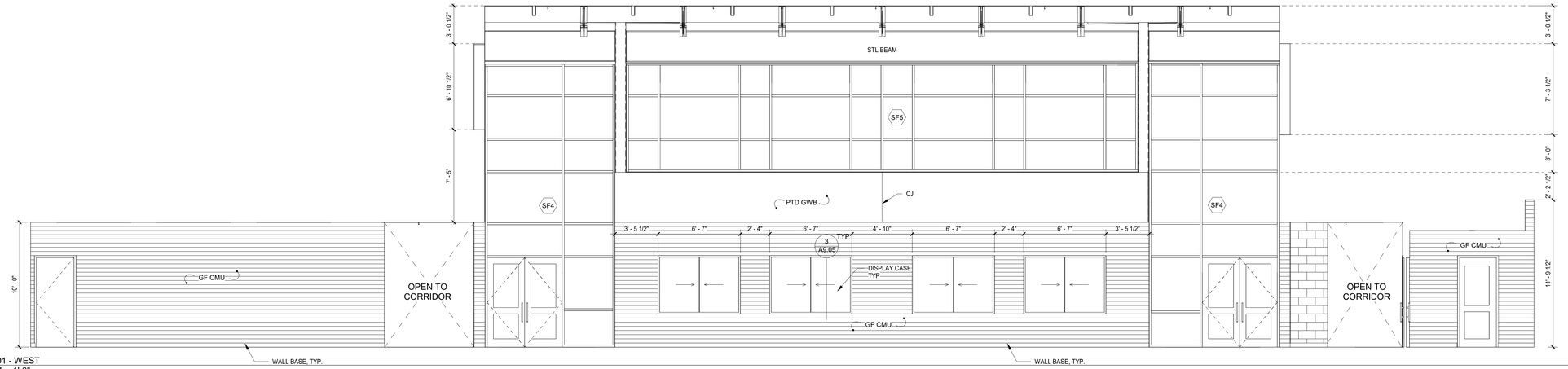


1 C101 - EAST
1/4" = 1'-0"



2 C101 - WEST
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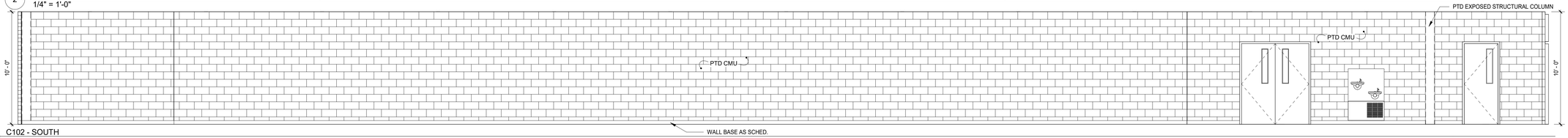

3 C102 - SOUTH
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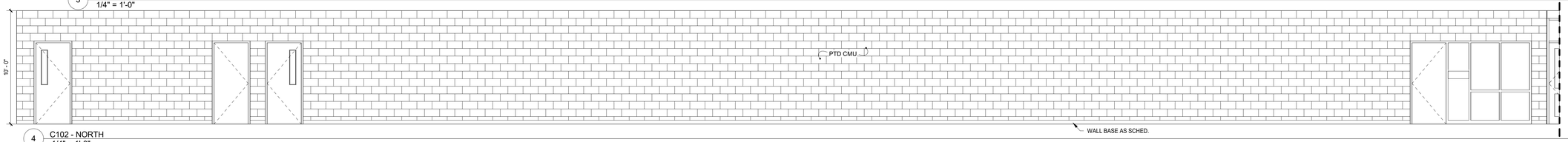
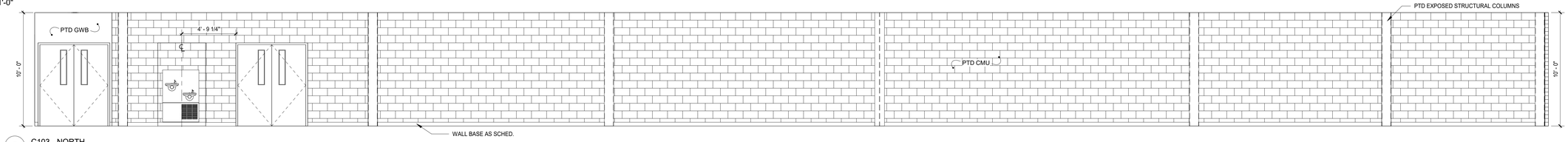
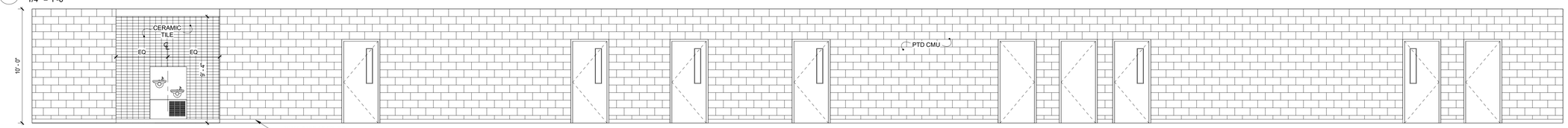


4 C102 - NORTH
1/4" = 1'-0"



5 C103 - NORTH
1/4" = 1'-0"



6 C103 - SOUTH
1/4" = 1'-0"

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KEY PLAN



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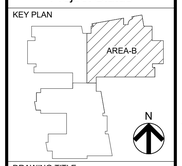

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INTERIOR ELEVATIONS - CORRIDOR

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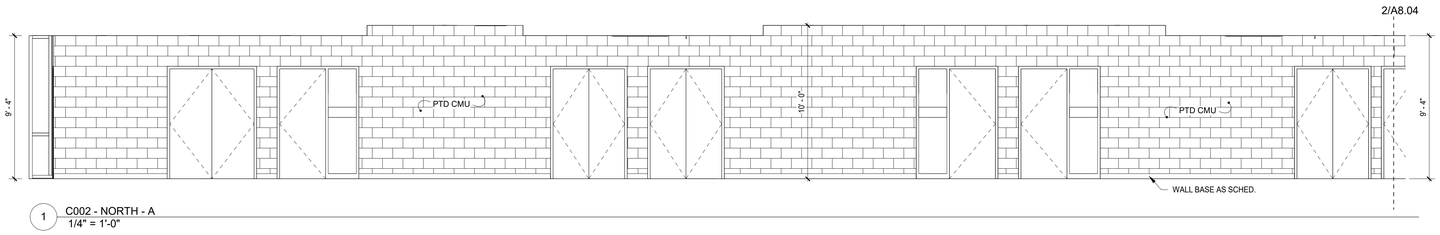
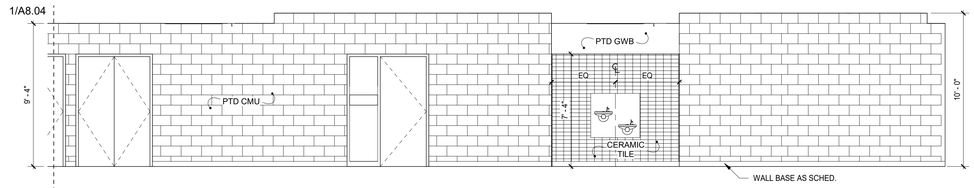
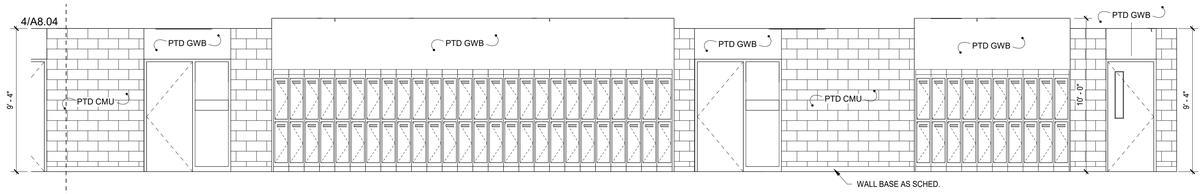


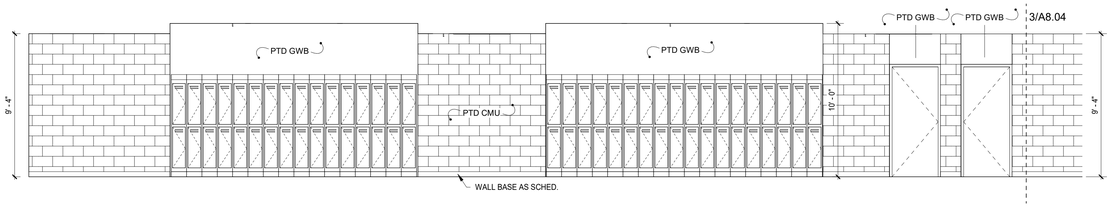
1 C002 - NORTH - A
1/4" = 1'-0"



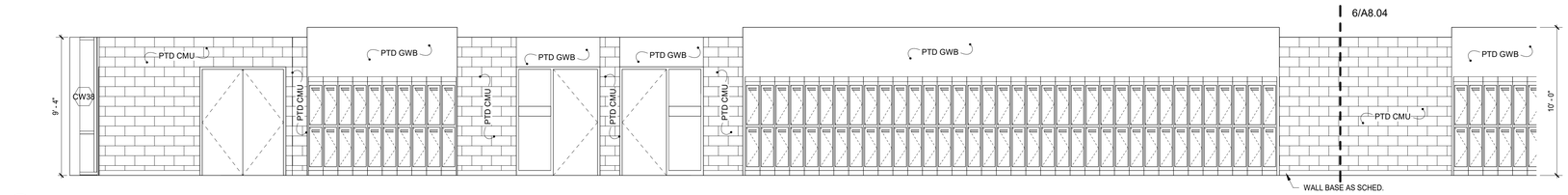
2 C002 - NORTH - B
1/4" = 1'-0"



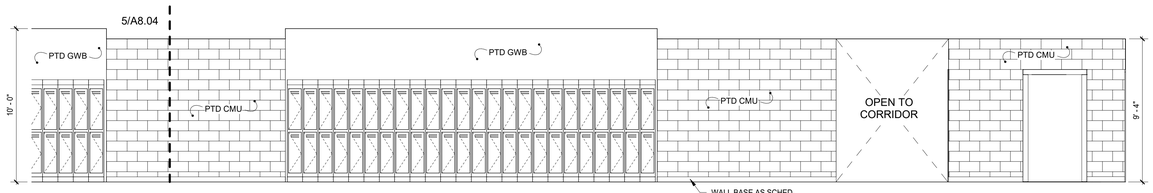
3 C002 - SOUTH - A
1/4" = 1'-0"



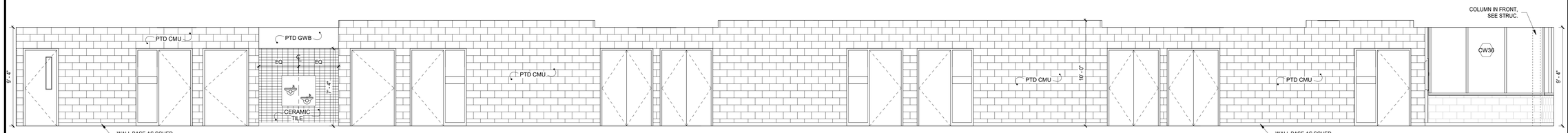
4 C002 - SOUTH - B
1/4" = 1'-0"



5 C003 - NORTH - A
1/4" = 1'-0"



6 C003 - NORTH - B
1/4" = 1'-0"



7 C003 - SOUTH
1/4" = 1'-0"

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530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CORRIDOR

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
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DRAWN BY	Author
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ISSUE DATES

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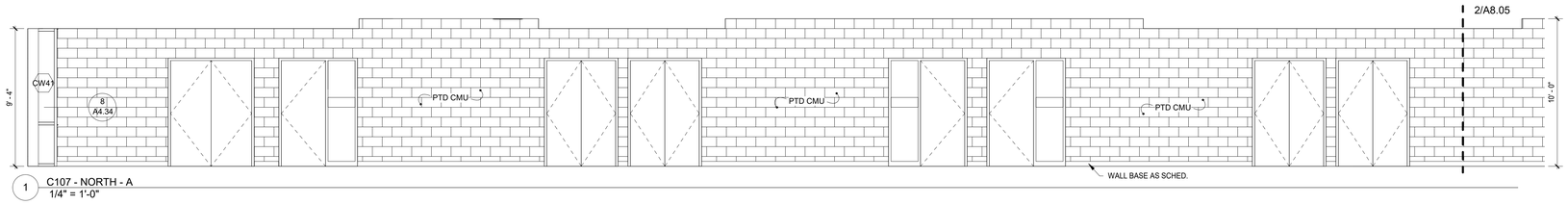
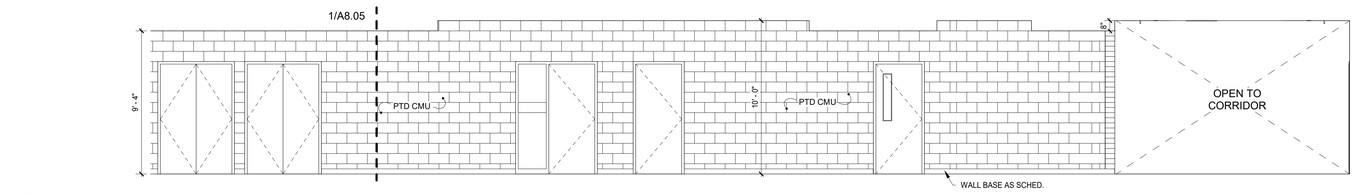
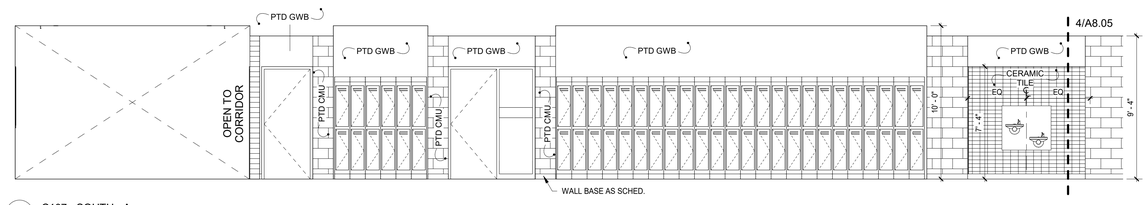


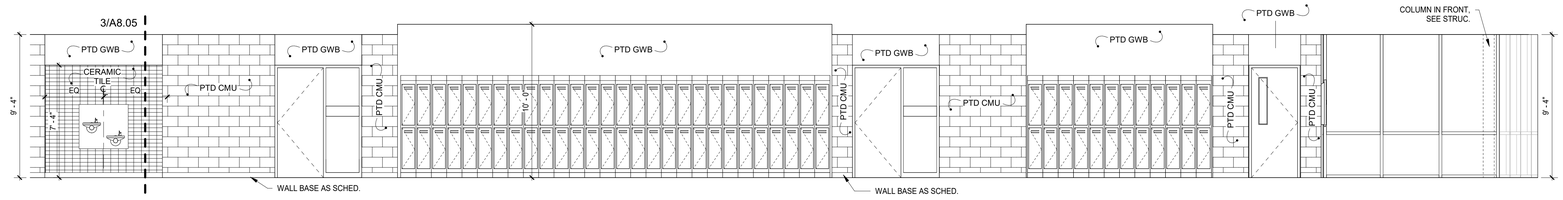
1 C107 - NORTH - A
1/4" = 1'-0"



2 C107 - NORTH - B
1/4" = 1'-0"



3 C107 - SOUTH - A
1/4" = 1'-0"



4 C107 - SOUTH - B
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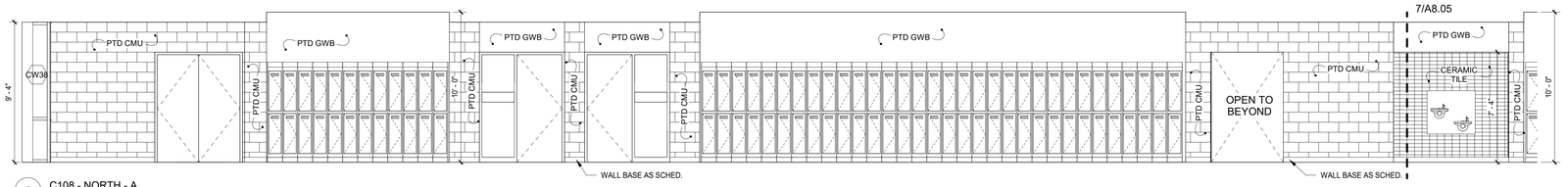
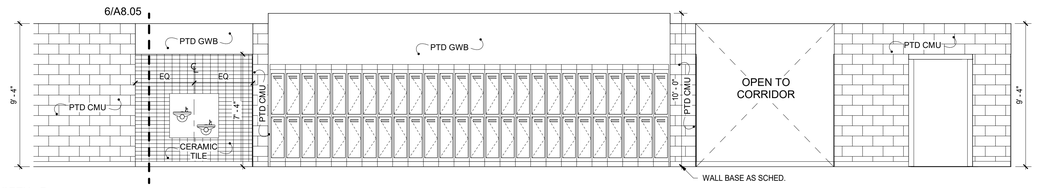


5 C108 - NORTH - A
1/4" = 1'-0"



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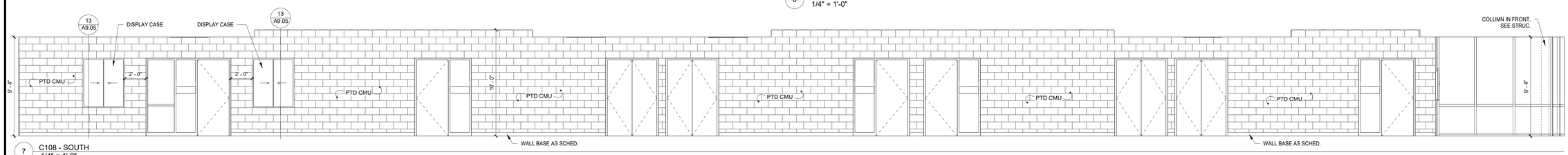
1/4" = 1'-0"



7 C108 - SOUTH
1/4" = 1'-0"

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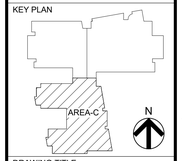
Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CORRIDOR

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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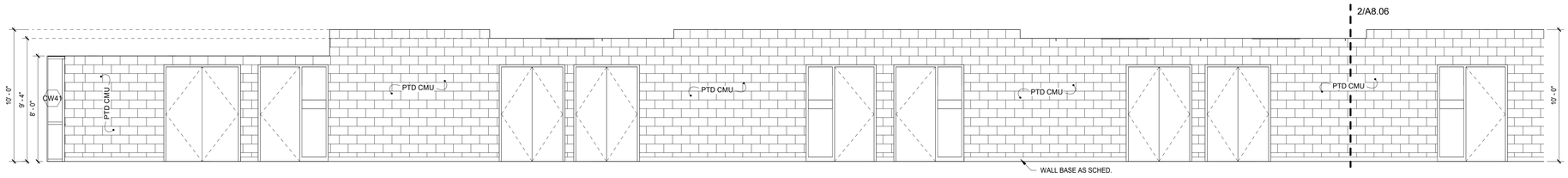

1 C202 - NORTH - A
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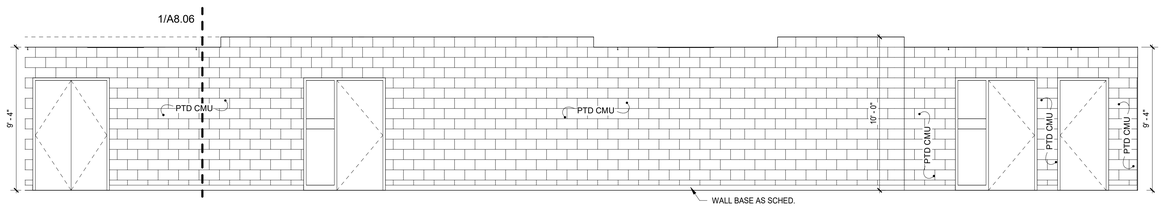

2 C202 - NORTH - B
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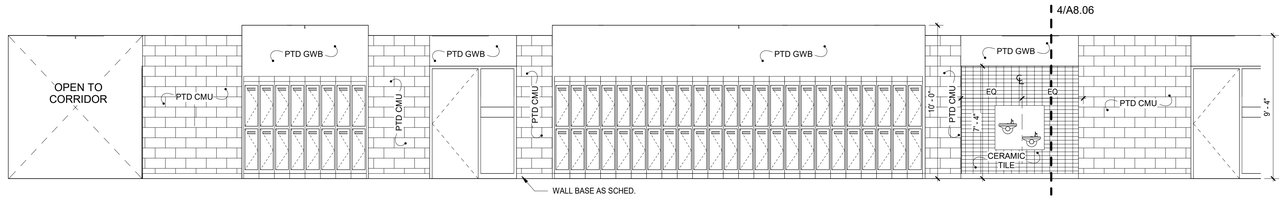
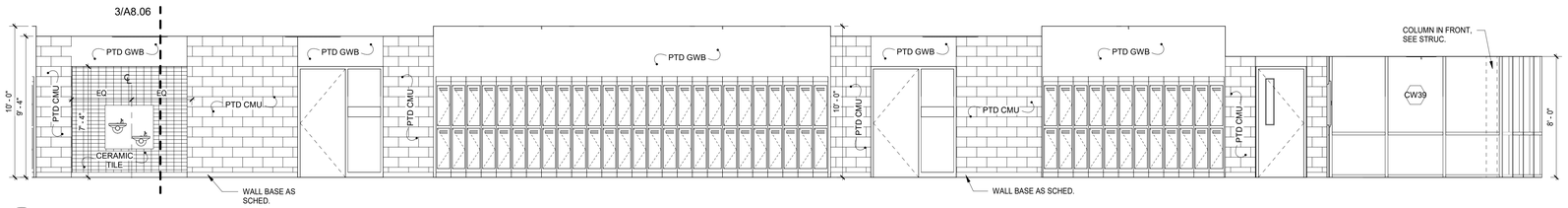


3 C202 - SOUTH - A
1/4" = 1'-0"



4 C202 - SOUTH - B
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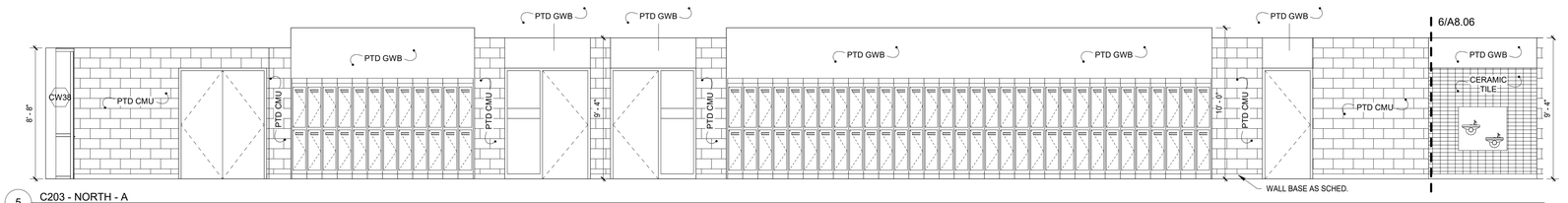

5 C203 - NORTH - A
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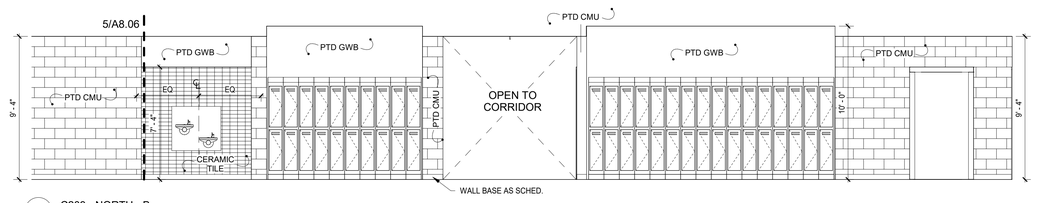
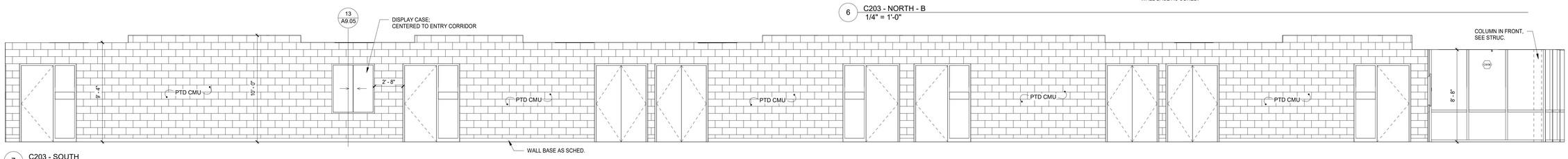


6 C203 - NORTH - B
1/4" = 1'-0"



7 C203 - SOUTH
1/4" = 1'-0"

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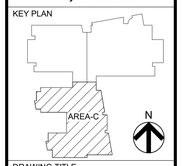

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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

A8.06

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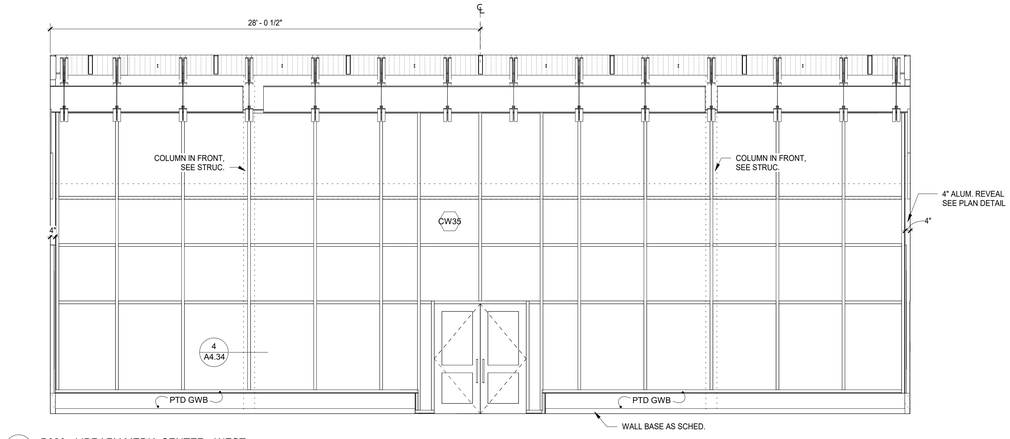
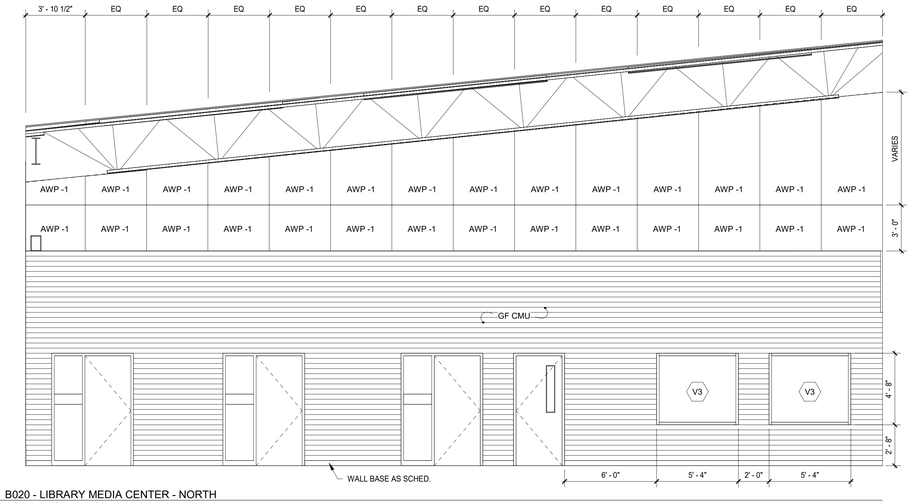


2 B020 - LIBRARY MEDIA CENTER - WEST
1/4" = 1'-0"



1 B020 - LIBRARY MEDIA CENTER - NORTH
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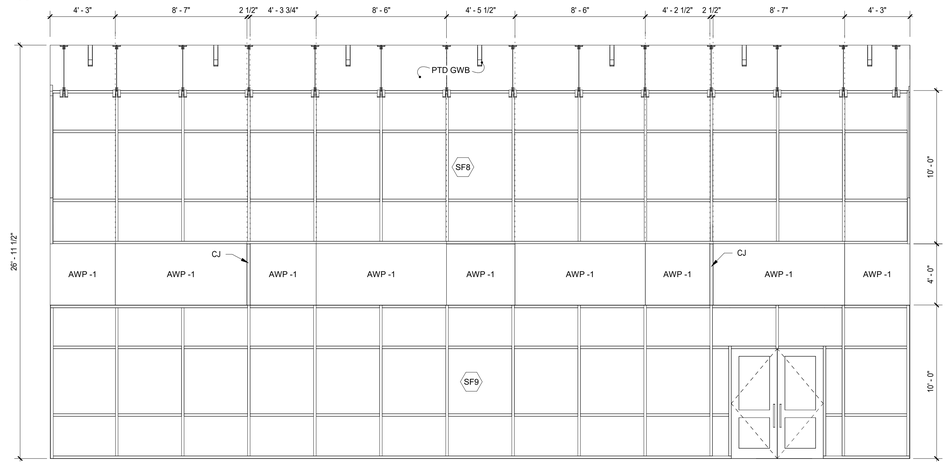

4 B020 - LIBRARY MEDIA CENTER - EAST
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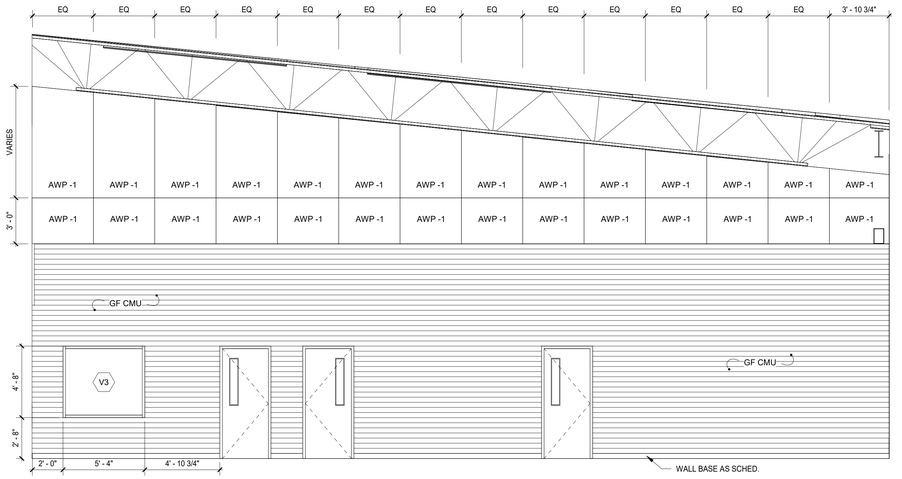
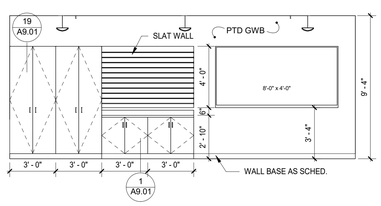


3 B020 - LIBRARY MEDIA CENTER - SOUTH
1/4" = 1'-0"



8 B019 - MAKER SPACE - EAST
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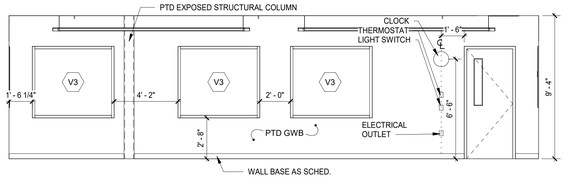
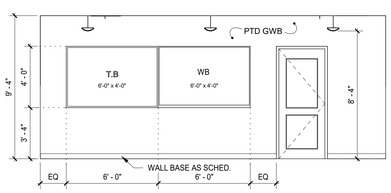
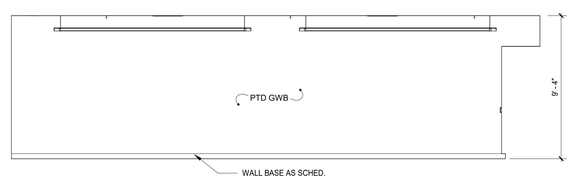


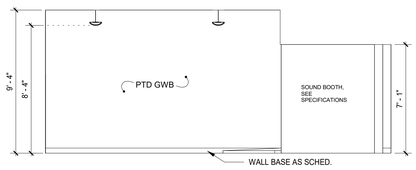
7 B019 - MAKER SPACE - SOUTH
1/4" = 1'-0"



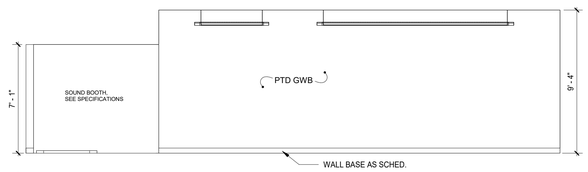
6 B019 - MAKER SPACE - WEST
1/4" = 1'-0"



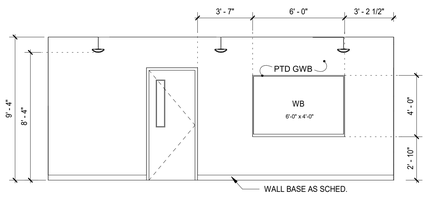
5 B019 - MAKER SPACE - NORTH
1/4" = 1'-0"



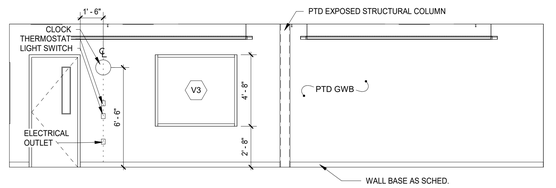
12 B026 - MULTI-MEDIA PRODUCTION - EAST
1/4" = 1'-0"



11 B026 - MULTI-MEDIA PRODUCTION - SOUTH
1/4" = 1'-0"



10 B026 - MULTI-MEDIA PRODUCTION - WEST
1/4" = 1'-0"



9 B026 - MULTI-MEDIA PRODUCTION - NORTH
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - LIBRARY MEDIA CENTER

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A8.07

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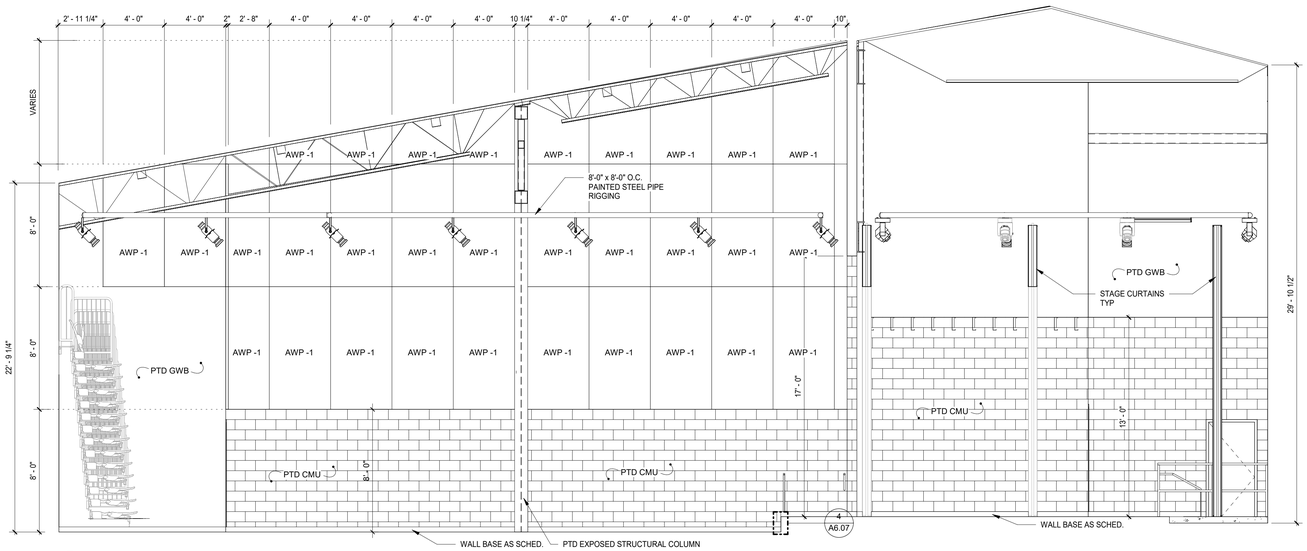
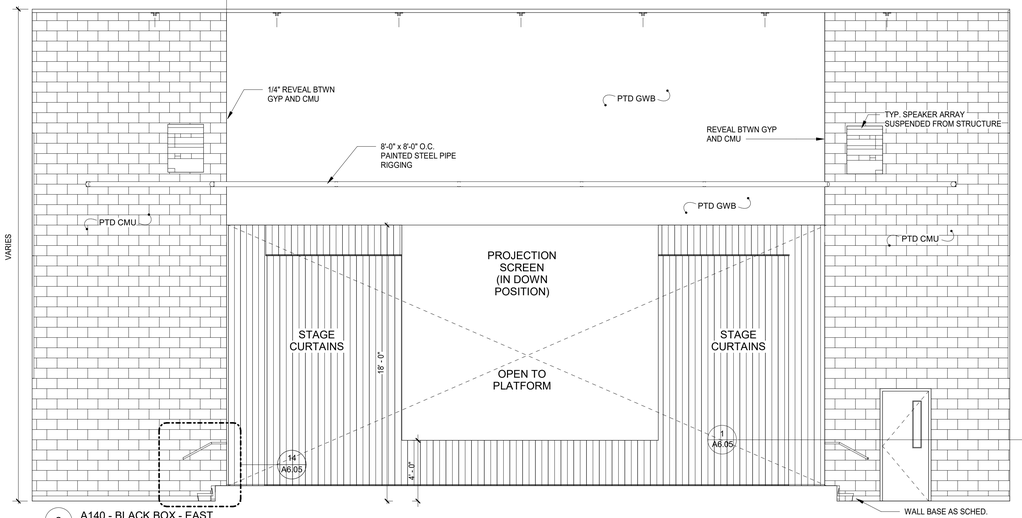
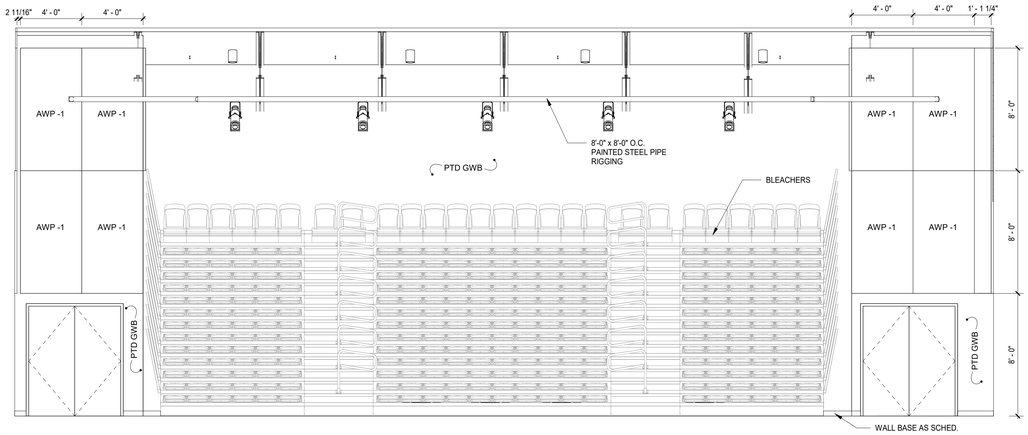


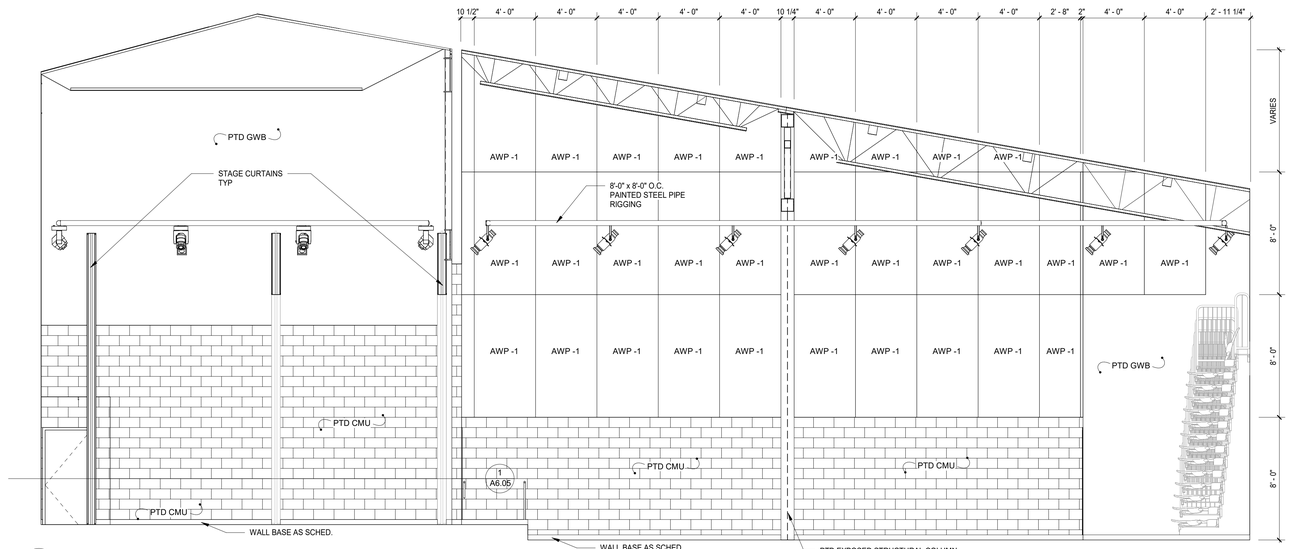
1 A140 - BLACK BOX - NORTH
1/4" = 1'-0"



2 A140 - BLACK BOX - EAST
1/4" = 1'-0"



3 A140 - BLACK BOX - WEST
1/4" = 1'-0"



4 A140 - BLACK BOX - SOUTH
1/4" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - BLACK BOX

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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3	03/16/2026	50% CD
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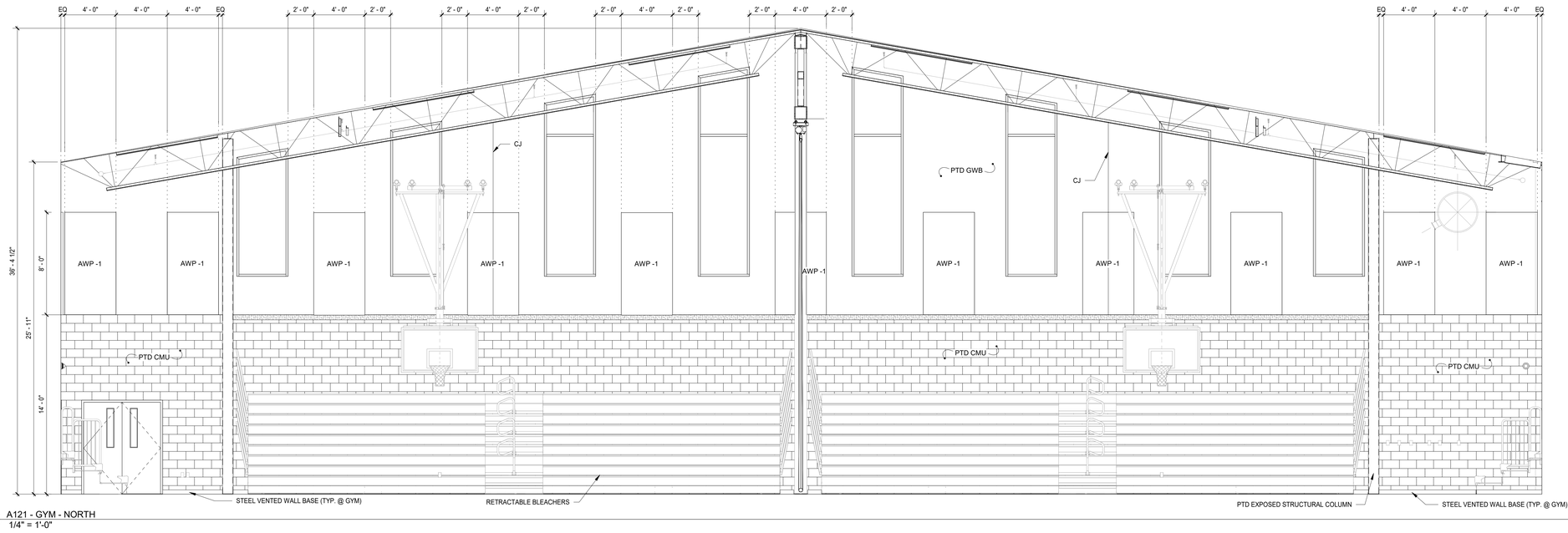
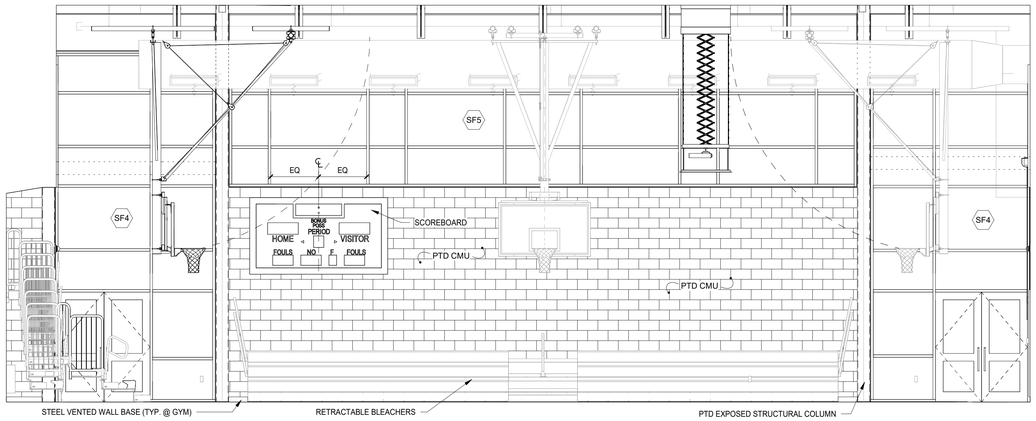
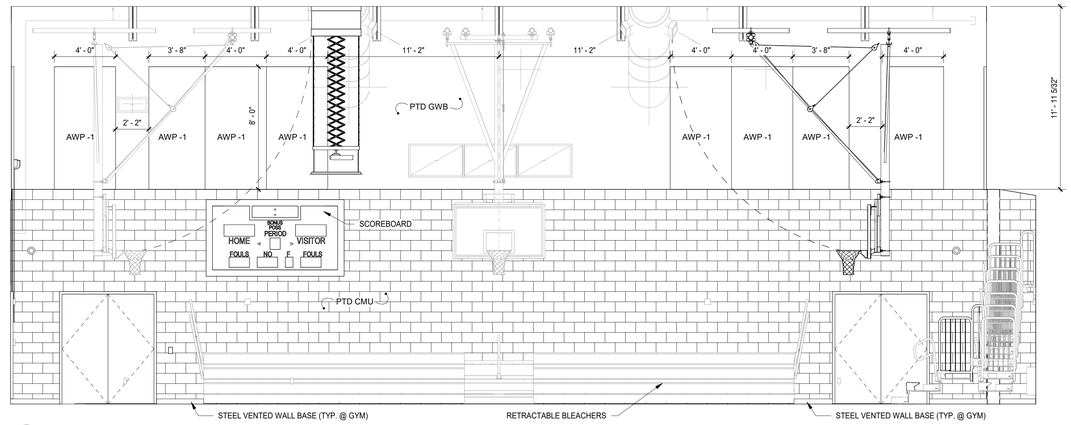


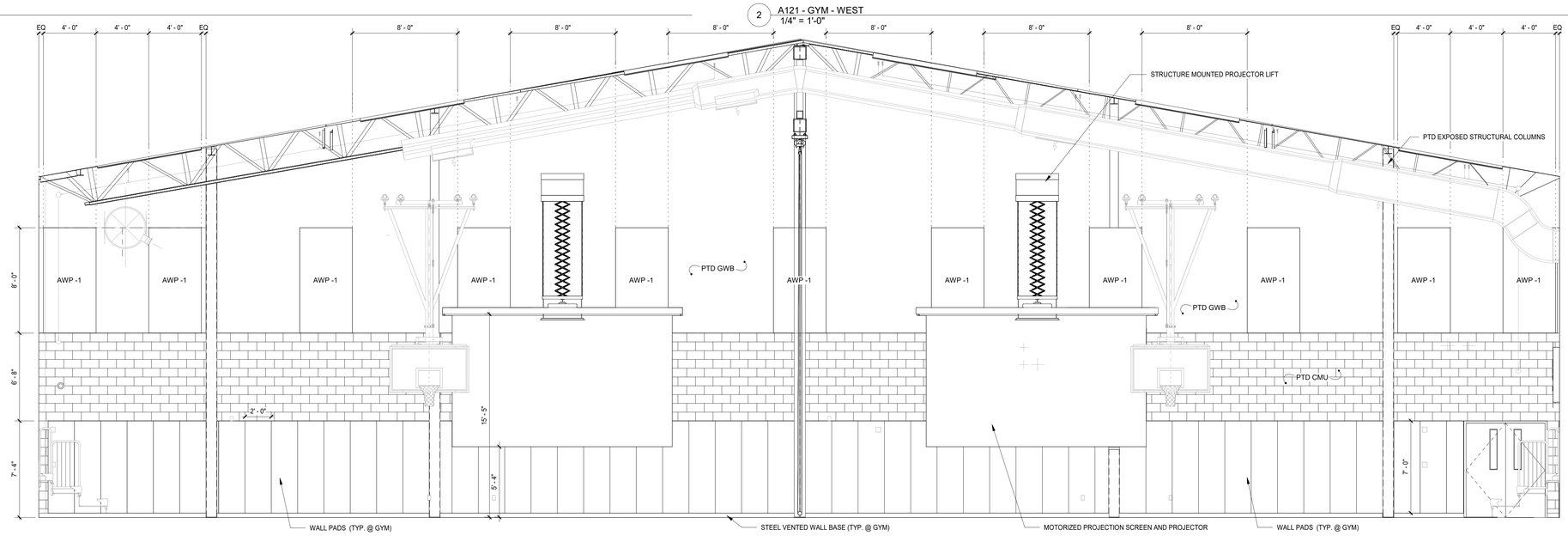
1 A121 - GYM - NORTH
1/4" = 1'-0"



3 A121 - GYM - EAST
1/4" = 1'-0"



2 A121 - GYM - WEST
1/4" = 1'-0"



4 A121 - GYM - SOUTH
1/4" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - GYM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
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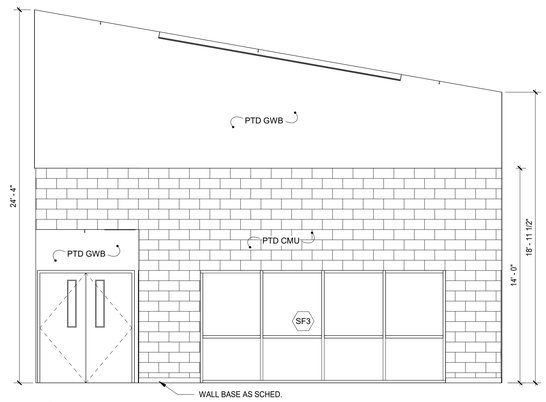
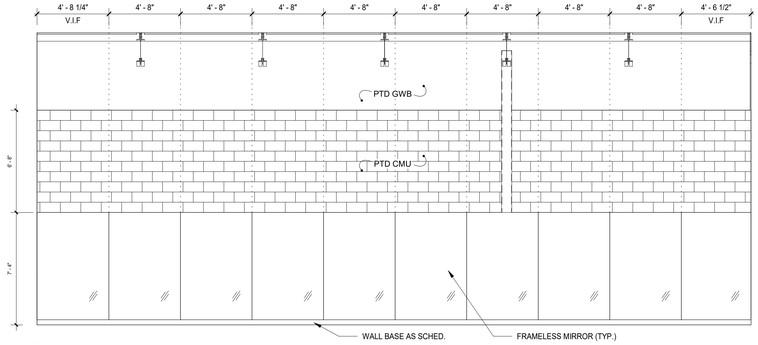
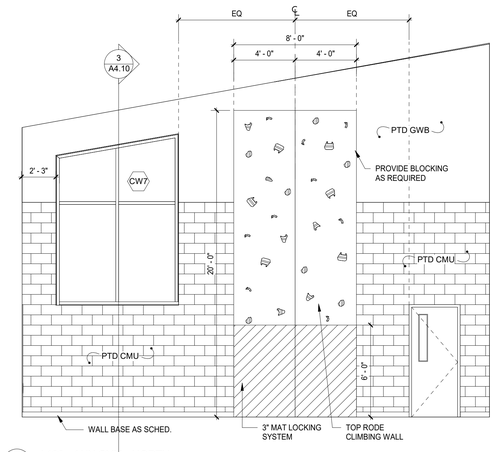


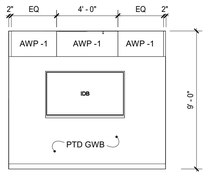
3 A122 - AUX GYM - SOUTH
1/4" = 1'-0"



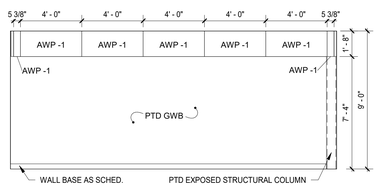
2 A122 - AUX GYM - WEST
1/4" = 1'-0"



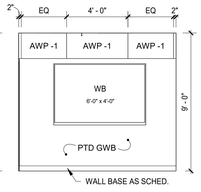
1 A122 - AUX GYM - NORTH
1/4" = 1'-0"



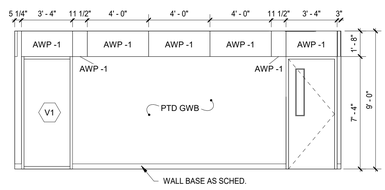
17 CONF. A115, A116 - WEST
1/4" = 1'-0"



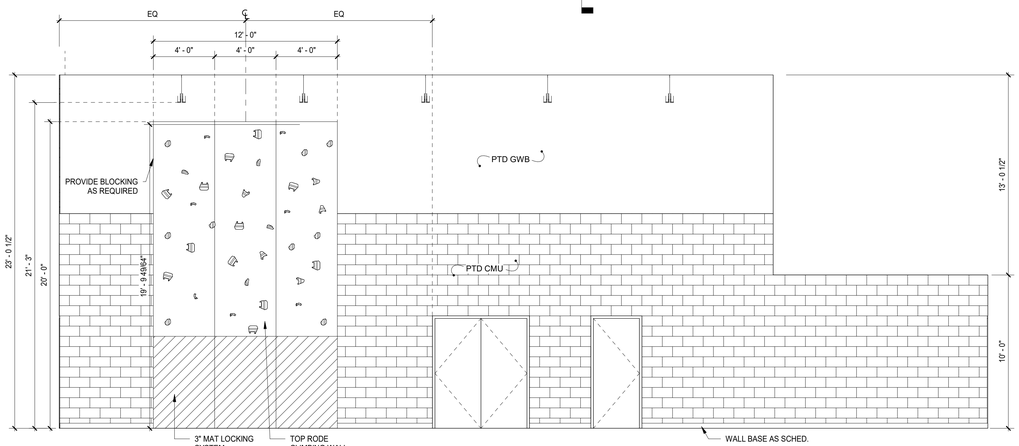
16 CONF. A115 - SOUTH
1/4" = 1'-0"



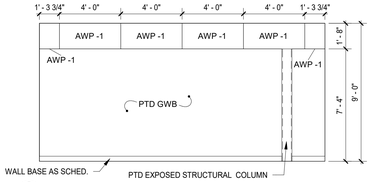
15 CONF. A115, A116 - EAST
1/4" = 1'-0"



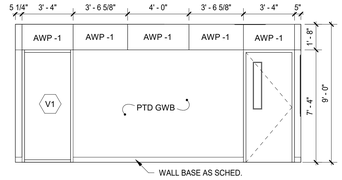
14 CONF. A115 - NORTH
1/4" = 1'-0"



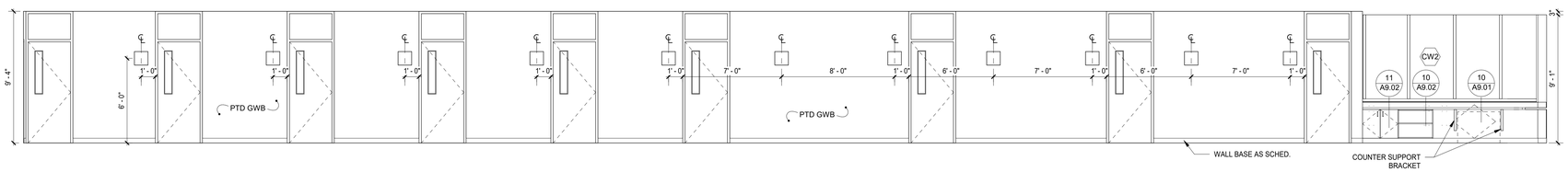
4 A122 - AUX GYM - EAST
1/4" = 1'-0"



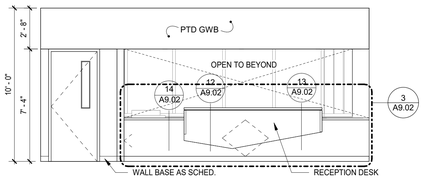
19 CONF A116 - SOUTH
1/4" = 1'-0"



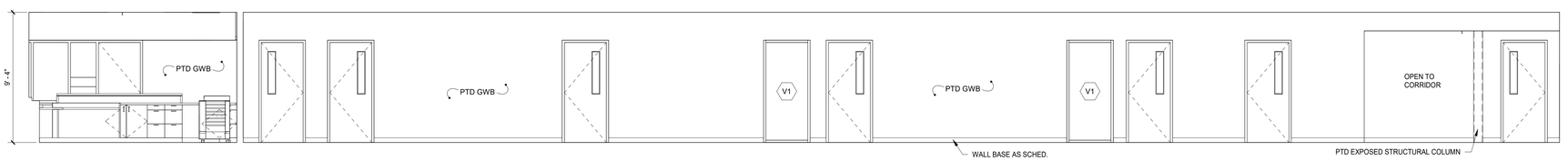
18 CONF A116 - NORTH
1/4" = 1'-0"



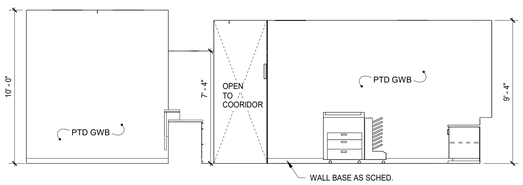
6 A100 - ADMIN - NORTH
1/4" = 1'-0"



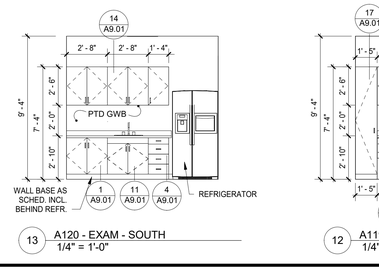
5 A100 - ADMIN WAITING - NORTH
1/4" = 1'-0"



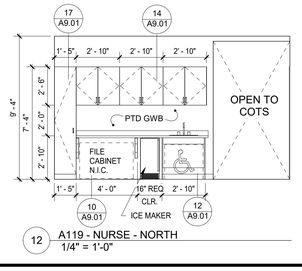
8 A100 - ADMIN - SOUTH
1/4" = 1'-0"



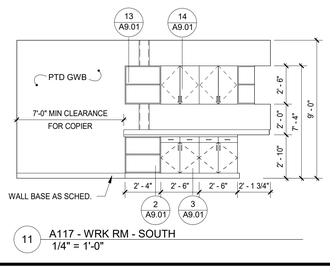
7 A100 - ADMIN - WEST
1/4" = 1'-0"



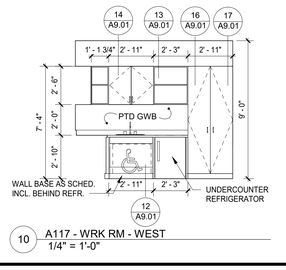
13 A120 - EXAM - SOUTH
1/4" = 1'-0"



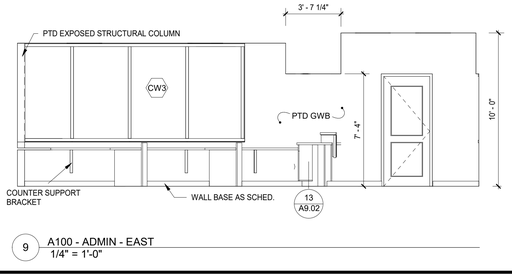
12 A119 - NURSE - NORTH
1/4" = 1'-0"



11 A117 - WRK RM - SOUTH
1/4" = 1'-0"



10 A117 - WRK RM - WEST
1/4" = 1'-0"



9 A100 - ADMIN - EAST
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - AUX GYM & ADMIN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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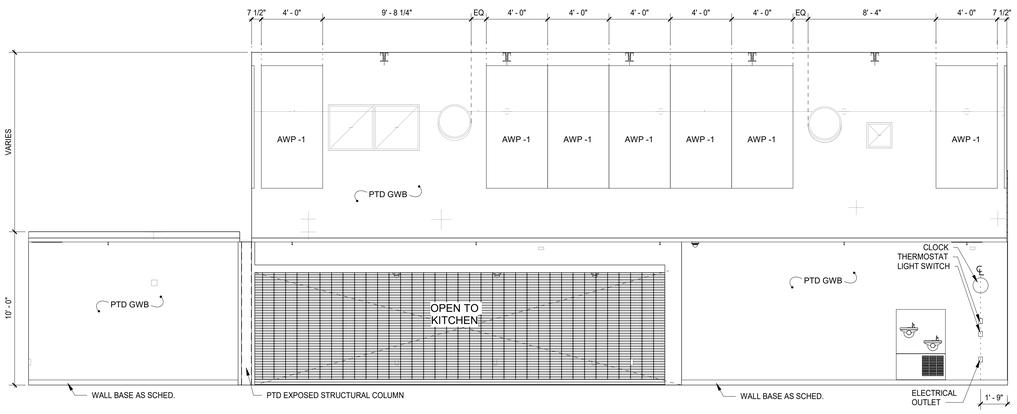
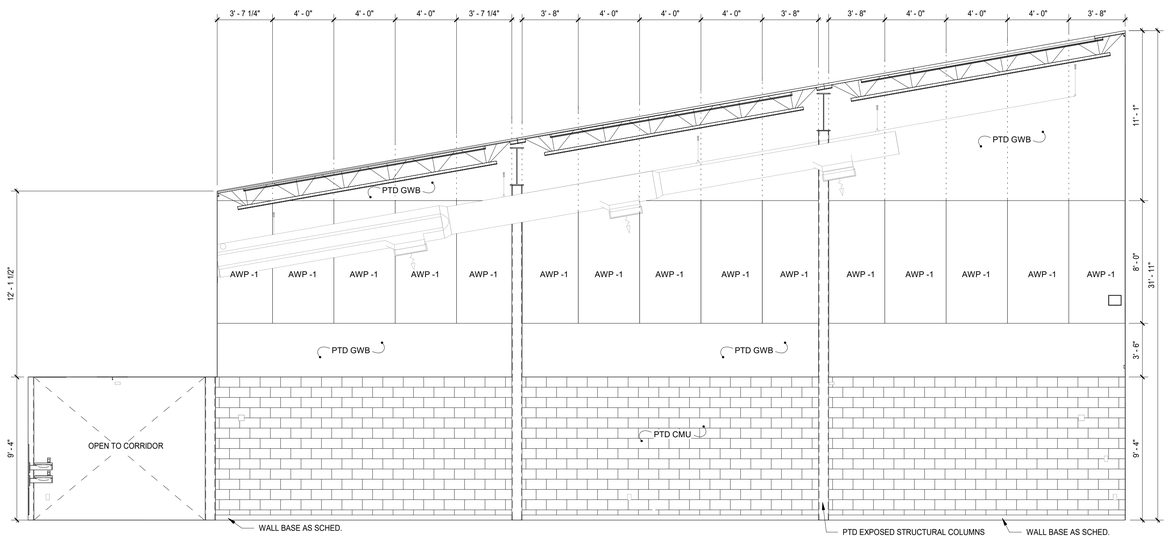
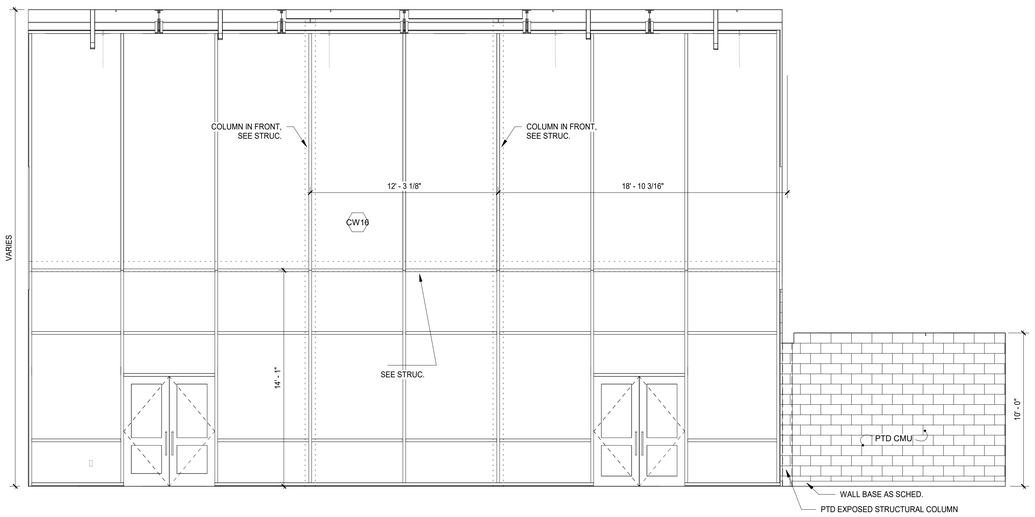


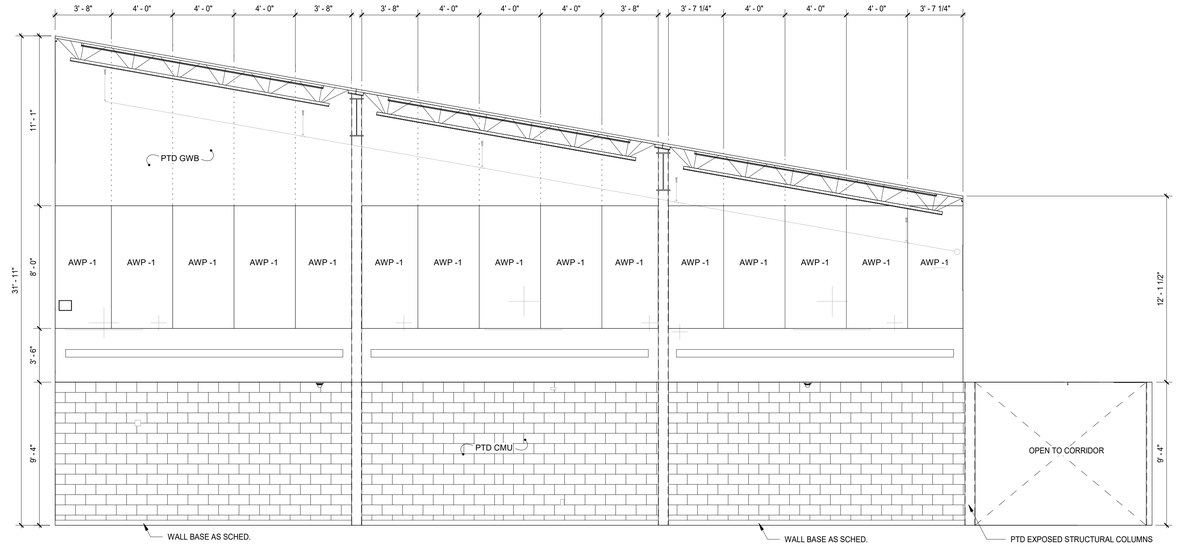
2 A137 - CAFETERIA - WEST
1/4" = 1'-0"



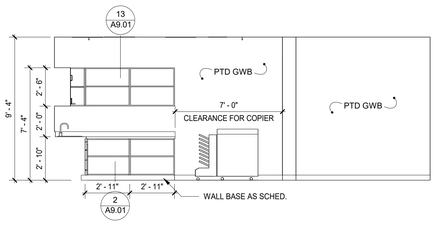
1 A137 - CAFETERIA - NORTH
1/4" = 1'-0"



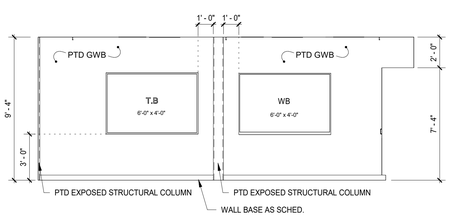
4 A137 - CAFETERIA - EAST
1/4" = 1'-0"



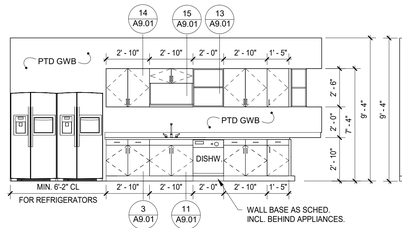
3 A137 - CAFETERIA - SOUTH
1/4" = 1'-0"



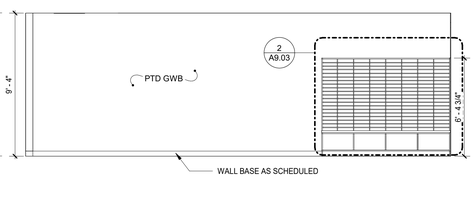
9 B040, B137 - TEACHER - SOUTH
1/4" = 1'-0"



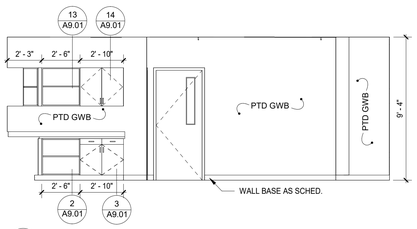
8 B040, B137 - TEACHER - NORTH
1/4" = 1'-0"



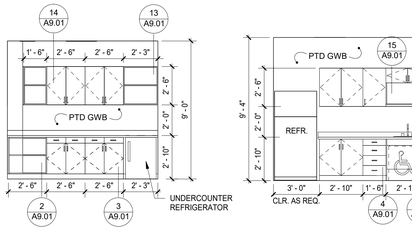
7 A136 - FACULTY DINING - WEST
1/4" = 1'-0"



6 A136 - FACULTY DINING - EAST
1/4" = 1'-0"

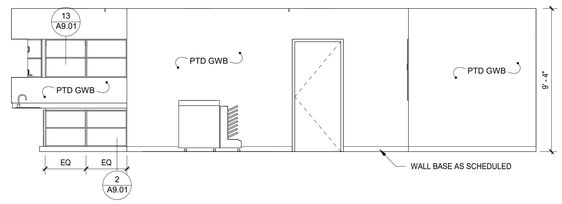


5 A136 - FACULTY DINING - NORTH
1/4" = 1'-0"

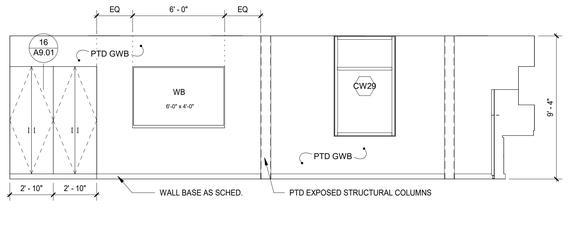


14 B103 - WR - SOUTH
1/4" = 1'-0"

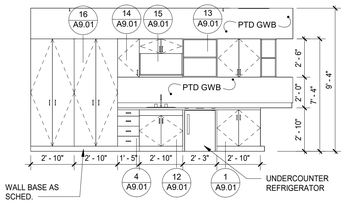
13 B232 - TEACHER - EAST
1/4" = 1'-0"



12 B232 - TEACHER - SOUTH
1/4" = 1'-0"



11 B232 - TEACHER - NORTH
1/4" = 1'-0"



10 B040, B137 - TEACHER - EAST
1/4" = 1'-0"

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TSKP STUDIO
One Hartford Square West
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Hartford, CT 06106
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ARCHITECTURE | PLANNING | INTERIORS

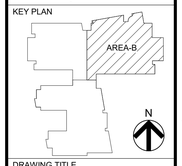
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CAFETERIA & FACULTY RMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A8.11

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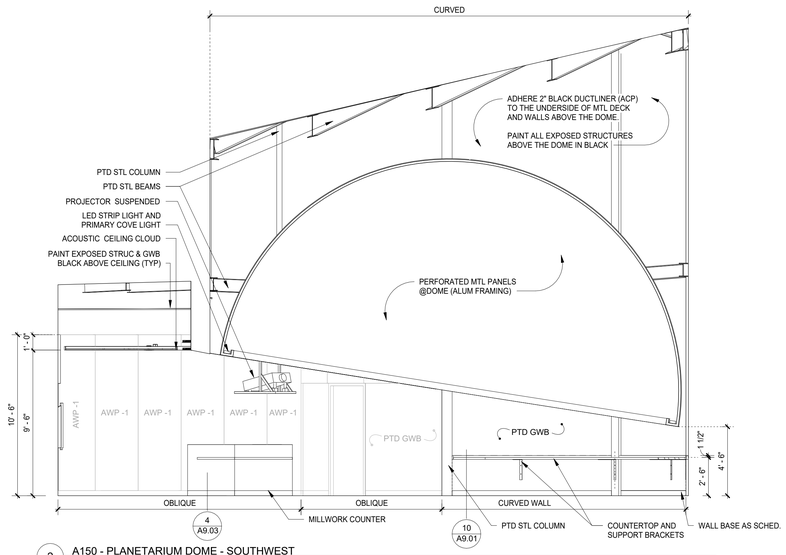
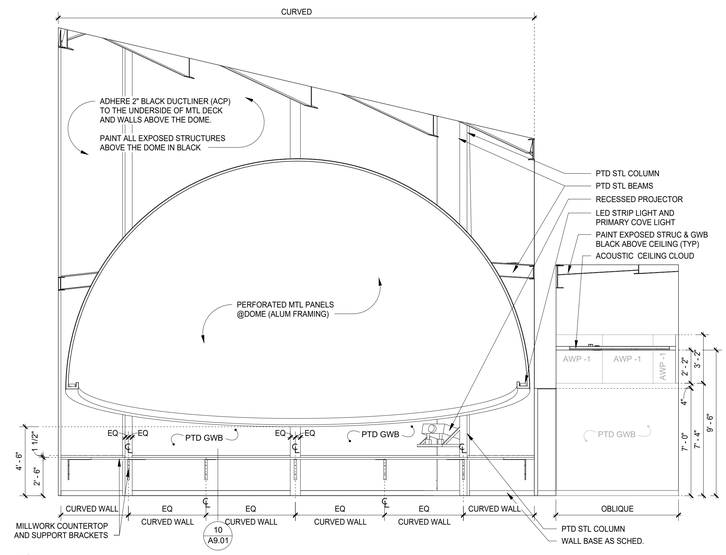
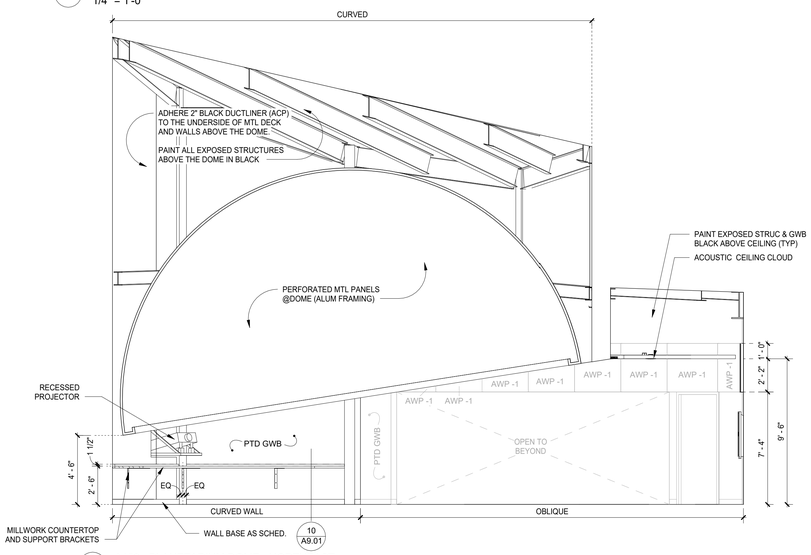


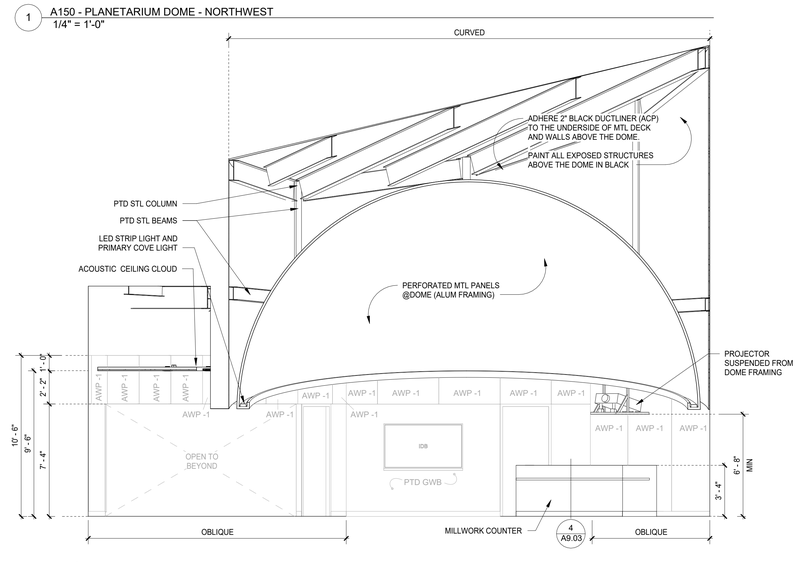
2 A150 - PLANETARIUM DOME - SOUTHWEST
1/4" = 1'-0"



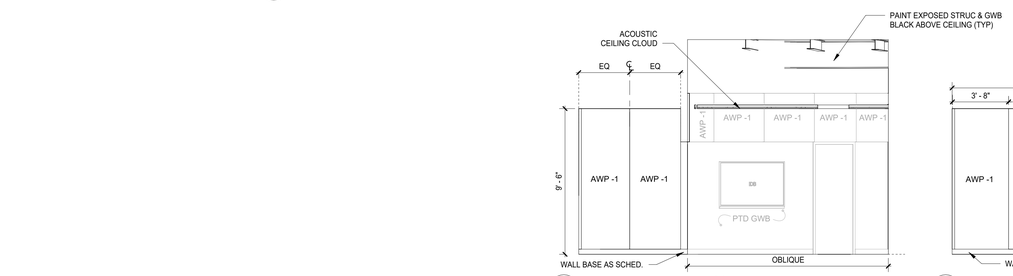
1 A150 - PLANETARIUM DOME - NORTHWEST
1/4" = 1'-0"



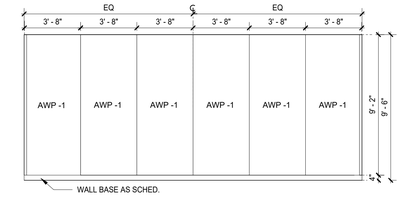
4 A150 - PLANETARIUM DOME - NORTHEAST
1/4" = 1'-0"



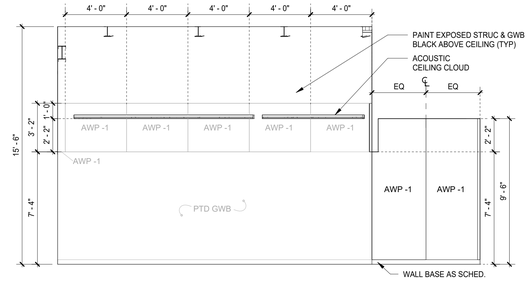
3 A150 - PLANETARIUM DOME - SOUTHEAST
1/4" = 1'-0"



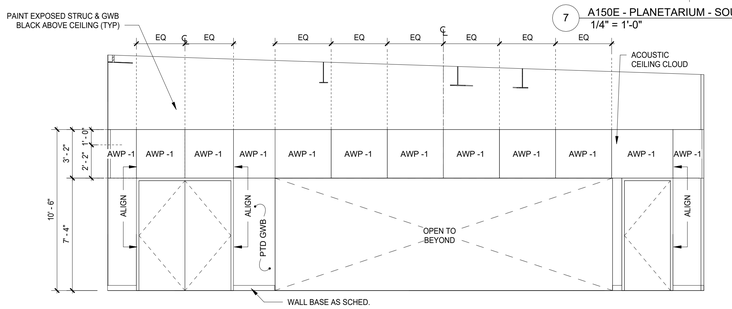
7 A150E - PLANETARIUM - SOUTH
1/4" = 1'-0"



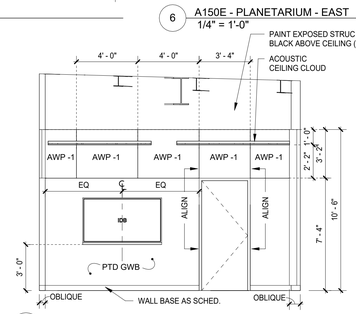
6 A150E - PLANETARIUM - EAST
1/4" = 1'-0"



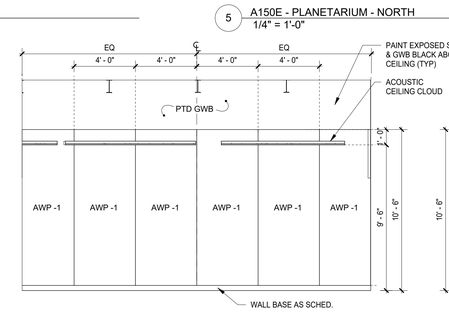
5 A150E - PLANETARIUM - NORTH
1/4" = 1'-0"



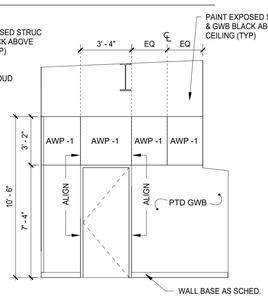
11 A150F - PLANETARIUM - EAST
1/4" = 1'-0"



10 A150F - PLANETARIUM - SOUTHEAST
1/4" = 1'-0"



9 A150F - PLANETARIUM - SOUTH
1/4" = 1'-0"



8 A150F - PLANETARIUM - WEST
1/4" = 1'-0"

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ARCHITECTURE | PLANNING | INTERIORS

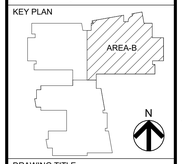
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - PLANETARIUM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A8.12

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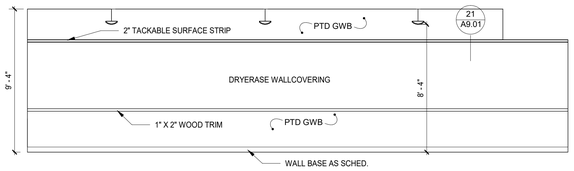
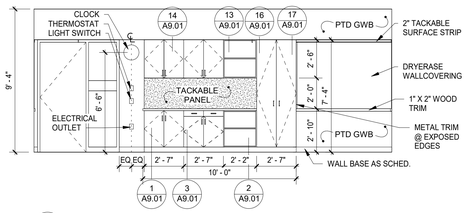
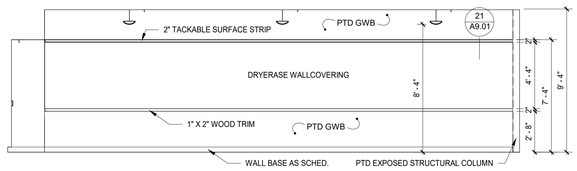


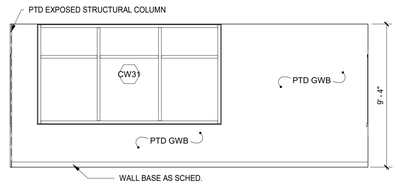
4 CLASSROOM TYP.1 - B108 - EAST
1/4" = 1'-0"



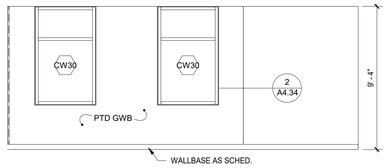
3 CLASSROOM TYP. 1 - B108 - SOUTH
1/4" = 1'-0"



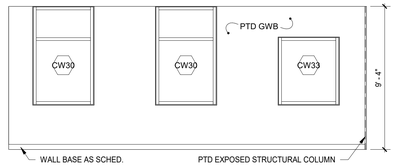
2 CLASSROOM TYP.1 - B108 - WEST
1/4" = 1'-0"



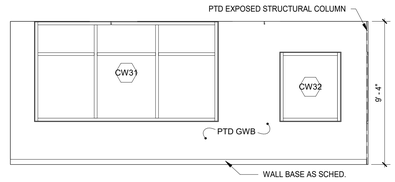
1 CLASSROOM TYP.1 - B108 - NORTH
1/4" = 1'-0"



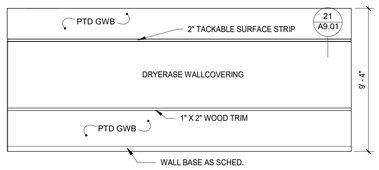
7 CLASSROOM TYP. 1 - LOWER LEVEL B009 - NORTH
1/4" = 1'-0"



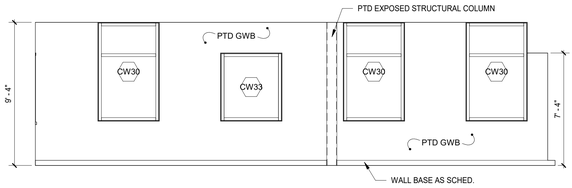
6 CLASSROOM TYP.1 - LOWER LEVEL B010 - NORTH
1/4" = 1'-0"



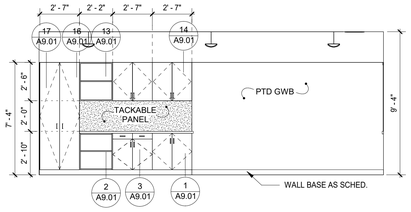
5 CLASSROOM TYP. 1 - B109 - NORTH
1/4" = 1'-0"



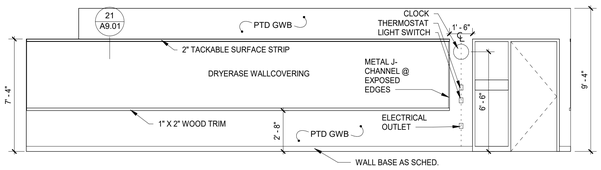
11 CLASSROOM TYP. 2 - B016 - EAST
1/4" = 1'-0"



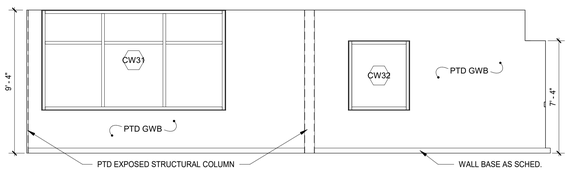
10 CLASSROOM TYP. 2 - B016 - SOUTH
1/4" = 1'-0"



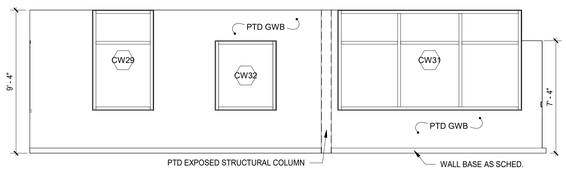
9 CLASSROOM TYP. 2 - B016 - WEST
1/4" = 1'-0"



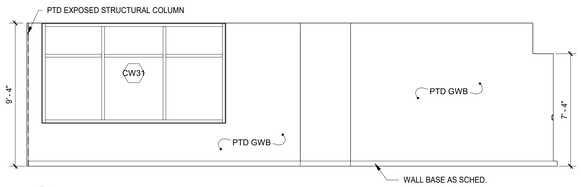
8 CLASSROOM TYP. 2 - B016- NORTH
1/4" = 1'-0"



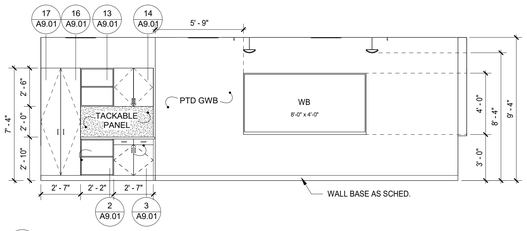
14 CLASSROOM TYP. 2 - B221 - NORTH
1/4" = 1'-0"



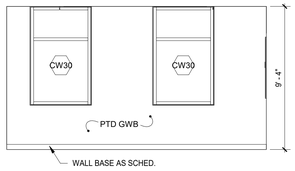
13 CLASSROOM TYP.2 - B115 & B211 - SOUTH
1/4" = 1'-0"



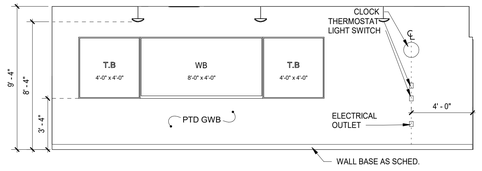
12 CLASSROOM TYP.2 - B127 - NORTH
1/4" = 1'-0"



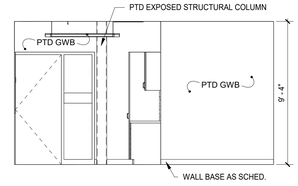
18 B036 - STRIDE - EAST
1/4" = 1'-0"



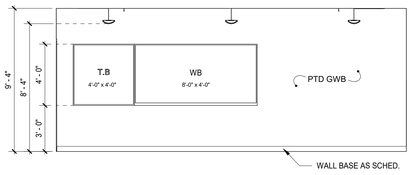
17 B036 - STRIDE - SOUTH
1/4" = 1'-0"



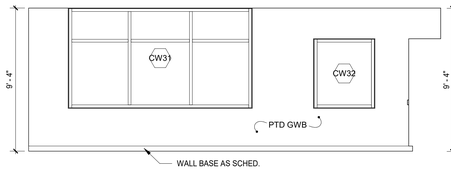
16 B036 - STRIDE - WEST
1/4" = 1'-0"



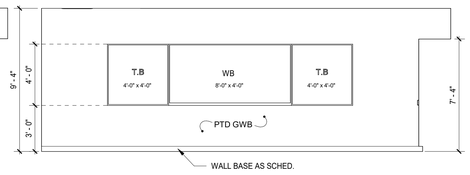
15 B036 - STRIDE - NORTH
1/4" = 1'-0"



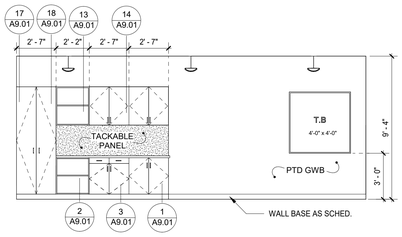
23 B118, B214 - STRIDE - EAST
1/4" = 1'-0"



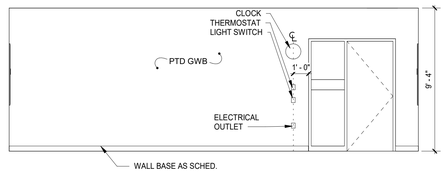
22 B214 - STRIDE - SOUTH
1/4" = 1'-0"



21 B118 - STRIDE - SOUTH
1/4" = 1'-0"



20 B118, B214 - STRIDE - WEST
1/4" = 1'-0"



19 B118, B214 - STRIDE - NORTH
1/4" = 1'-0"

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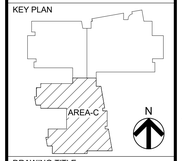
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CLASSROOMS

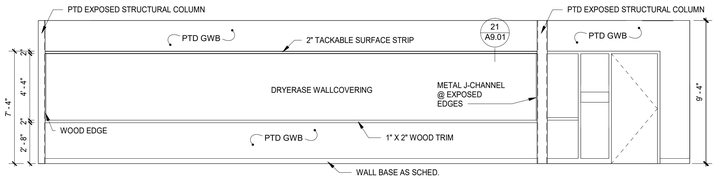
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

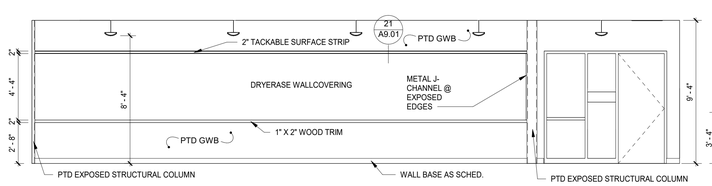
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A8.13

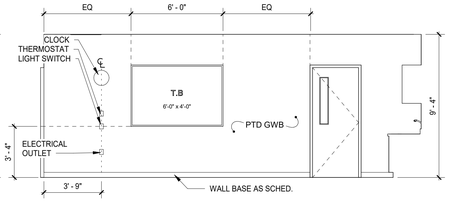
5/19/2026 11:09:19 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



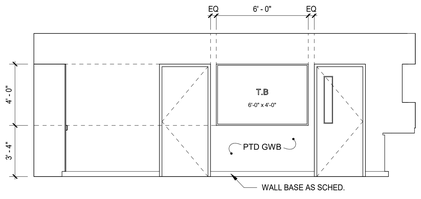
3 B201 - SCIENCE - WEST
1/4" = 1'-0"



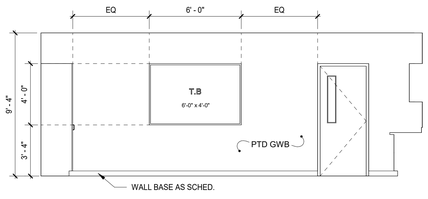
2 B001, B101 - SCIENCE - WEST
1/4" = 1'-0"



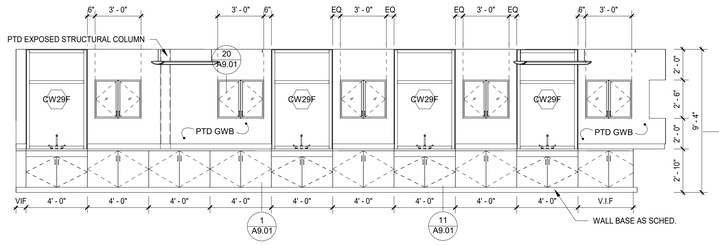
1 B001, B101, B201 - SCIENCE - NORTH
1/4" = 1'-0"



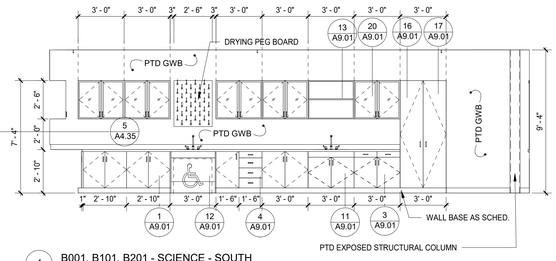
7 B229 - SCIENCE - NORTH
1/4" = 1'-0"



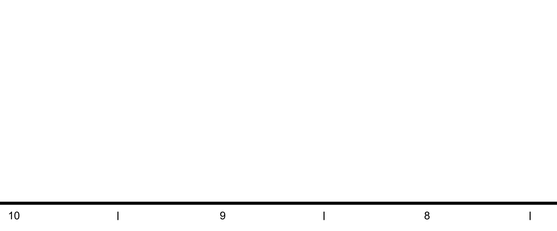
6 B038, B135 - SCIENCE - NORTH
1/4" = 1'-0"



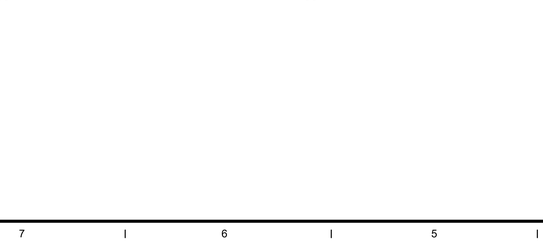
5 B001, B101, B201 - SCIENCE - EAST
1/4" = 1'-0"



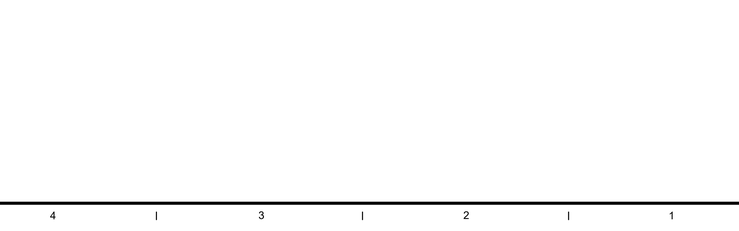
4 B001, B101, B201 - SCIENCE - SOUTH
1/4" = 1'-0"



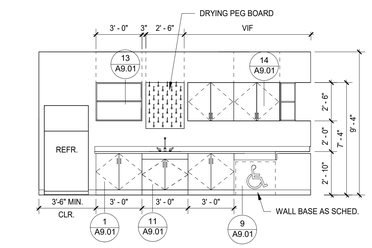
10 B135, B229 - SCIENCE - SOUTH
1/4" = 1'-0"



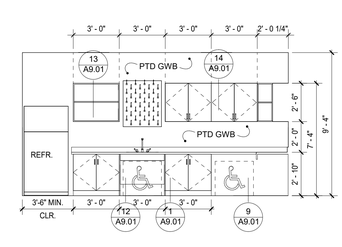
30 B038 SCIENCE - SOUTH
1/4" = 1'-0"



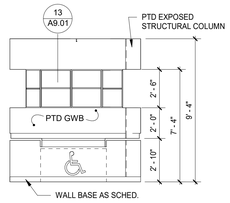
8 B038, B135, B229 - SCIENCE - WEST
1/4" = 1'-0"



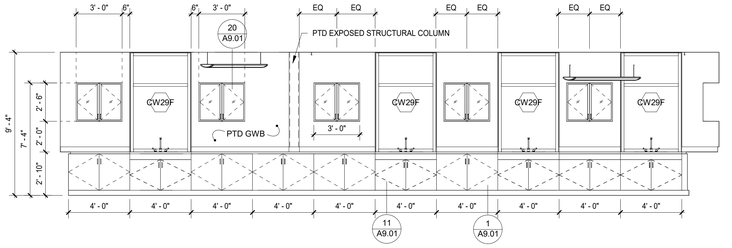
14 B101A, B135A, B201A, B229A- PREP - WEST
1/4" = 1'-0"



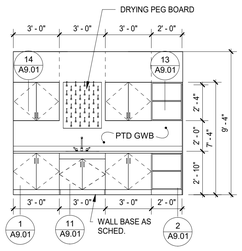
13 B001A PREP - WEST
1/4" = 1'-0"



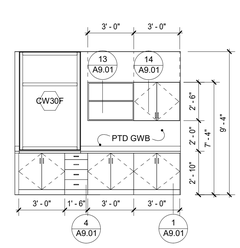
12 B001A, B101A, B135A, B201A. B229A - PREP - NORTH
1/4" = 1'-0"



11 B038, B135, B229 - SCIENCE - EAST
1/4" = 1'-0"



18 B038A - PREP - WEST
1/4" = 1'-0"



17 B038A - PREP - EAST
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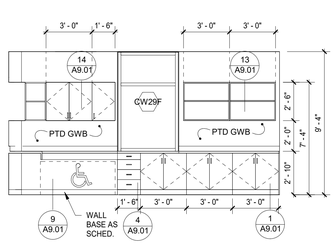
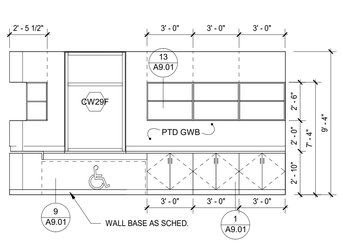


16 B135A, B229A - PREP - EAST
1/4" = 1'-0"



15 B101A, B201A - PREP - EAST
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CLASSROOMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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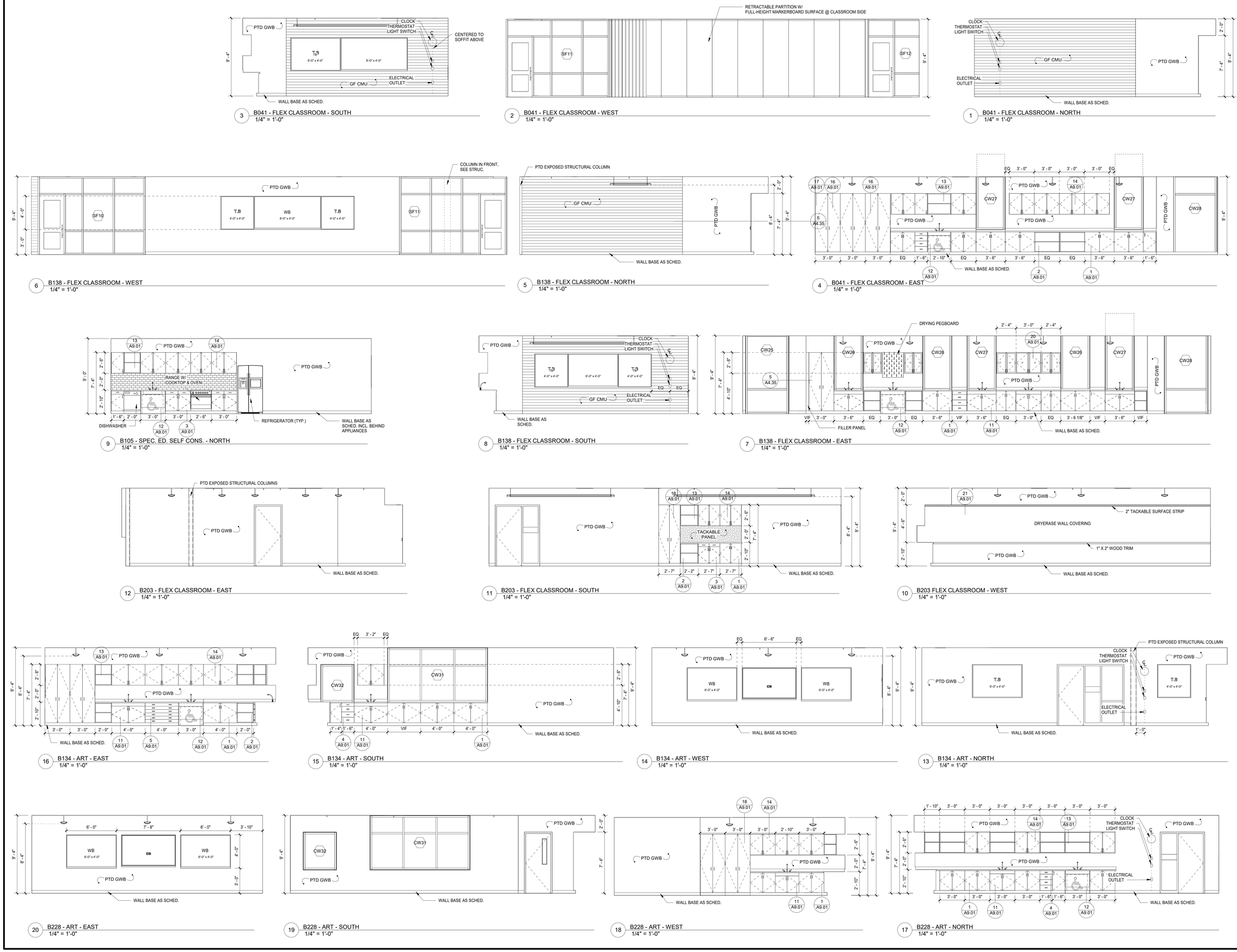

1 B041 - FLEX CLASSROOM - NORTH
1/4" = 1'-0"

2 B041 - FLEX CLASSROOM - WEST
1/4" = 1'-0"

3 B041 - FLEX CLASSROOM - SOUTH
1/4" = 1'-0"

4 B041 - FLEX CLASSROOM - EAST
1/4" = 1'-0"

5 B138 - FLEX CLASSROOM - NORTH
1/4" = 1'-0"

6 B138 - FLEX CLASSROOM - WEST
1/4" = 1'-0"

7 B138 - FLEX CLASSROOM - EAST
1/4" = 1'-0"

8 B138 - FLEX CLASSROOM - SOUTH
1/4" = 1'-0"

9 B105 - SPEC. ED. SELF CONS. - NORTH
1/4" = 1'-0"

10 B203 FLEX CLASSROOM - WEST
1/4" = 1'-0"

11 B203 - FLEX CLASSROOM - SOUTH
1/4" = 1'-0"

12 B203 - FLEX CLASSROOM - EAST
1/4" = 1'-0"

13 B134 - ART - NORTH
1/4" = 1'-0"

14 B134 - ART - WEST
1/4" = 1'-0"

15 B134 - ART - SOUTH
1/4" = 1'-0"

16 B134 - ART - EAST
1/4" = 1'-0"

17 B228 - ART - NORTH
1/4" = 1'-0"

18 B228 - ART - WEST
1/4" = 1'-0"

19 B228 - ART - SOUTH
1/4" = 1'-0"

20 B228 - ART - EAST
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CLASSROOM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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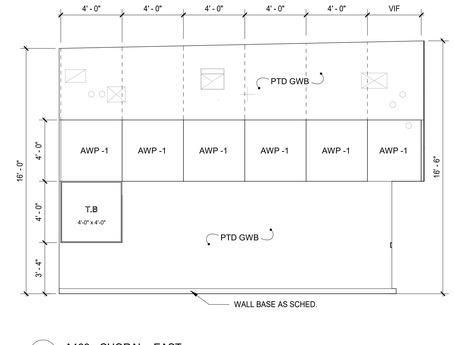
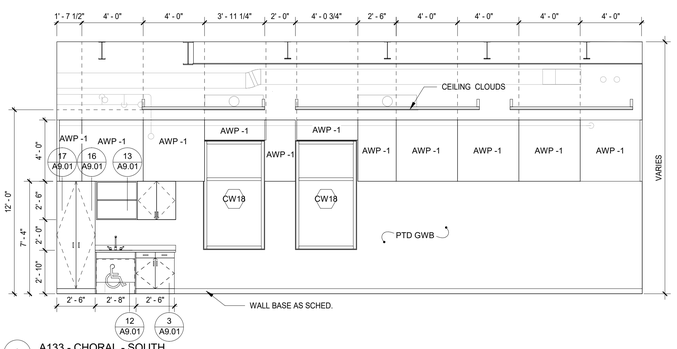
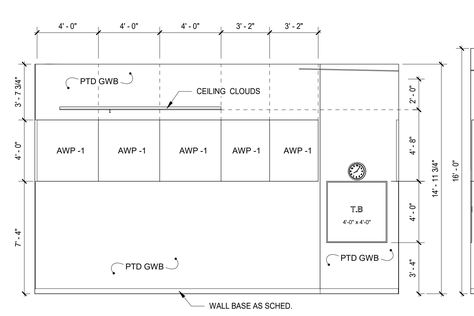


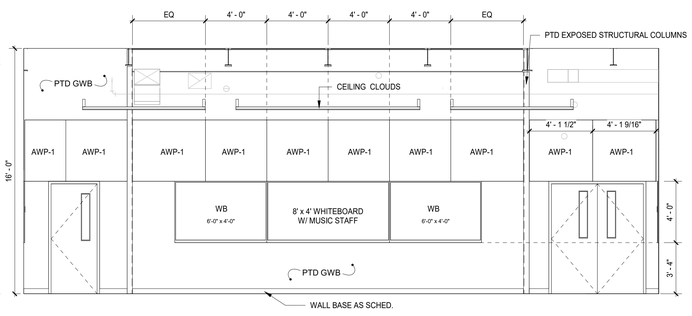
4 A133 - CHORAL - EAST
1/4" = 1'-0"



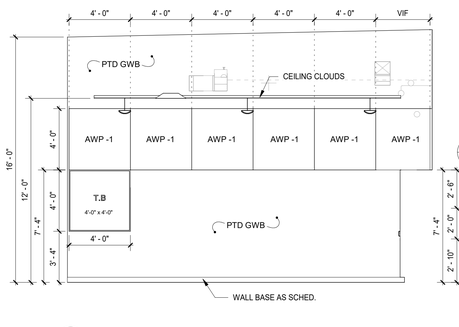
3 A133 - CHORAL - SOUTH
1/4" = 1'-0"



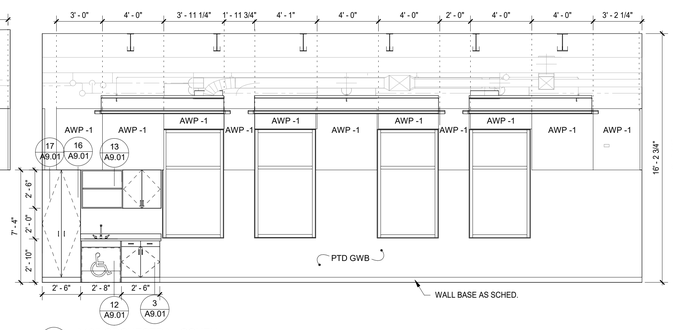
2 A133 - CHORAL - WEST
1/4" = 1'-0"



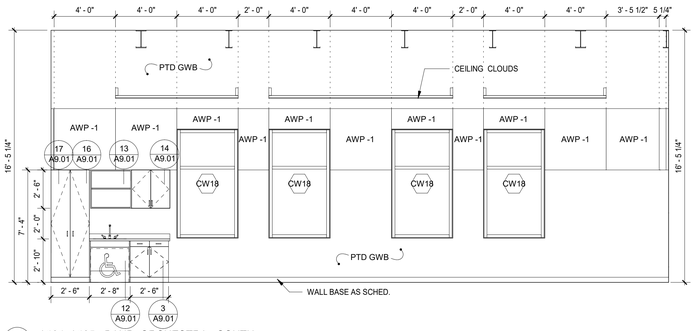
1 A133, A134, A135 - CHORAL, BAND, ORCHESTRA - NORTH
1/4" = 1'-0"



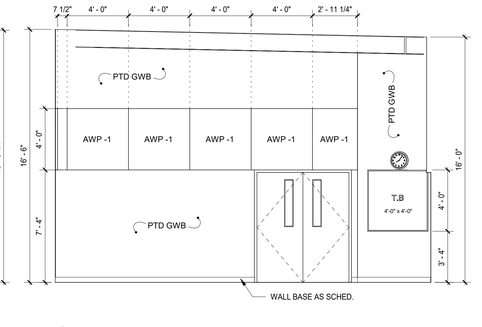
8 A134, A135 - BAND, ORCHESTRA - EAST
1/4" = 1'-0"



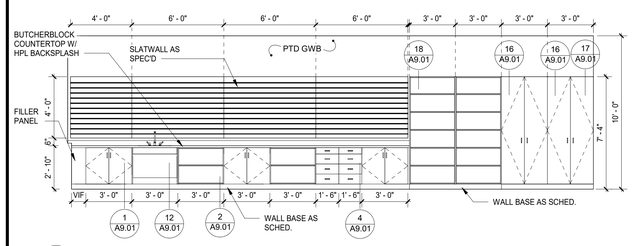
7 A135 ORCHESTRA - SOUTH
1/4" = 1'-0"



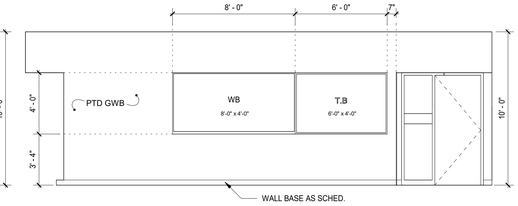
6 A134, A135 - BAND, ORCHESTRA - SOUTH
1/4" = 1'-0"



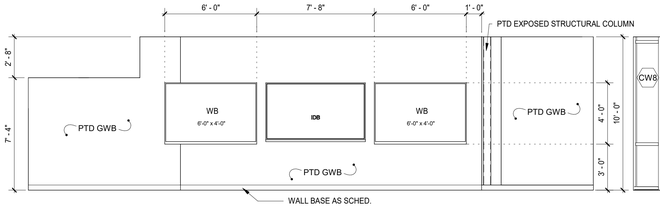
5 A134, A135 - BAND, ORCHESTRA - WEST
1/4" = 1'-0"



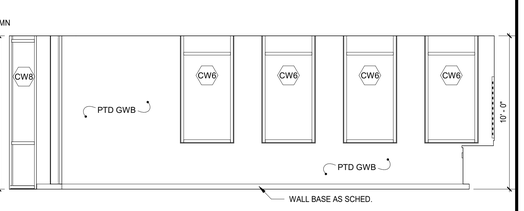
12 A141 - ROBOTIC TECH ENG. - EAST
1/4" = 1'-0"



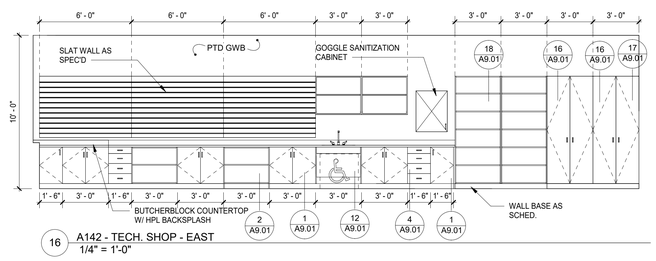
11 A141 - ROBOTIC TECH ENG. - SOUTH
1/4" = 1'-0"



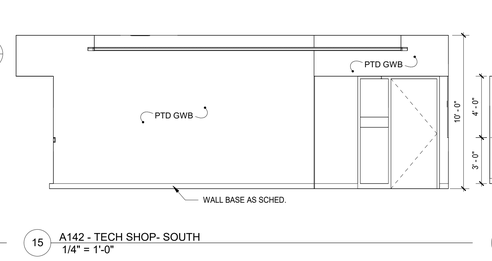
10 A141 - ROBOTIC TECH ENG. - WEST
1/4" = 1'-0"



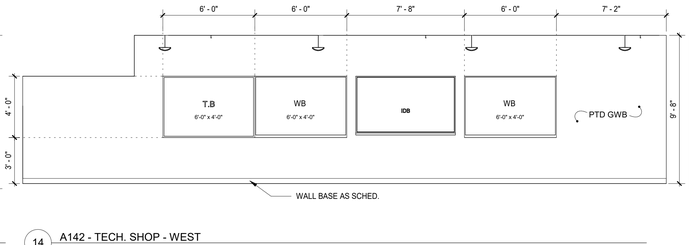
9 A141 - ROBOTIC TECH ENG. - NORTH
1/4" = 1'-0"



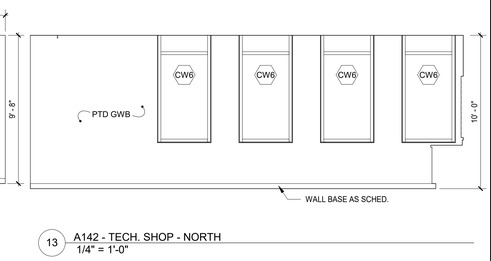
16 A142 - TECH. SHOP - EAST
1/4" = 1'-0"



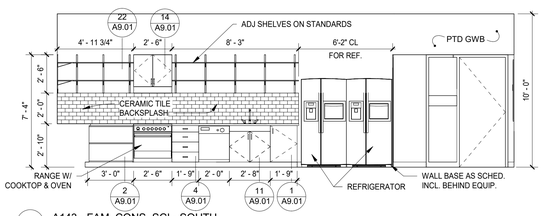
15 A142 - TECH SHOP- SOUTH
1/4" = 1'-0"



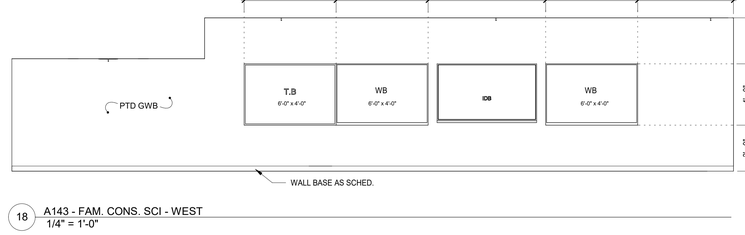
14 A142 - TECH. SHOP - WEST
1/4" = 1'-0"



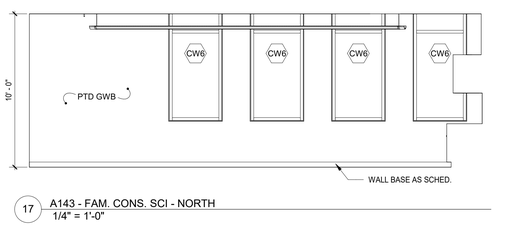
13 A142 - TECH. SHOP - NORTH
1/4" = 1'-0"



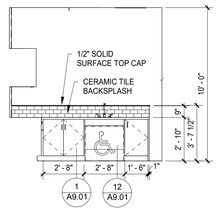
19 A143 - FAM. CONS. SCI - SOUTH
1/4" = 1'-0"



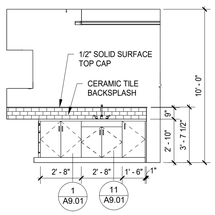
18 A143 - FAM. CONS. SCI - WEST
1/4" = 1'-0"



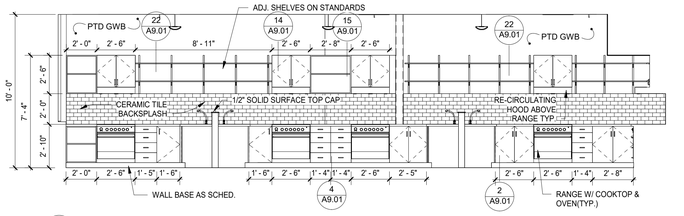
17 A143 - FAM. CONS. SCI - NORTH
1/4" = 1'-0"



22 A143 - FAM. CONS. SCI. - PARTIAL
1/4" = 1'-0"



21 A143 - FAM CONS. SCI - PARTIAL
1/4" = 1'-0"



20 A143 - FAM. CONS. SCI - EAST
1/4" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

INTERIOR ELEVATIONS - CLASSROOM

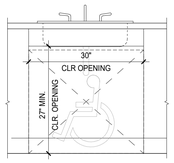
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

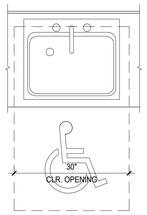
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A8.16

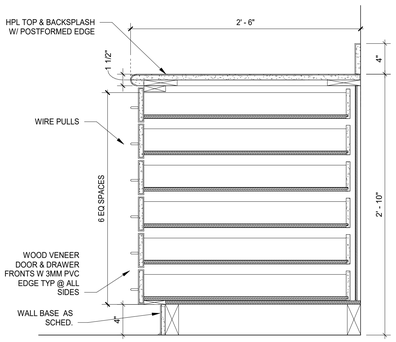
5/19/2026 11:10:01 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



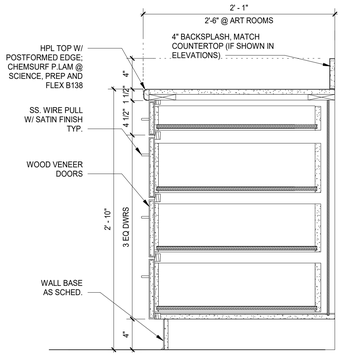
7 TYP. ADA SINK ELEVATION
3/4" = 1'-0"



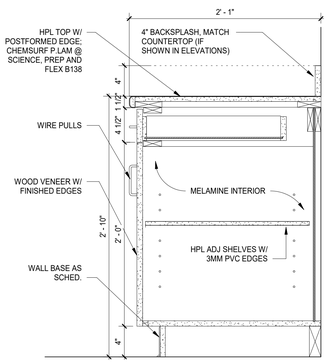
8 TYP. ADA SINK PLAN
3/4" = 1'-0"



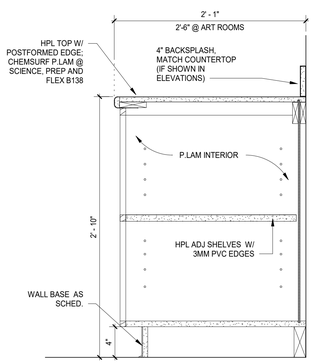
5 CW - BASE CABINET W/ 6 DRAWERS (TYP)
1 1/2" = 1'-0"



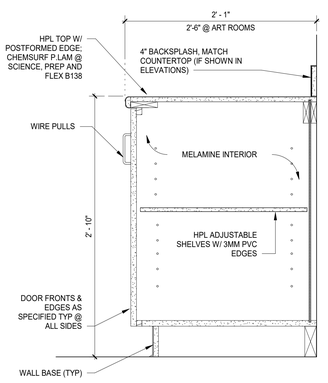
4 CW - BASE CAB. 4 DRAWER
1 1/2" = 1'-0"



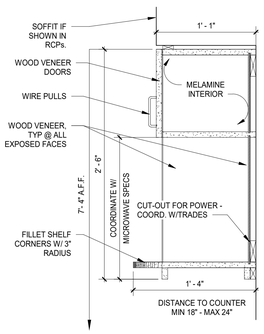
3 CW - BASE CAB. DOOR & DRAWER (TYP)
1 1/2" = 1'-0"



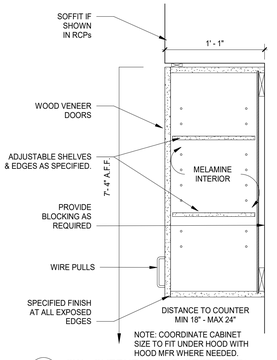
2 CW - BASE OPEN CABINET (TYP)
1 1/2" = 1'-0"



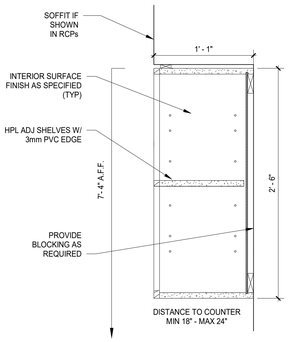
1 CW - BASE CABINET (TYP)
1 1/2" = 1'-0"



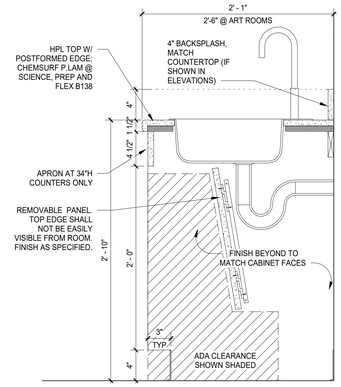
15 CW - OVERHEAD MICROWAVE CAB
1 1/2" = 1'-0"



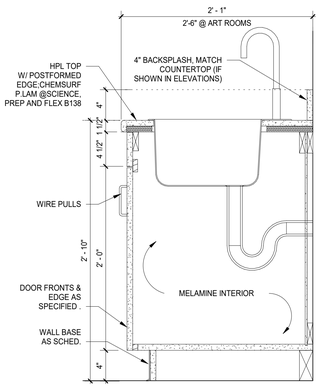
14 CW - OVERHEAD CAB. SECT. (TYP)
1 1/2" = 1'-0"



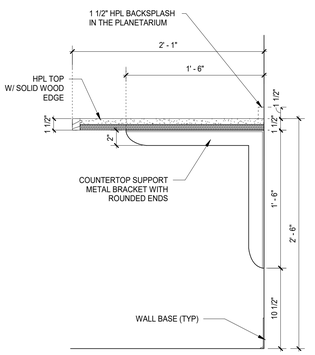
13 CW - OVERHEAD OPEN CAB. SECT. (TYP)
1 1/2" = 1'-0"



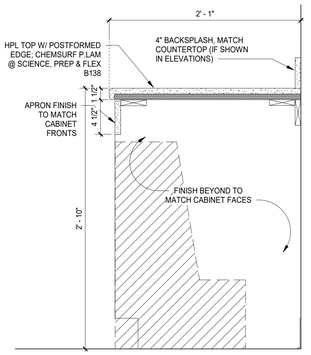
12 CW - ADA SINK SECTION (TYP)
1 1/2" = 1'-0"



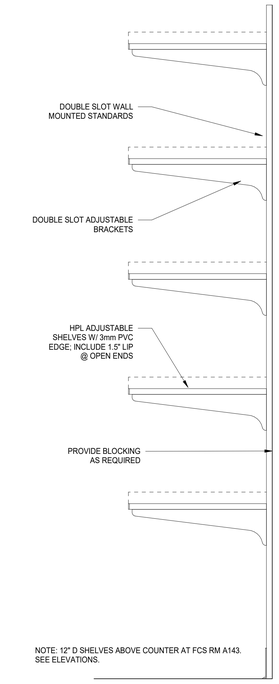
11 CW - BASE CABINET SINK SECTION (TYP)
1 1/2" = 1'-0"



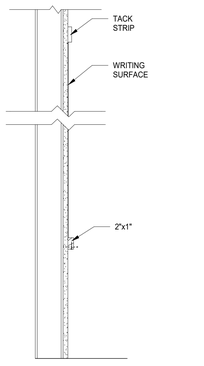
10 CW - COUNTER SECTION ADMIN & PLANETARIUM
1 1/2" = 1'-0"



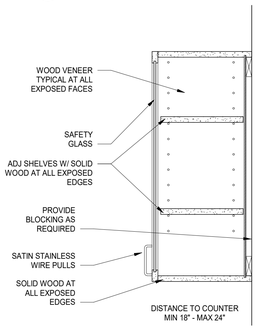
9 CW - COUNTER SECTION TYP.
1 1/2" = 1'-0"



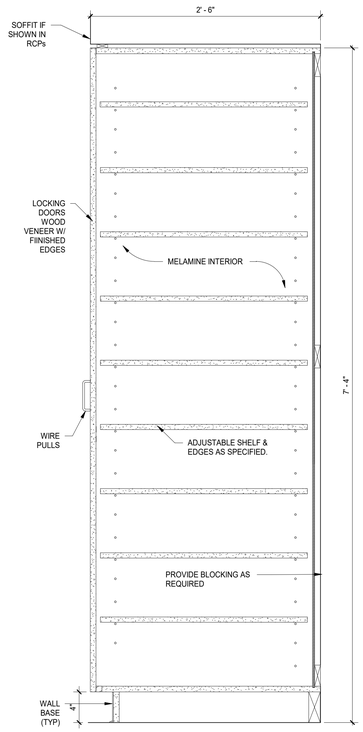
22 CW - ADJUSTABLE SHELVING 18"
1 1/2" = 1'-0"



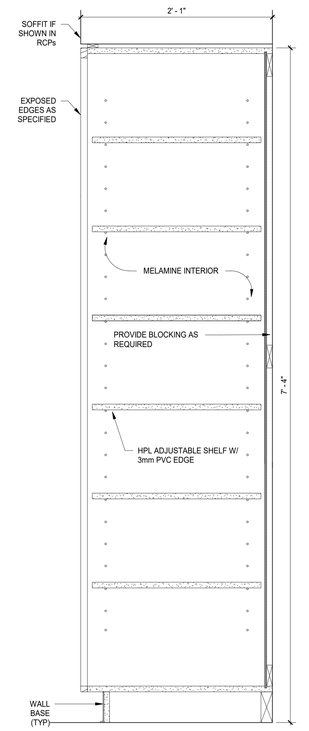
21 CW -DRYERASE WC AND WOOD TRIM
1 1/2" = 1'-0"



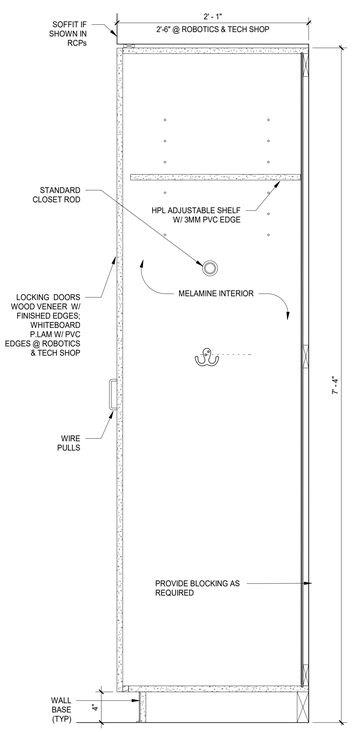
20 GLAZED OVERHEAD CAB (TYP)
1 1/2" = 1'-0"



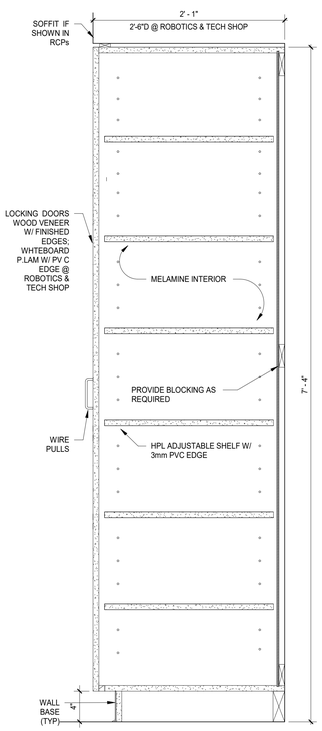
19 CW - TALL STORAGE CABINET (TYP) ART
1 1/2" = 1'-0"



18 CW - TALL STOR.W/OPEN SHELVES (TYP)
1 1/2" = 1'-0"



17 CW - TALL WARDROBE CABINET (TYP)
1 1/2" = 1'-0"



16 CW - TALL STORAGE CABINET (TYP)
1 1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MILLWORK DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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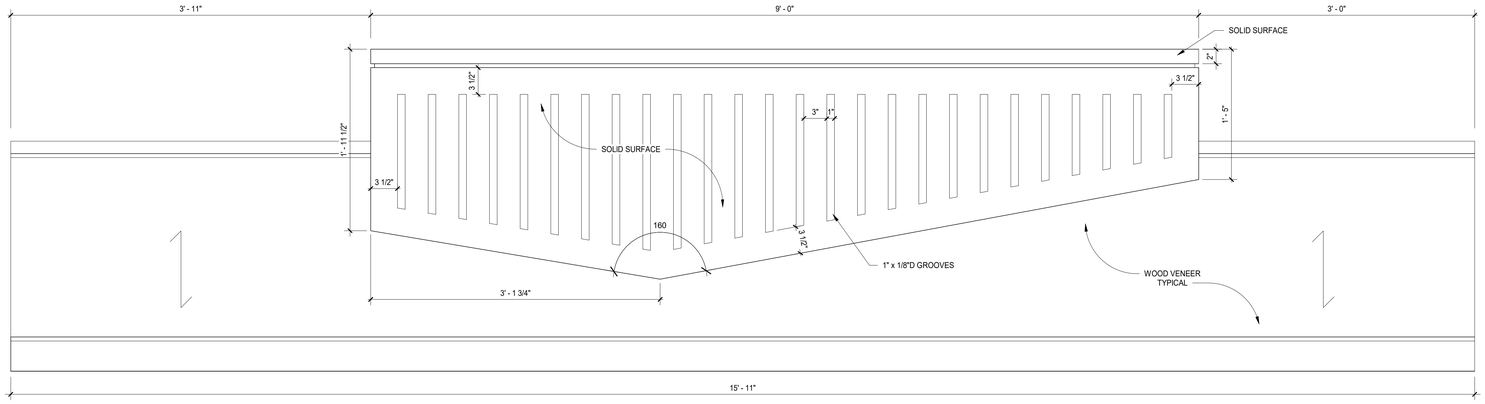
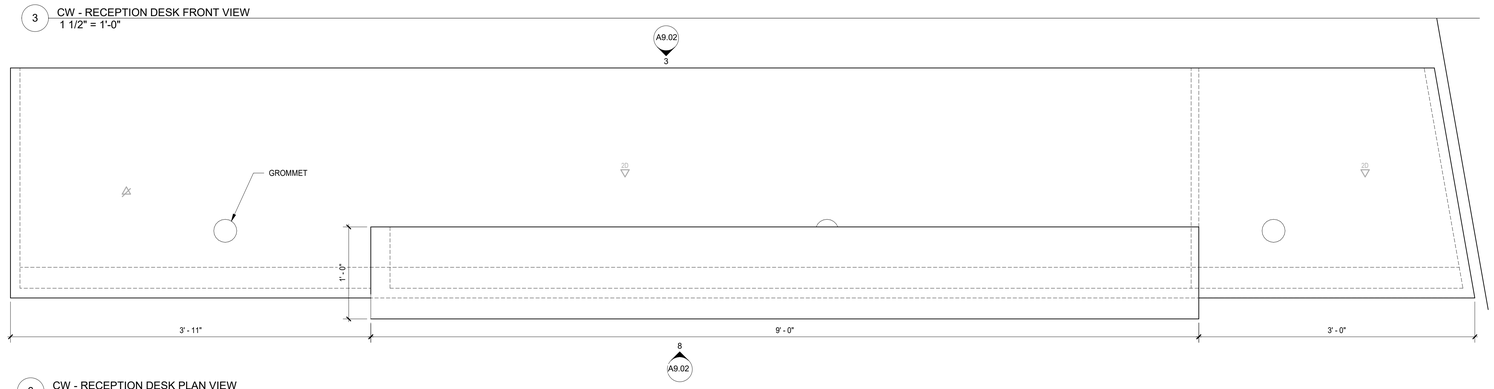
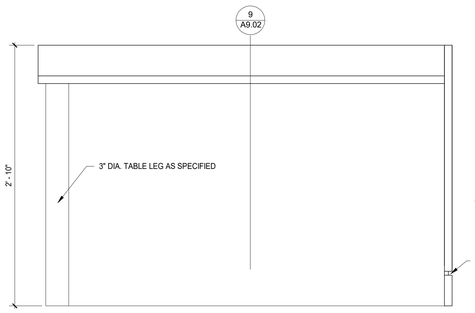


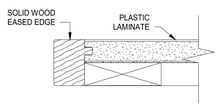
3 CW - RECEPTION DESK FRONT VIEW
1 1/2" = 1'-0"



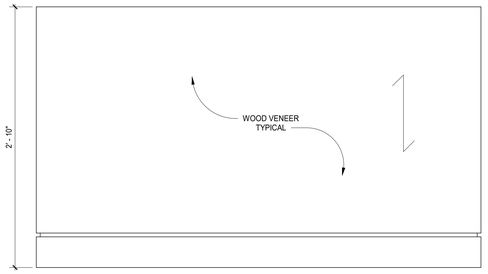
6 CW - RECEPTION DESK PLAN VIEW
1 1/2" = 1'-0"



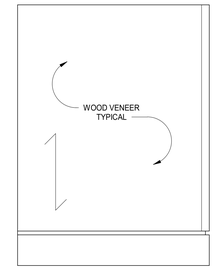
2 DESK ELEVATION WORKING SIDE
1 1/2" = 1'-0"



1 CW - TYP SOLID WOOD COUNTER EDGE
6" = 1'-0"



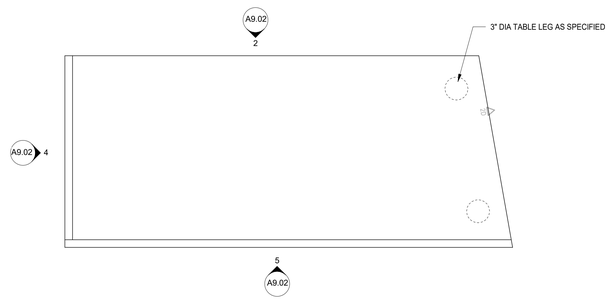
5 DESK FRONT ELEVATION
1 1/2" = 1'-0"



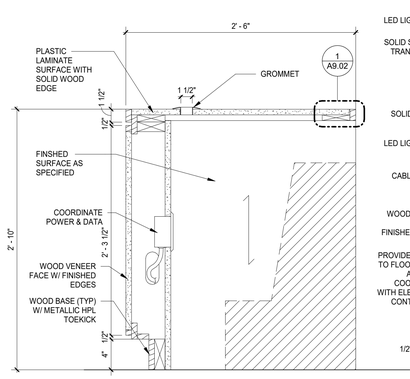
4 DESK SIDE ELEVATION
1 1/2" = 1'-0"

NOTE: CONTRACTOR TO ABIDE BY AWI STANDARDS FOR CUSTOM GRADE CABINETS. ECONOMY GRADE SHALL NOT BE ACCEPTED

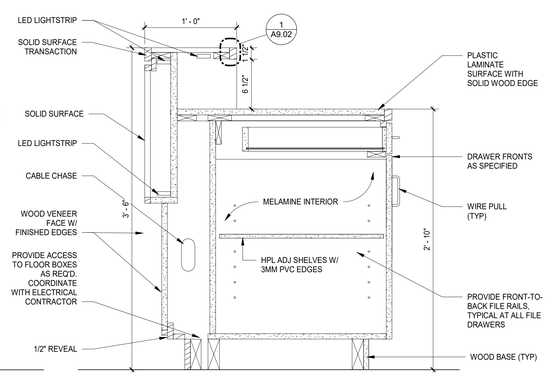
8 CW - RECEPTION DESK REAR ELEV
1 1/2" = 1'-0"



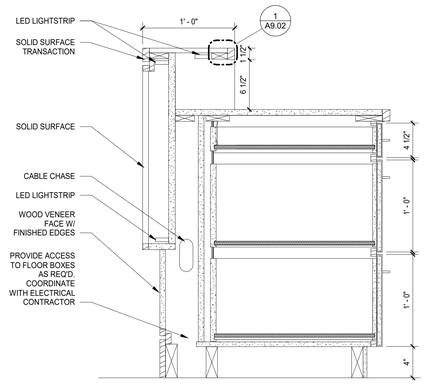
7 DESK PLAN
1 1/2" = 1'-0"



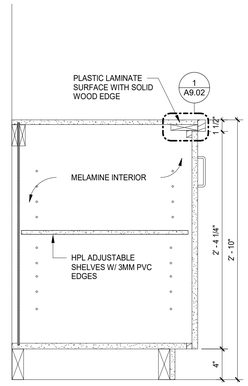
14 CW - SECTION AT RECEPTION DESK LOW COUNTER
1 1/2" = 1'-0"



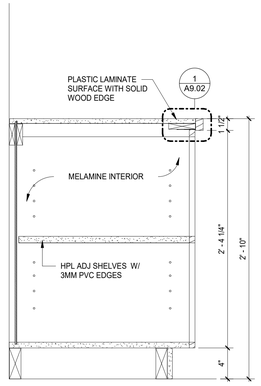
13 CW - SECTION AT RECEPTION TRANSACTION COUNTER
1 1/2" = 1'-0"



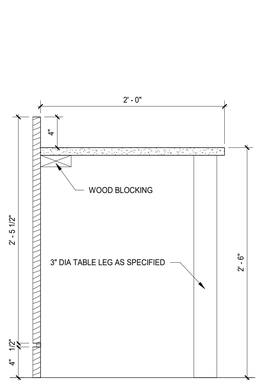
12 CW - SECTION AT RECEPTION
1 1/2" = 1'-0"



11 SECTION AT ADMIN DESK
1 1/2" = 1'-0"



10 SECTION AT ADMIN DESK OPEN CABINET
1 1/2" = 1'-0"



9 SECTION AT DESK
1 1/2" = 1'-0"

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MILWORK DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
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APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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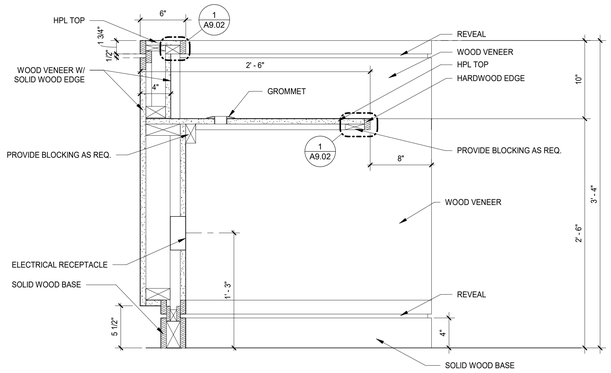
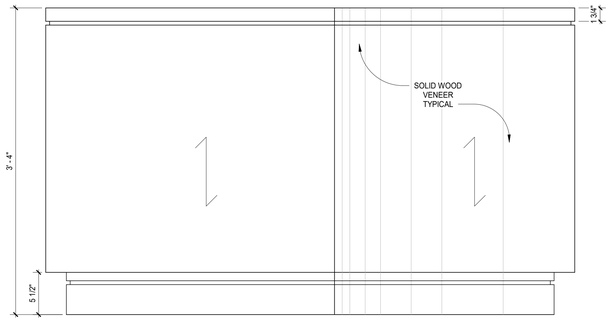
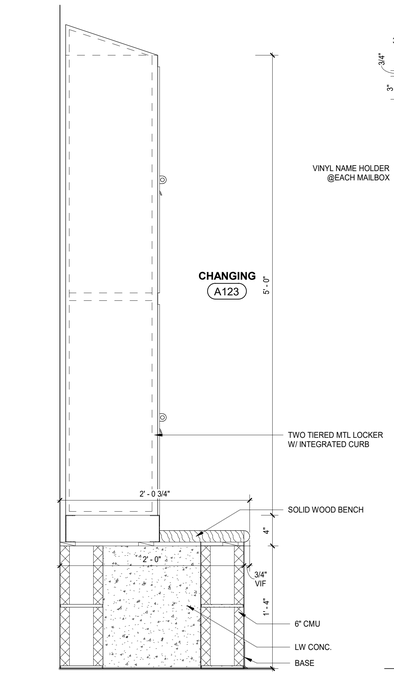


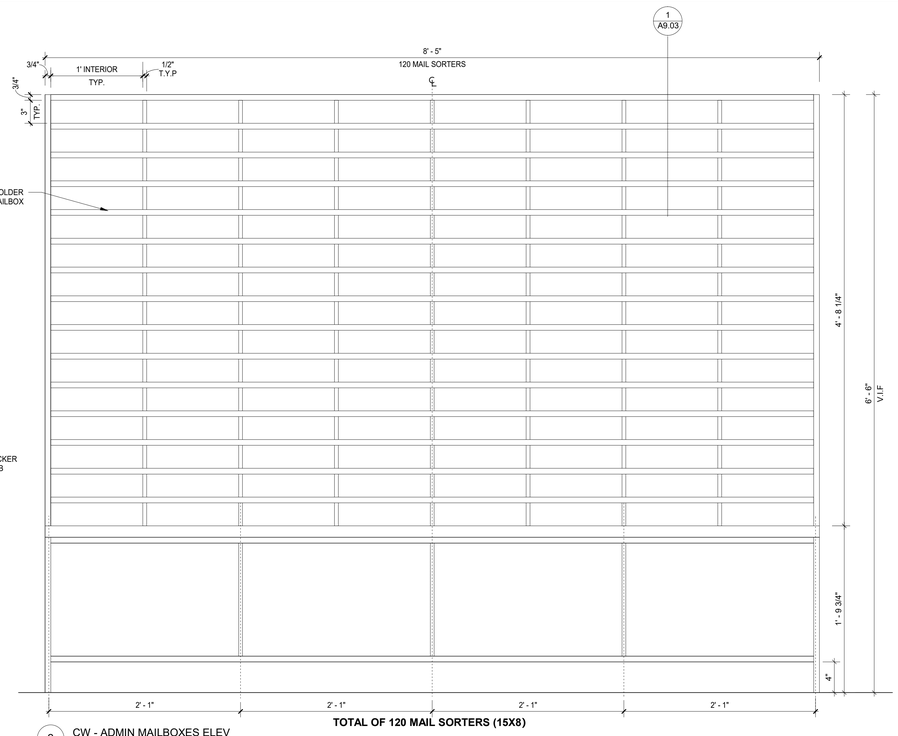
4 CW - PLANETARIUM CONTROL DESK
1 1/2" = 1'-0"



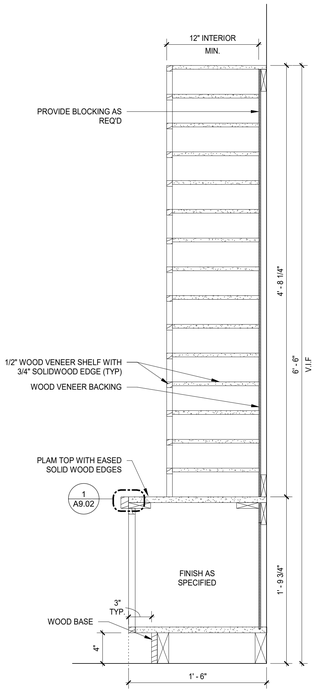
5 PLANETARIUM CONTROL DESK SIDE ELEVATION
1 1/2" = 1'-0"



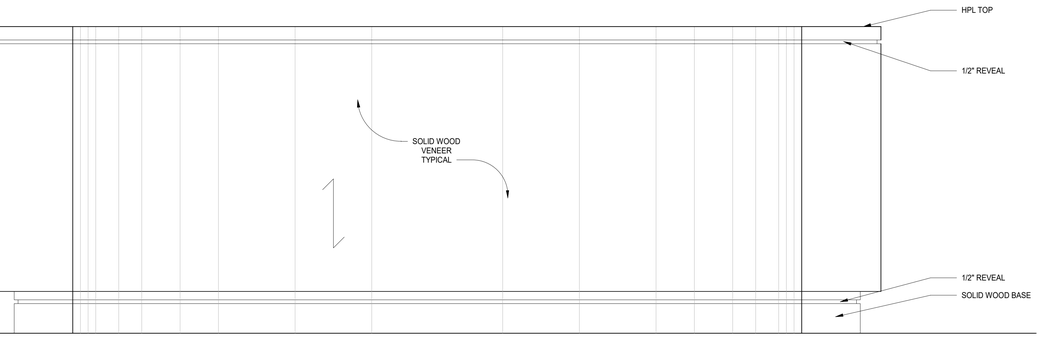
3 TYPICAL LOCKER SECTION DETAIL AT LOCKER ROOMS
1 1/2" = 1'-0"



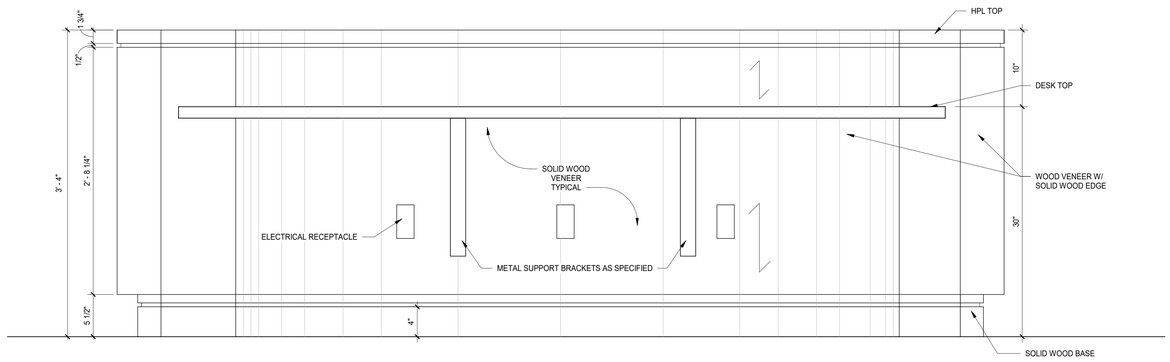
2 CW - ADMIN MAILBOXES ELEV
1 1/2" = 1'-0"



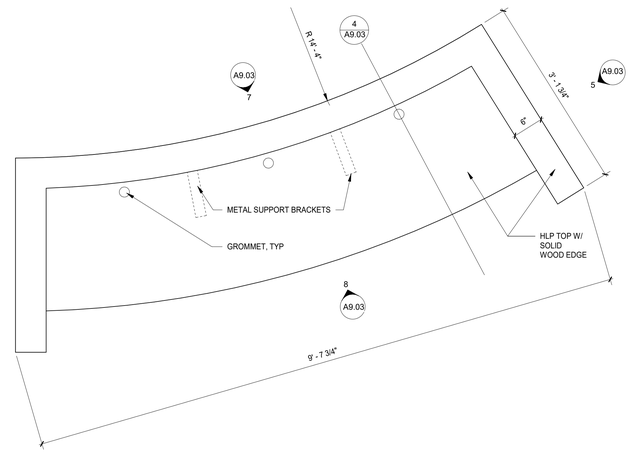
1 CW - ADMIN MAILBOXES SECTION
1 1/2" = 1'-0"



7 PLANETARIUM CONTROL DESK NORTH ELEVATION
1 1/2" = 1'-0"



8 PLANETARIUM CONTROL DESK SOUTH ELEVATION
1 1/2" = 1'-0"



6 CW - PLANETARIUM DESK PLAN
1" = 1'-0"

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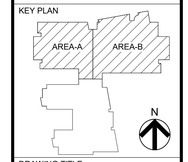
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MILLWORK DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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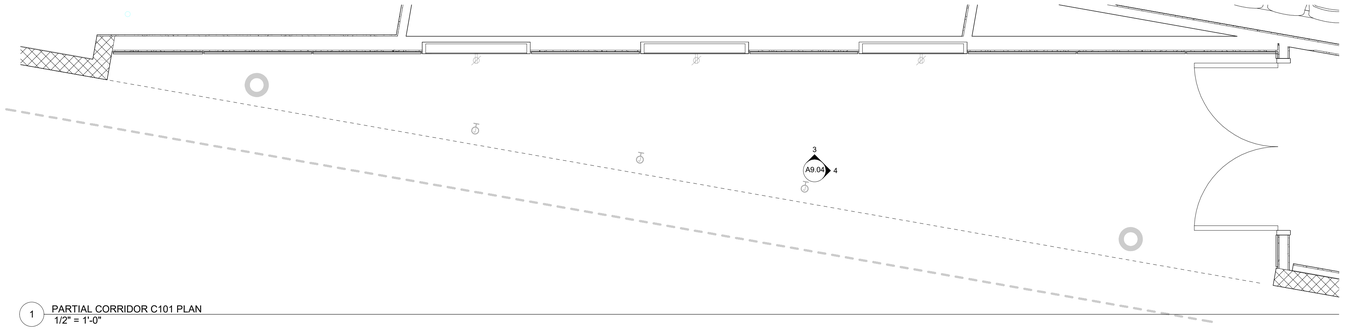
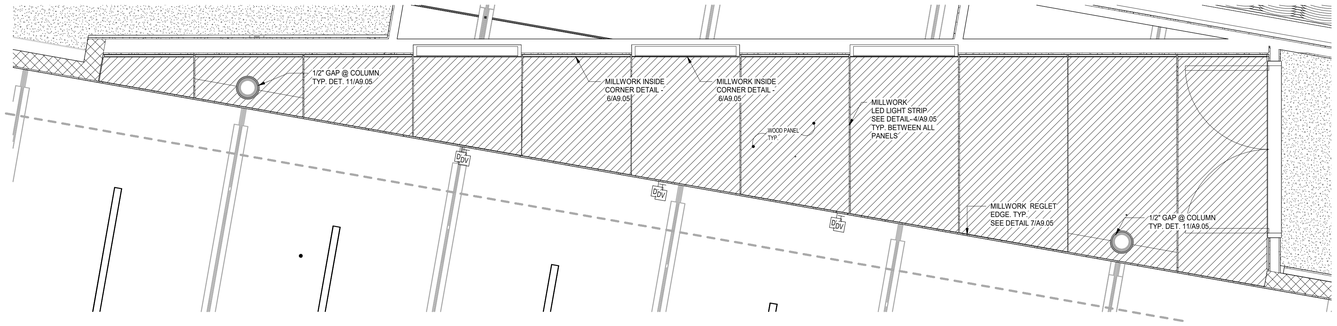
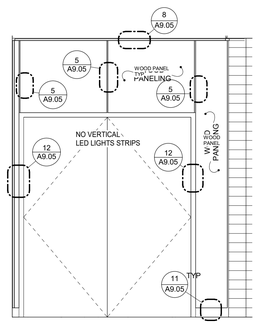


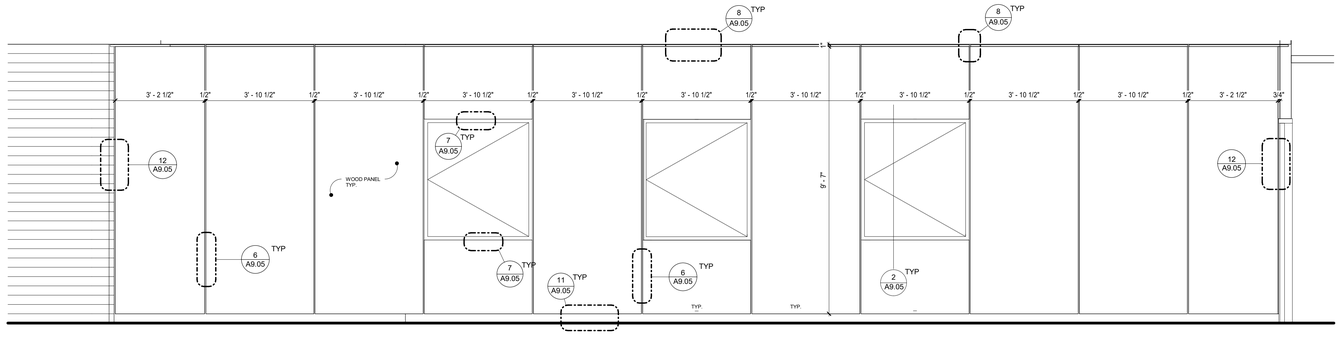
1 PARTIAL CORRIDOR C101 PLAN
1/2" = 1'-0"



2 PARTIAL CORRIDOR C101 RCP
1/2" = 1'-0"



4 THEATER ENTRANCE - CORRIDOR C101
1/2" = 1'-0"



3 THEATER ALCOVE- CORRIDOR C101 ELEVATION
1/2" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

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Project Status

KEY PLAN



DRAWING TITLE

MAIN CORRIDOR DISPLAY WALL

STATE PROJ. NO.	144-0108N
PROJ. NO.	250501
SCALE	1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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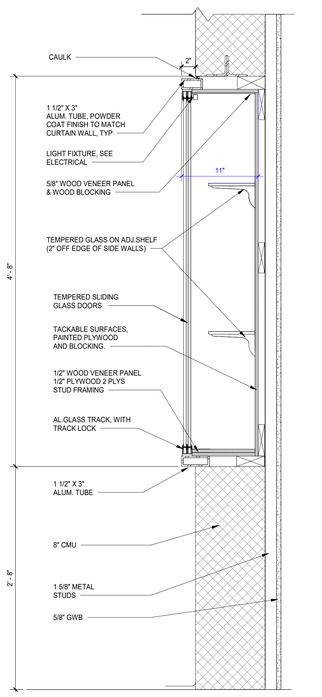
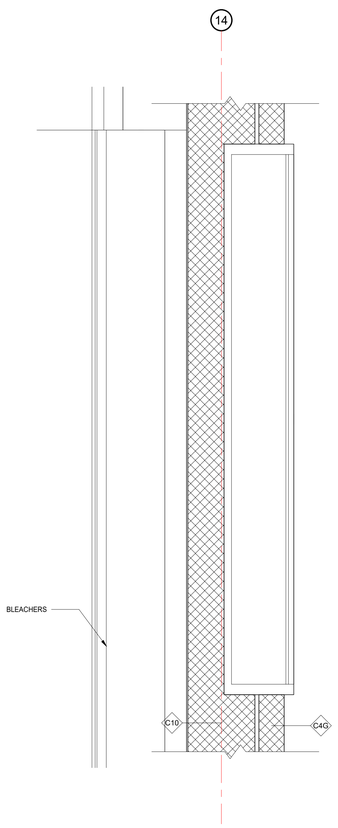
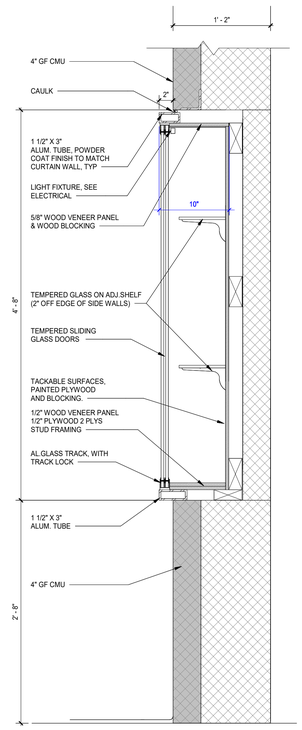


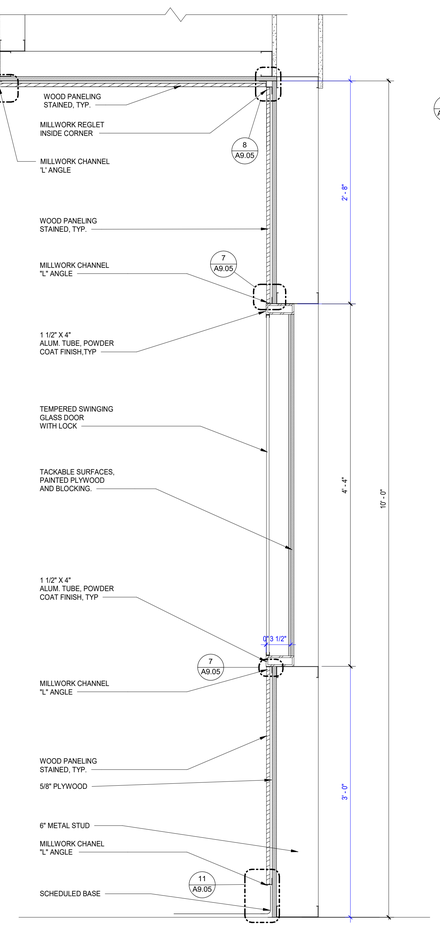
13 DISPLAY CASE - ART & MUSIC @ C104, C108 & C203
1 1/2" = 1'-0"



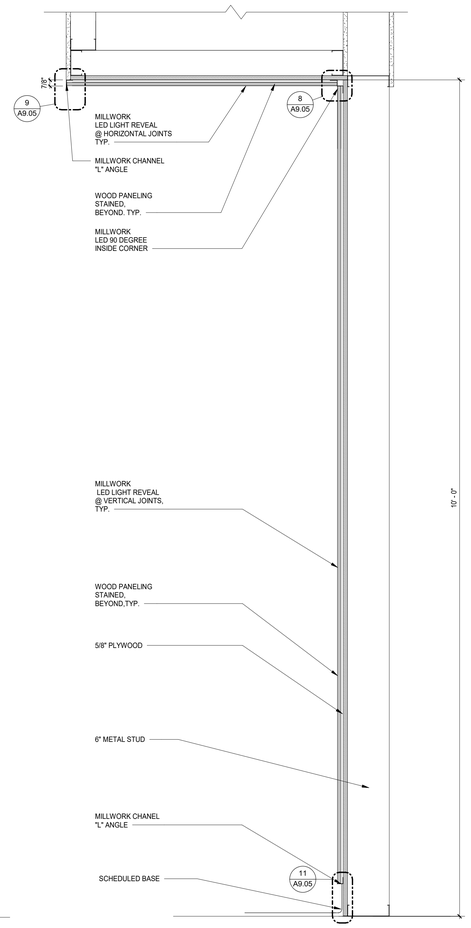
4 PLAN DETAIL - CORRIDOR C101 GYM DISPLAY CASE
1 1/2" = 1'-0"



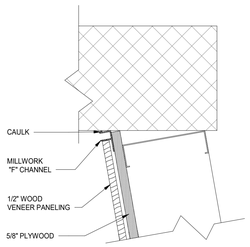
3 CORRIDOR C101 - GYM DISPLAY CASE SECTION DETAIL
1 1/2" = 1'-0"

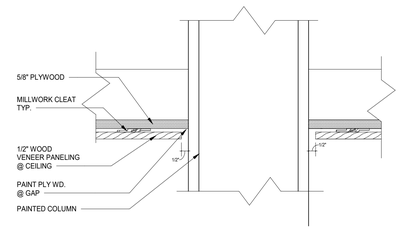


2 CORRIDOR C101 - THEATER ALCOVE DISPLAY CASE SECTION DETAIL
1 1/2" = 1'-0"

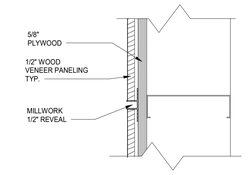


1 CORRIDOR C101 - THEATER ALCOVE PANEL WALL SECTION DETAIL
1 1/2" = 1'-0"

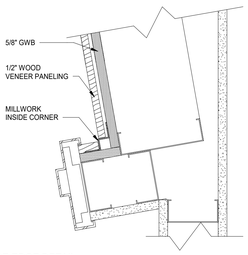




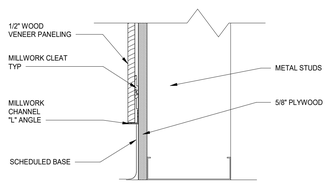
10 CORRIDOR C101@ THEATER ALCOVE - CEILING / COLUMN INTERSECTION
3" = 1'-0"



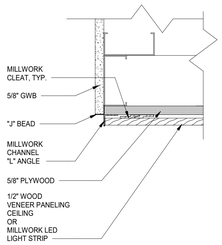
5 1/2" MILLWORK REVEAL
3" = 1'-0"



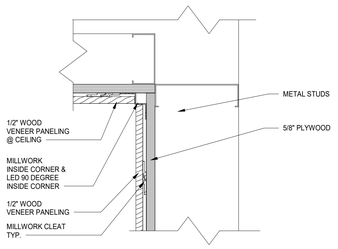
12 SIDE EDGE DETAIL
3" = 1'-0"



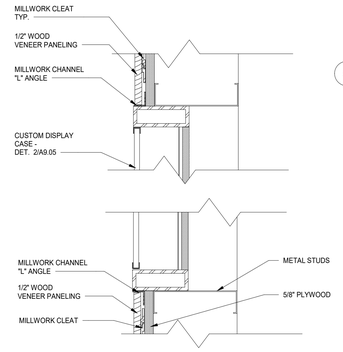
11 4" BASE DETAIL
3" = 1'-0"



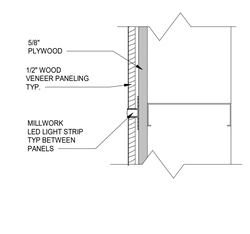
9 CEILING - OUTSIDE EDGE
3" = 1'-0"



8 INSIDE CORNER DETAIL
3" = 1'-0"



7 TOP AND BOTTOM OF DISPLAY CASE
3" = 1'-0"



6 VERTICAL LIGHT STRIPS
3" = 1'-0"

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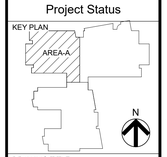
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

DISPLAY WALL DETAILS

STATE PROJ. NO.	144-0108N
PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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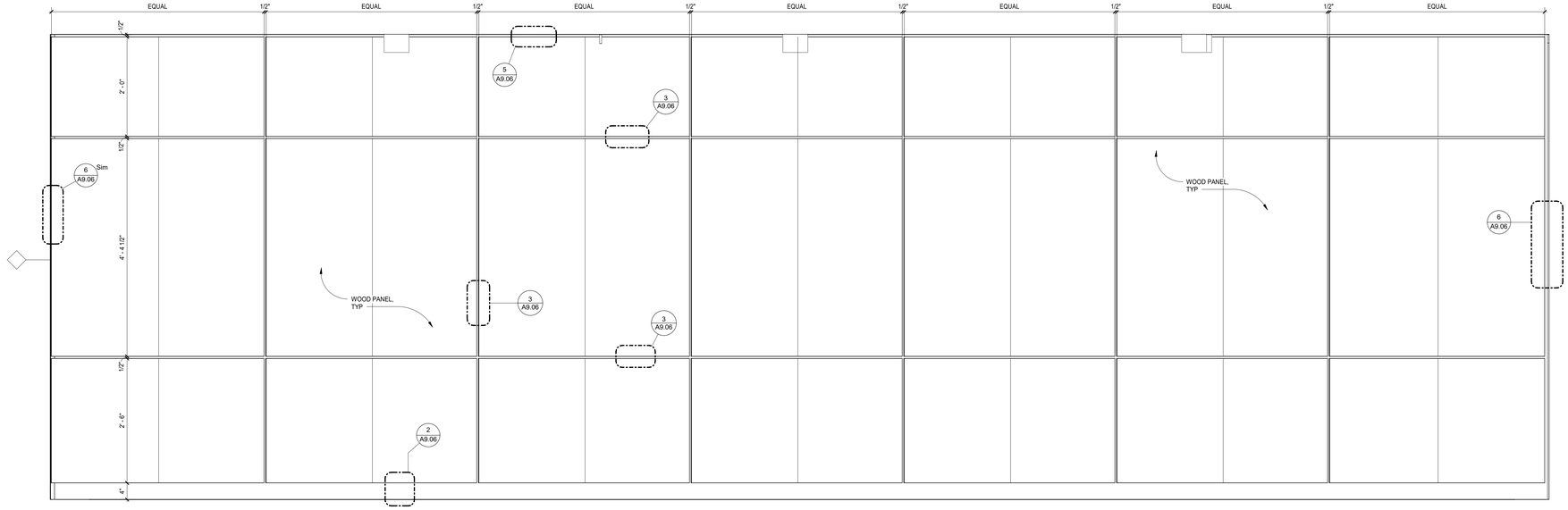
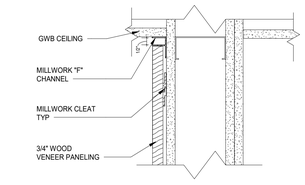
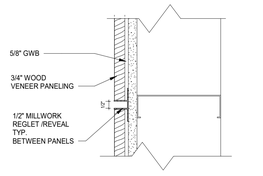


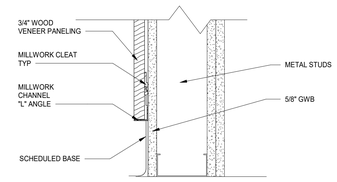
1 CORRIDOR C101S - EAST WALL- WOOD PANELING LAYOUT
1" = 1'-0"



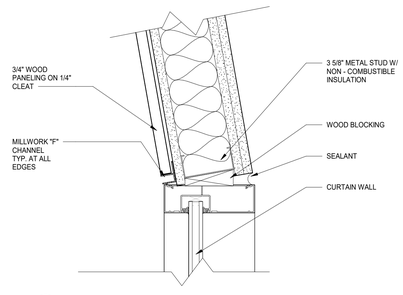
5 CEILING REVEAL DETAIL- C101S
3" = 1'-0"



3 PANEL JOINTS DETAIL - C101S
3" = 1'-0"



2 4" BASE DETAIL- C101S
3" = 1'-0"



6 TOP & SIDE EDGE DETAIL - C101S
3" = 1'-0"

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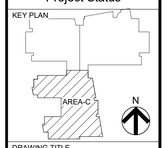
Project Status

KEY PLAN



DRAWING TITLE

WOOD PANELING WALL

STATE PROJ. NO.	144-0108N
PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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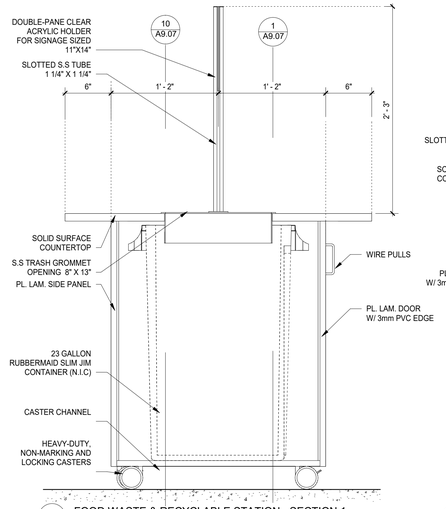

6 FOOD WASTE & RECYCLABLE STATION - SECTION 1
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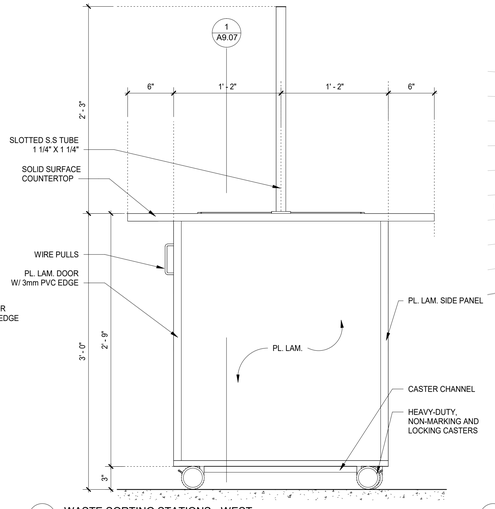
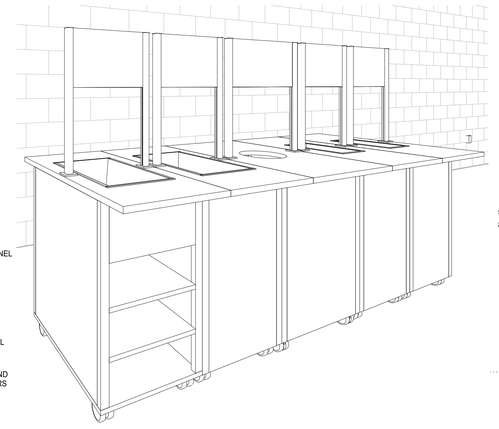
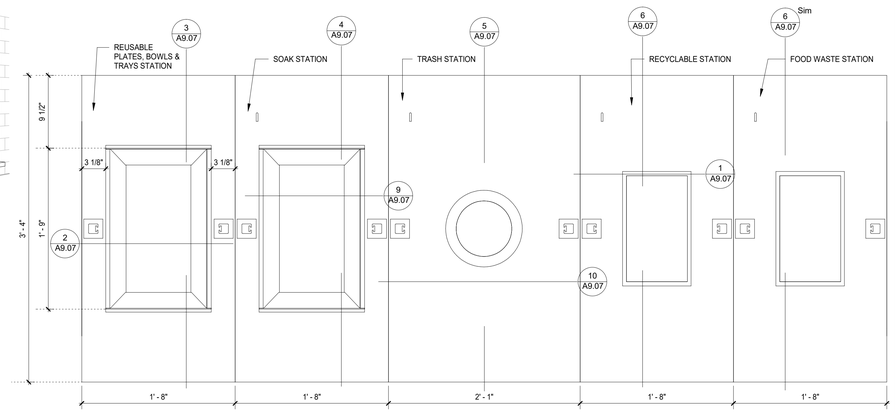


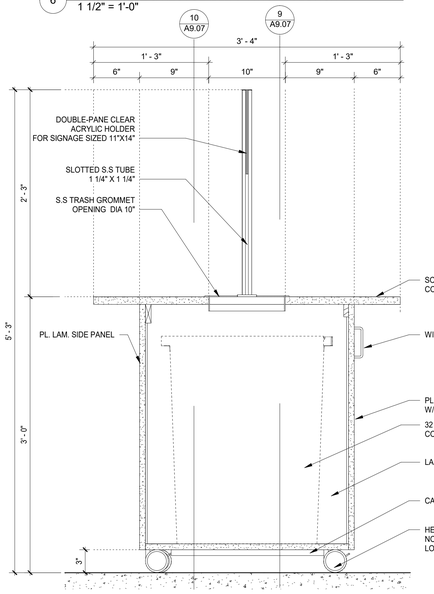
14 WASTE SORTING STATIONS - WEST
1 1/2" = 1'-0"



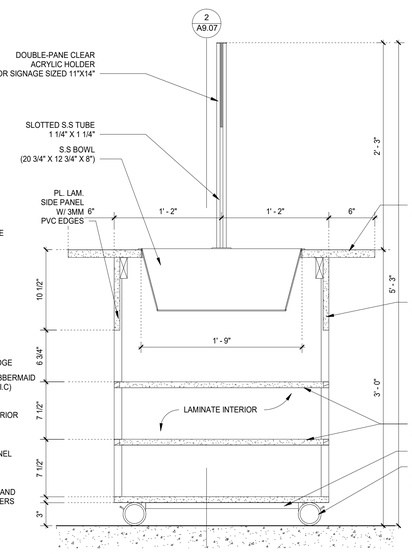
8 WASTE SORTING STATIONS - 3D



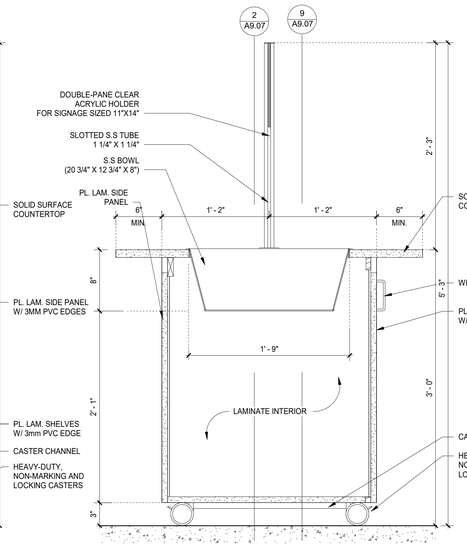
11 WASTE SORTING STATIONS - PLAN
1 1/2" = 1'-0"



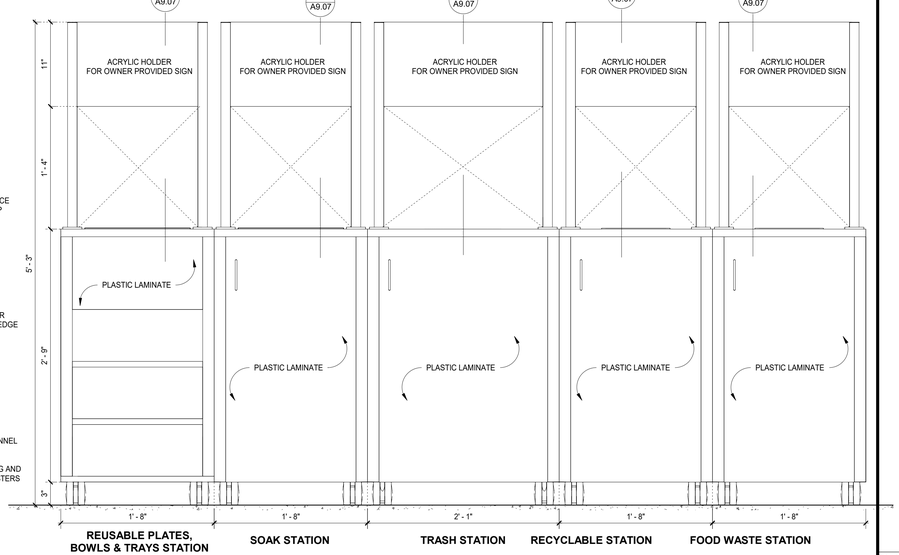
5 TRASH STATION
1 1/2" = 1'-0"



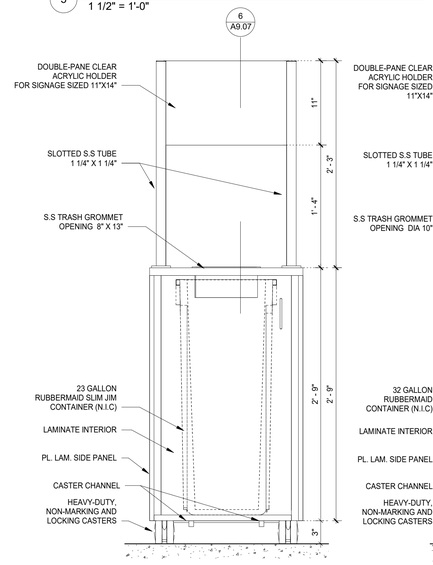
3 REUSABLE PLATES, BOWLS & TRAYS STATION - SECTION 1
1 1/2" = 1'-0"



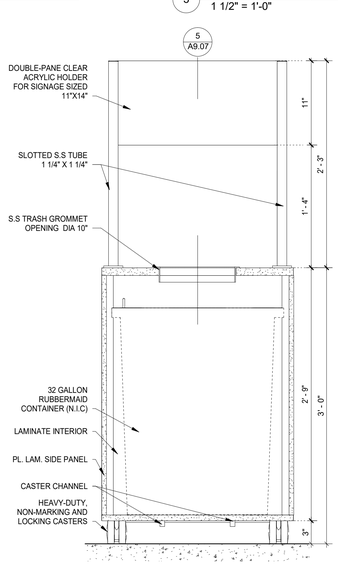
4 SOAK STATION - SECTION 1
1 1/2" = 1'-0"



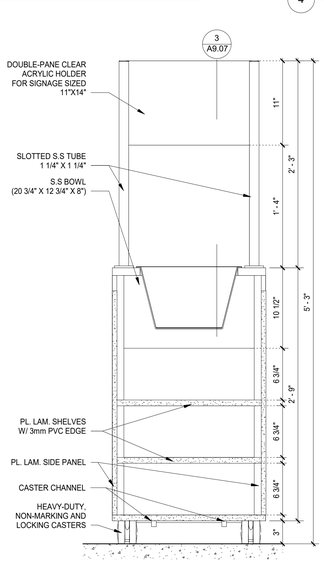
13 WASTE SORTING STATION - SOUTH
1 1/2" = 1'-0"



1 FOOD WASTE & RECYCLABLE STATION - SECTION 2
1 1/2" = 1'-0"



10 TRASH STATION - SECTION 2
1 1/2" = 1'-0"



2 DISHES & TRAYS DEPOSIT STATION - SECTION 2
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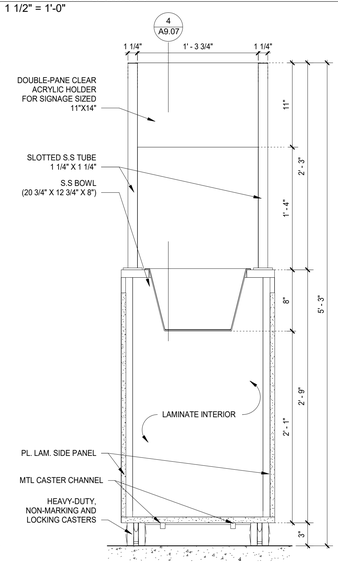
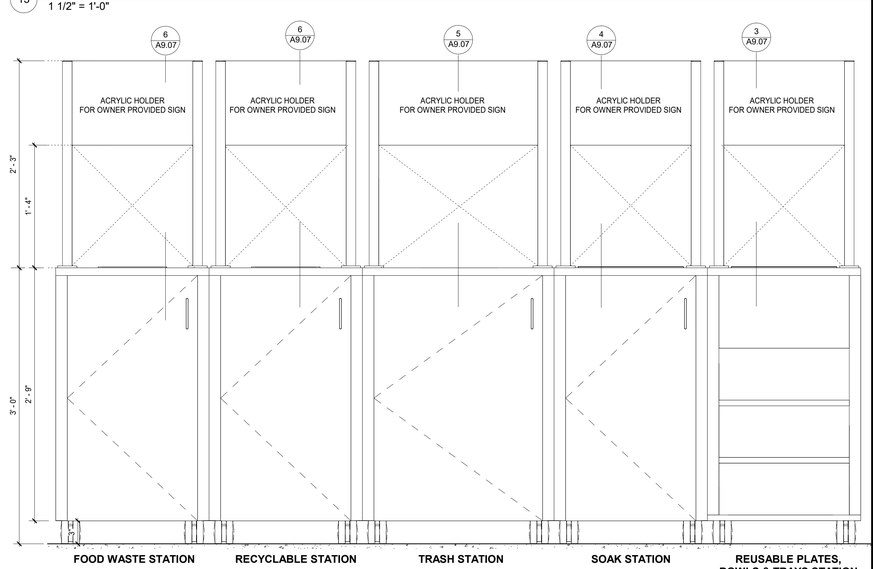


9 SOAK STATION - SECTION 2
1 1/2" = 1'-0"



12 WASTE SORTING STATION - NORTH
1 1/2" = 1'-0"

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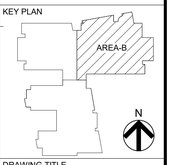
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MILWORK DETAILS - WASTE SORTING STATION

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1 1/2" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A9.07

5/19/2026 11:29:59 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



ROOM FINISH TAG

ROOM NAME
NUMBER
WALL
BASE
FLOOR

ROLLER SHADE, LIGHT FILTERING, MANUAL

ROLLER SHADE, LIGHT FILTERING, MOTORIZED

M — ROLLER SHADE MOTOR LOCATION - PROVIDE POWER AND CONTROL WIRING - SEE ELECTRICAL

FINISH LEGEND	
ABBR.	NAME
AWP	ACOUSTICAL WALL PANEL
CMU	CONCRETE MASONRY UNIT
CONC	SEALED CONCRETE
CPT-1	CARPET TILE1
CPT-2	CARPET TILE 2
CPT-3	CARPET TILE 3
CT	CERAMIC TILE
EXP	EXPOSED STRUCTURE
EXTG	EXISTING
GFC	GROUND FACE CMU
GL	GLASS
GWB	GYPSUM BOARD
LIN	LINOLEUM TILE
PES	PAINTED EXPOSED STRUCTURE
PT	PORCELAIN TILE
PTD	PAINTED
RB	RUBBER
RB	RUBBER BASE
RES	RESINOUS FLOORING
SB	STEEL VENTED ANGLE BASE
VG	VINYL GRAPHIC - CUSTOM
WAF	WOOD ATHLETIC FLOORING
WC	WALLCOVERING
WD	WOOD
WOM	WALK-OFF MAT
WP	WALL PAD
WRF	WEIGHT ROOM FLOOR

4 LOWER LEVEL FINISH PLAN
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

LOWER LEVEL FINISH AND FLOOR PATTERN PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

A10.01

5/19/2026 10:38:20 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt

ROOM FINISH TAG

ROOM NAME
NUMBER
WALL
BASE
FLOOR

ROLLER SHADE, LIGHT FILTERING, MANUAL

ROLLER SHADE, LIGHT FILTERING, MOTORIZED

M — ROLLER SHADE MOTOR LOCATION - PROVIDE POWER AND CONTROL WIRING - SEE ELECTRICAL

FINISH LEGEND	
ABBR.	NAME
AWP	ACOUSTICAL WALL PANEL
CMU	CONCRETE MASONRY UNIT
CONC	SEALED CONCRETE
CPT-1	CARPET TILE1
CPT-2	CARPET TILE 2
CPT-3	CARPET TILE 3
CT	CERAMIC TILE
EXP	EXPOSED STRUCTURE
EXTG	EXISTING
GFC	GROUND FACE CMU
GL	GLASS
GWB	GYPSUM BOARD
LIN	LINOLEUM TILE
PES	PAINTED EXPOSED STRUCTURE
PT	PORCELAIN TILE
PTD	PAINTED
RB	RUBBER
RB	RUBBER BASE
RES	RESINOUS FLOORING
SB	STEEL VENTED ANGLE BASE
VG	VINYL GRAPHIC - CUSTOM
WAF	WOOD ATHLETIC FLOORING
WC	WALLCOVERING
WD	WOOD
WOM	WALK-OFF MAT
WP	WALL PAD
WRF	WEIGHT ROOM FLOOR

1 MAIN LEVEL PLAN - AREA A FINISH PLAN
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

AREA-A

DRAWING TITLE

MAIN LEVEL AREA A FINISH AND FLR PATTERN PLN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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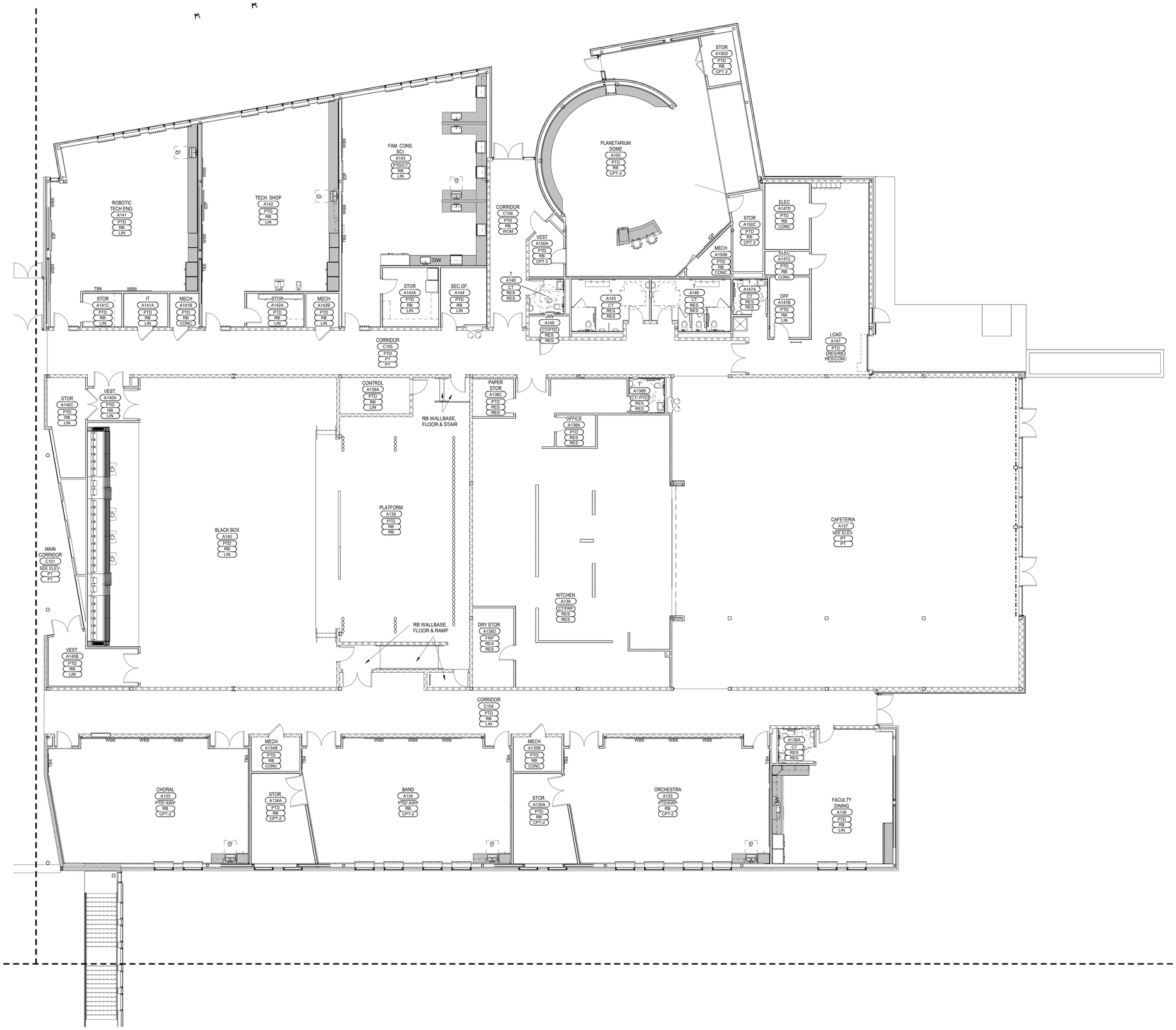

1 MAIN LEVEL PLAN - AREA B FINISH PLAN
1/8" = 1'-0"

ROOM FINISH TAG

ROOM NAME
NUMBER
WALL
BASE
FLOOR

---------- ROLLER SHADE, LIGHT FILTERING, MANUAL

-·-·-·- ROLLER SHADE, LIGHT FILTERING, MOTORIZED

M ——→ ROLLER SHADE MOTOR LOCATION - PROVIDE POWER AND CONTROL WIRING - SEE ELECTRICAL

FINISH LEGEND	
ABBR.	NAME
AWP	ACOUSTICAL WALL PANEL
CMU	CONCRETE MASONRY UNIT
CONC	SEALED CONCRETE
CPT-1	CARPET TILE1
CPT-2	CARPET TILE 2
CPT-3	CARPET TILE 3
CT	CERAMIC TILE
EXP	EXPOSED STRUCTURE
EXTG	EXISTING
GFC	GROUND FACE CMU
GL	GLASS
GWB	GYPSUM BOARD
LIN	LINOLEUM TILE
PES	PAINTED EXPOSED STRUCTURE
PT	PORCELAIN TILE
PTD	PAINTED
RB	RUBBER
RB	RUBBER BASE
RES	RESINOUS FLOORING
SB	STEEL VENTED ANGLE BASE
VG	VINYL GRAPHIC - CUSTOM
WAF	WOOD ATHLETIC FLOORING
WC	WALLCOVERING
WD	WOOD
WOM	WALK-OFF MAT
WP	WALL PAD
WRF	WEIGHT ROOM FLOOR

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MAIN LEVEL AREA B FINISH AND FLR PATTERN PLN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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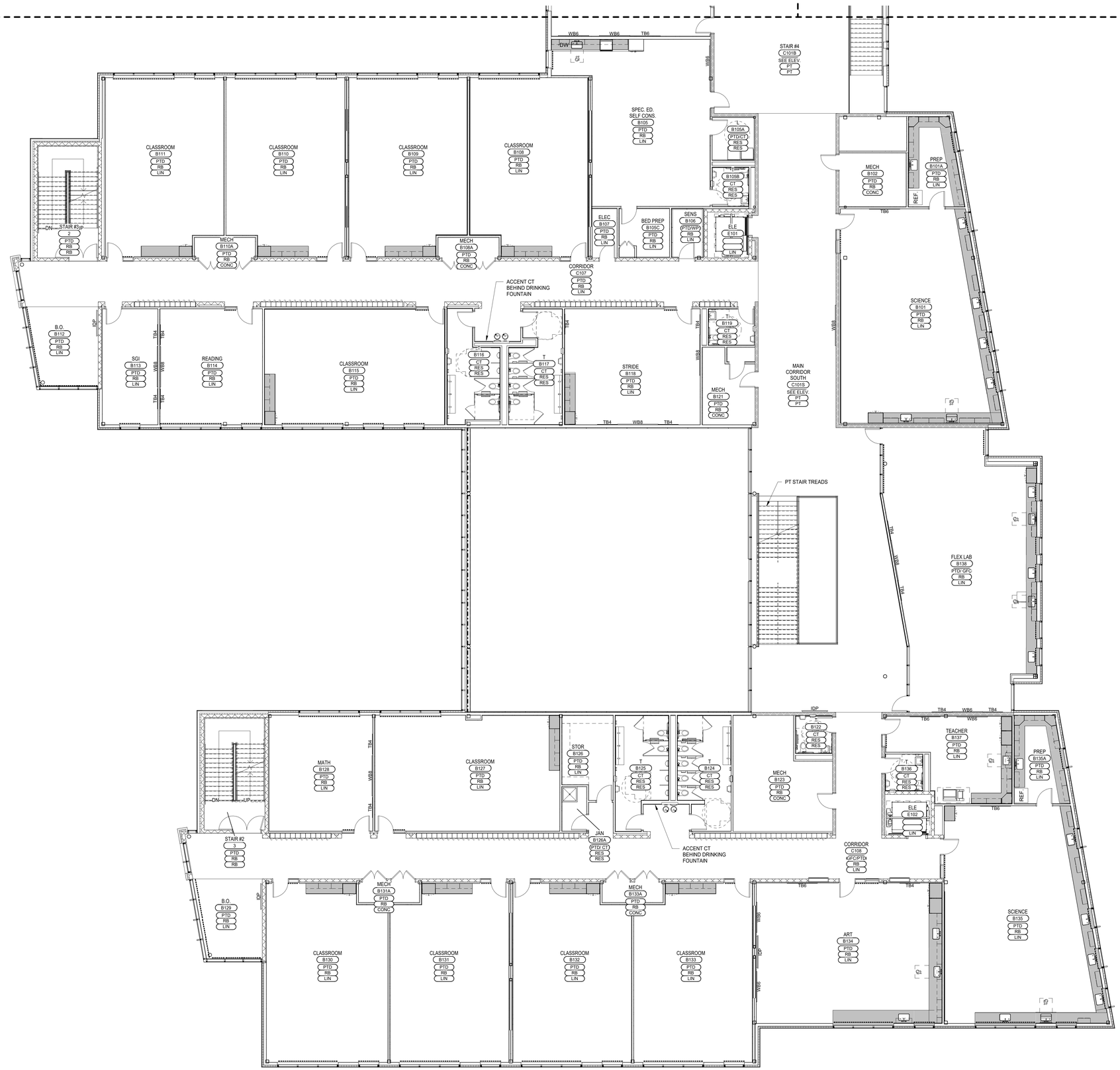

ROOM FINISH TAG

ROOM NAME
NUMBER
WALL
BASE
FLOOR

ROLLER SHADE, LIGHT FILTERING, MANUAL

ROLLER SHADE, LIGHT FILTERING, MOTORIZED

M — ROLLER SHADE MOTOR LOCATION - PROVIDE POWER AND CONTROL WIRING - SEE ELECTRICAL

FINISH LEGEND	
ABBR.	NAME
AWP	ACOUSTICAL WALL PANEL
CMU	CONCRETE MASONRY UNIT
CONC	SEALED CONCRETE
CPT-1	CARPET TILE1
CPT-2	CARPET TILE 2
CPT-3	CARPET TILE 3
CT	CERAMIC TILE
EXP	EXPOSED STRUCTURE
EXTG	EXISTING
GFC	GROUND FACE CMU
GL	GLASS
GWB	GYPSUM BOARD
LIN	LINOLEUM TILE
PES	PAINTED EXPOSED STRUCTURE
PT	PORCELAIN TILE
PTD	PAINTED
RB	RUBBER
RB	RUBBER BASE
RES	RESINOUS FLOORING
SB	STEEL VENTED ANGLE BASE
VG	VINYL GRAPHIC - CUSTOM
WAF	WOOD ATHLETIC FLOORING
WC	WALLCOVERING
WD	WOOD
WOM	WALK-OFF MAT
WP	WALL PAD
WRF	WEIGHT ROOM FLOOR

1 MAIN LEVEL - AREA C FINISH PLAN
1/8" = 1'-0"

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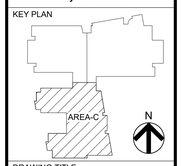
KEY PLAN



DRAWING TITLE

MAIN LEVEL AREA C FINISH AND FLR PATTERN PLN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A10.02C

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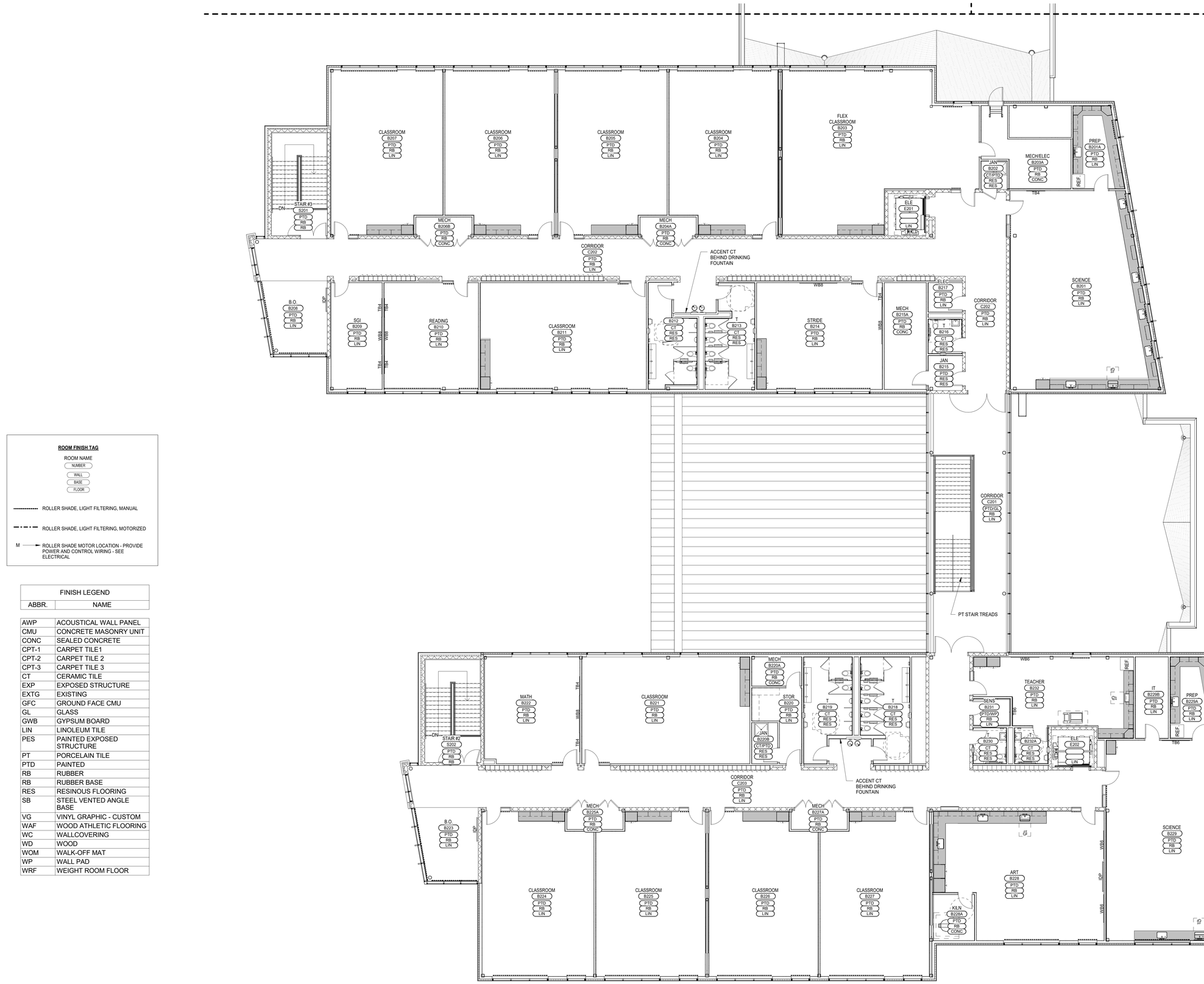

ROOM FINISH TAG

ROOM NAME
NUMBER
WALL
BASE
FLOOR

ROLLER SHADE, LIGHT FILTERING, MANUAL

ROLLER SHADE, LIGHT FILTERING, MOTORIZED

M → ROLLER SHADE MOTOR LOCATION - PROVIDE POWER AND CONTROL WIRING - SEE ELECTRICAL

FINISH LEGEND	
ABBR.	NAME
AWP	ACOUSTICAL WALL PANEL
CMU	CONCRETE MASONRY UNIT
CONC	SEALED CONCRETE
CPT-1	CARPET TILE1
CPT-2	CARPET TILE 2
CPT-3	CARPET TILE 3
CT	CERAMIC TILE
EXP	EXPOSED STRUCTURE
EXTG	EXISTING
GFC	GROUND FACE CMU
GL	GLASS
GWB	GYPSUM BOARD
LIN	LINOLEUM TILE
PES	PAINTED EXPOSED STRUCTURE
PT	PORCELAIN TILE
PTD	PAINTED
RB	RUBBER
RB	RUBBER BASE
RES	RESINOUS FLOORING
SB	STEEL VENTED ANGLE BASE
VG	VINYL GRAPHIC - CUSTOM
WAF	WOOD ATHLETIC FLOORING
WC	WALLCOVERING
WD	WOOD
WOM	WALK-OFF MAT
WP	WALL PAD
WRF	WEIGHT ROOM FLOOR

1 UPPER LEVEL FINISH PLAN
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

DRAWING TITLE

UPPER LEVEL FINISH AND FLOOR PATTERN PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A10.03

5/19/2026 10:38:42 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt

DOOR AND FRAME SCHEDULE - AREA A&B

NUMBER	DOUBLE LEAF DOOR	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR TYPE/MATERIAL MATERIAL	DOOR TYPE/MATERIAL TYPE	FRAME TYPE/MATERIAL MATERIAL	FRAME TYPE/MATERIAL TYPE	HEAD DETAIL	JAMB DETAIL	SADDLE DETAIL	FIRE RATING (MINUTES)	HARDWARE - SEE SPECIFICATIONS: FIRECODE PANIC RELEASE LATCH	FIRECODE POSITIVE LATCHING	FIRECODE CLOSER	FIRECODE E-M. HOLD OPEN	DISABLED LEVER U-HANDLE	DISABLED ACCESSIBLE THRESHOLD	PUSH/PULL	KICKPLATE	SIGNAGE ACCESSIBILITY SYMBOL	SIGNAGE REQUIRED	SIGNAGE TEXT	HARDWARE SET NUMBER	CARD READER	REMARKS
A100		3' - 0"	7' - 2"	HM	D4	HM	F1	H9	J9	T11			•	•		•	•				•	•	MAIN OFFICE		•	
A100A		3' - 0"	7' - 2"	HM	D1	HM	F4	H7	J7	T3			•	•									MAIN OFFICE		•	
A100B		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•	•				•							•	
A100C		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T3			•	•		•	•					•	ADIMN		•	
A101		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A102		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A103		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	PRINCIPAL	19		
A104		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A105		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A106		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A107		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A108		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A109		3' - 0"	7' - 2"	WD	D2	HM	F1A	H1	J1	-			•			•						•	OFFICE	19		
A110		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-		•	•		•	•				•	•	TOILET	24		
A111		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T6	-		•	•		•	•		•	•		•	TOILET	24		
A113		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T7			•	•		•	•		•			•	STORAGE	17	•	
A114		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	T7			•			•	•					•	ISS ROOM			
A115		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•						•	CONFERENCE	19		
A116		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•						•	CONFERENCE	19		
A117		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	T7			•	•		•	•					•	WORK ROOM	19		
A118		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T4			•	•		•	•		•			•	NURSE	22	•	
A118A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-		•			•						•	STORAGE	18		
A118B		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-		•			•	•		•	•		•	TOILET	23		
A120		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-			•			•						•	EXAM			
A121.1	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF4	1/A5.02	1/A5.02	T9	-	•	•	•		•	•					•	GYM	11		
A121.2	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF4	1/A5.02	1/A5.02	T9	-	•	•	•		•	•					•	GYM	11		
A121.3	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	T9		•	•	•		•	•					•	GYM	11		
A121.4	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	T9		•	•	•		•	•					•	GYM	11		
A121A	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T9			•			•	•		•			•	STORAGE	32		
A121B	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T9			•			•	•		•			•	GYM STORAGE	32		
A122.1		3' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	T9	-		•	•		•	•		•			•	AUXILIARY GYM	11		
A122.2	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H2	J4	T9		•	•	•		•	•		•			•	AUXILIARY GYM	11		
A122A	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T9			•			•	•		•			•	STORAGE	32		
A122B		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T9	45 MIN		•	•		•	•					•	ELECTRICAL	18	•	
A122C	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	T8			•			•	•		•			•	FITNESS ROOM	11		
A123		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T1	-			•		•	•	•				•	MENS LOCKERS			
A123A		3' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2/J4	T6	-		•			•	•				•	•	TOILET	24		
A124		3' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	-			•	•		•			•			•	OFFICE	19		
A124.1		3' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2	T1	-		•			•	•							19		
A125		3' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	-			•	•		•						•	OFFICE	19		
A125.1		3' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2	T1	-		•			•	•							19		
A125A		3' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2	T1	-		•	•		•	•					•	CUSTODIAL	17	•	
A126		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T1	-							•	•	•		•	WOMENS LOCKERS			
A126A		3' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2/J4	T6	-		•			•	•				•	•	TOILET	24		
A127		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T7			•	•		•	•					•	SPEECH	22		
A128		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T7			•	•		•	•					•	OFFICE	19		
A129		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T7			•	•		•	•					•	OFFICE	19		
A129A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-			•			•								19		
A130		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•	•		•				•		•	OT/PT	22		
A130A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T2	-		•	•		•						•	MECHANICAL	18	•	
A131		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•		•	WOMENS RESTROOM			
A132		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•		•	MENS RESTROOM			
A132A		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•		•	•		•	FAMILY RESTROOM	24		
A133.1		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-		•	•	•					•			•	CHORAL	12		
A133.2	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-		•	•	•		•			•			•	CHORAL	10		
A134.1	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-		•	•	•		•			•			•	BAND ROOM	10		
A134.2		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-		•	•	•		•			•			•	BAND ROOM	12		
A134A	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H8	J8	-			•			•						•	STORAGE	17		
A134B		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	-		•	•			•					•	MECHANICAL	18	•	
A135.1	•	6' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-		•	•	•		•			•			•	ORCHESTRA	10		
A135.2		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-	-	•	•	•		•			•			•	ORCHESTRA	12		
A135A	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H8	J8	-			•			•						•	STORAGE	17		
A135B		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	-		•	•		•	•					•	MECHANICAL	18	•	
A136		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	-	-		•	•		•						•	FACULTY DINING			
A136A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-		•			•	•				•	•	TOILET	23		
A137.2	•	5' - 11 5/16"	7' - 2"	ALUM/GL	D4	ALUM	CW16	1/A5.02	1/A5.02	T12	-	•	•	•			•					•	EXIT	7	•	
A137.3	•	5' - 11 5/16"	7' - 2"	ALUM/GL	D4	ALUM	CW16	1/A5.02	1/A5.02	T12	-	•	•	•			•					•	EXIT	7	•	
A137.5		26' - 9"	8' - 0"	ALUM	D6	-	-	18/A2.31	3/A4.32														OVERHEAD COILING GRILLE			
A138	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H7	H7	T4			•			•	•		•			•	KITCHEN		•	
A138A		3' - 0"	7' - 2"	HM	D2	HM	F1	H1	J1	-			•			•						•	OFFICE	19		
A138B		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T6	-		•			•	•				•	•	TOILET	23		
A138C		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T1	-		•			•	•					•	PAPER STORAGE	17		
A138D		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	-	-		•			•						•	DRY STORAGE	17		
A139.1		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4	-		•	•		•	•		•			•	THEATER PLATFORM	12		ACOUSTIC DOOR
A139.2	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T1						•	•		•			•	THEATER			ACOUSTIC DOOR
A139A		3' - 0"	7' - 2"	HM	D2	HM	F1	H1	J1	-			•			•						•	CONTROL ROOM	12	•	ACOUSTIC DOOR
A140.1	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-				•				•	•					10		
A140.2	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-				•				•	•					10		
A140.3		3' - 0"	7' - 2"	WD	D2	HM	F1	H2	J2	T1				•			•	•	•			•	PLATFORM	12		
A140A	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T4		•	•	•		•	•		•			•	THEATER	10		
A140B	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T4		•	•	•		•	•		•			•	THEATER	10		
A140C	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-			•			•						•	STORAGE	17		
A141		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	T4			•	•		•	•		•			•	ROBOTICS/TECHNOLOGY ENGINEERING	22		
A141A		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T4	-		•	•		•	•					•	IT	11	•	
A141B		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4	-		•	•		•	•					•	MECHANICAL	18	•	
A141C		4' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-		•			•						•	STORAGE	17		
A142		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	T4			•	•		•	•		•			•	TECHNICAL SHOP	22		
A142A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-			•			•						•	STORAGE	17		
A142B		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4	-		•	•		•	•					•	MECHANICAL	18	•	
A143		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	T4			•	•		•	•		•			•	FAMILY CONSUMER SCIENCE	22		
A143A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•						•	STORAGE	17		
A144		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T4			•	•		•	•					•	SECURITY OFFICE	19	•	
A145		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-						•	•	•	•		•	WOMENS RESTROOM			
A146		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-						•	•	•	•		•	MENS RESTROOM			
A147	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4			•	•		•	•		•			•	CUSTODIAL	11	•	
A147.1		3' - 0"	7' - 2"	HM	D1	HM	F1	H5	J5	T12	-		•	•		•	•					•	LOADING		•	

DOOR AND FRAME SCHEDULE - AREA A&B

NUMBER	DOUBLE LEAF DOOR	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR TYPE/MATERIAL MATERIAL	DOOR TYPE/MATERIAL TYPE	FRAME TYPE/MATERIAL MATERIAL	FRAME TYPE/MATERIAL TYPE	HEAD DETAIL	JAMB DETAIL	SADDLE DETAIL	FIRE RATING (MINUTES)	HARDWARE - SEE SPECIFICATIONS: FIRECODE PANIC RELEASE LATCH	FIRECODE POSITIVE LATCHING	FIRECODE CLOSER	FIRECODE E-M. HOLD OPEN	DISABLED LEVER U-HANDLE	DISABLED ACCESSIBLE THRESHOLD	PUSH/PULL	KICKPLATE	SIGNAGE ACCESSIBILITY SYMBOL	SIGNAGE REQUIRED	SIGNAGE TEXT	HARDWARE SET NUMBER	CARD READER	REMARKS
A147.2		7' - 0"	9' - 4"	HM	D7	HM	-	6/A4.26	9/A4.33	10/A4.26															OVERHEAD INSULATED COILING DOOR
A147A		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T6	-		•			•	•			•	•	TOILET	24		
A147B		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T1	-		•			•	•				•	OFFICE	19		
A147C		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T1	90 MIN		•	•		•	•				•	ELECTRICAL	18	•	
A147D		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T1	45 MIN		•	•		•	•				•	ELECTRICAL	18	•	
A148		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•		•	•	•	TOILET	24		
A149		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•			•	•	CUSTODIAL	19	•	
A150		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T3	-		•	•		•	•				•	PLANETARIUM			
A150A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-			•					•	•						
A150B		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T2	-		•	•		•	•				•	MECHANICAL	18	•	
A150C		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-		•	•		•					•	STORAGE	17		
A150D	•	6' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-			•	•						•	•	STORAGE	17		
A150E		3' - 0"	7' - 2"	ALUM	D5	ALUM	CW9	1/A5.02	1/A5.02	T12	-	•	•	•		•	•				•	EXIT			
B001		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7	-			•			•					•	SCIENCE	22		
B001A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•	•		•					•	PREP	21		
B002		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•		•		•	CUSTODIAL	17	•	
B003		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	-	-		•	•		•					•	STORAGE	17		
B004A	•	6' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2	-			•	•		•					•	ELECTRICAL	18	•	
B004B		3' - 4"	7' - 2"	HM	D1	HM	F1	H10	J10	T12	-		•	•		•	•					EXIT		•	
B005	•	6' - 4"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	90 MIN		•	•		•	•		•		•	MECHANICAL	18	•	
B005B		4' - 0"	7' - 2"	HM	D1	HM	F1	H2	J2	T2	-		•	•		•	•				•	ELECTRICAL	17	•	
B006		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•		•	•	•	TOILET	24		
B007		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B008		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B009		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B009A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•				18	•	
B010		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B010A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•	•	MECHANICAL	18	•	
B011		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B011A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2				•		•	•		•					18	•	
B012		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B012A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•	•	MECHANICAL	18	•	
B014		3' - 0"	7' - 2"	WD	D2	HM	F1	H9	J9	-			•			•					•	SMALL GROUP INSTRUCTION	22		
B015		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	READING	22		
B016		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	CLASSROOM	22		
B017		3' - 0"	7' - 2"	WD	D1	HM	F1	H9	J9	T6	-		•	•		•	•		•	•	•	TOILET	24		
B018		3' - 0"	7' - 2"	WD	D1	HM	F1	H9	J9	-	-		•	•		•					•	MDF	18	•	
B019		3' - 0"	7' - 2"	WD	D4	HM	F1	H7	J7	T7			•			•	•				•	MAKERSPACE	22		
B019A		3' - 0"	7' - 2"	WD	D3	HM	F1	H1	J1	-			•			•					•	TECH STORAGE	17		ROLLER SHADE @ DOOR
B020	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF9	1/A5.02	1/A5.02	T7	-	•	•	•		•	•			•	•	MEDIA CENTER			
B020A	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW35	1/A5.02	1/A5.01	T12	-	•	•	•		•	•				•	EXIT		•	
B021		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	BREAKOUT	22		
B022		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	BREAKOUT	22		
B023		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	BREAKOUT	22		
B024		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•			•					•	IT OFFICE	19	•	
B025		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•			•					•	WORK ROOM	19		
B026		3' - 0"	7' - 2"	WD	D4	HM	F1	H7	J7	T7			•			•	•				•	MULTI-MEDIA	22		
B026A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	GREEN SCREEN	22		ACOUSTIC DOOR
B027		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	CLASSROOM	22		
B028		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	MATH	22		
B030		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B030A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•			•							18	•	
B031		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B031A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•				•	MECHANICAL	18	•	
B032		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B032A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•							18	•	
B033		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B033A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•				•	MECHANICAL	18	•	
B034		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B034A		4' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	-		•	•		•	•				•	CUSTODIAL	18	•	
B035		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B035A		4' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	45 MIN		•	•		•	•				•	ELECTRICAL	18	•	
B036		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	STRIDE	22		
B037		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•		•	•					•	SENSORY			
B038		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7	-			•			•					•	SCIENCE	22		
B038A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•	•		•					•	PREP	21		
B038B		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T2	-		•	•		•	•				•	MECHANICAL	18	•	
B039		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-			•			•		•	•	•	TOILET	24		
B040		3' - 0"	7' - 2"	WD	D1	HM	F2A	H7	J7	-			•	•		•					•	WORKROOM	19		
B041		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF11	1/A5.02	1/A5.02	-	-		•	•		•					•	FLEX CLASSROOM			
B041A		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF12	1/A5.02	1/A5.02	-	-		•	•		•					•	FLEX CLASSROOM			
B041B		30' - 6"	9' - 4"	-	D8	-	-	17/A2.31	7 & 8/A4.35	-												FLEX CLASSROOM			FLEXABLE WALL
B101		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7	T4			•			•	•				•	SCIENCE	22		
B101A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	PREP	21		
B102		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4	-		•	•		•	•			•	•	MECHANICAL	18	•	
B103		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T4			•	•		•	•				•	WORK ROOM	19		
B104		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	T4			•			•	•				•	SKILLS	22		
B105		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	T4			•			•	•				•	SPECIAL EDUCATION	22		
B105A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	T6	-		•			•	•				•	LAUNDRY	17		
B105B		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-								•	•	•	TOILET	23		
B105C		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	BED PREP	17		
B105D		2' - 8"	7' - 2"	WD	D1	HM	F1	H1	J1	-											•	CLOSET			
B106		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•		•	•	•				•	SENSORY			
B107		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	-	45 MIN		•	•		•				•	•	ELECTRICAL	18	•	
B108		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B108A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•				18	•	
B109		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B109A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•	•	MECHANICAL	18	•	
B110		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B110A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•				18	•	
B111		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B111A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•	•	MECHANICAL	18	•	
B113		3' - 0"	7' - 2"	WD	D2	HM	F1	H9	J9	-			•			•					•	SMALL GROUP INSTRU

DOOR AND FRAME SCHEDULE - AREA A&B

NUMBER	DOUBLE LEAF DOOR	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR TYPE/MATERIAL MATERIAL	DOOR TYPE/MATERIAL TYPE	FRAME TYPE/MATERIAL MATERIAL	FRAME TYPE/MATERIAL TYPE	FRAME HEAD DETAIL	FRAME JAMB DETAIL	FRAME SADDLE DETAIL	FIRE RATING (MINUTES)	HARDWARE - SEE SPECIFICATIONS FIRECODE PANIC RELEASE LATCH	FIRECODE POSITIVE LATCHING	FIRECODE CLOSER	FIRECODE E.M. HOLD OPEN	DISABLED LEVER U-HANDLE	DISABLED ACCESSIBLE THRESHOLD	PUSH/PULL	KICKPLATE	SIGNAGE ACCESSIBILITY SYMBOL	SIGNAGE SIGNAGE REQUIRED	SIGNAGE TEXT	HARDWARE SET NUMBER	CARD READER	REMARKS
B115		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•								•	CLASSROOM	22		
B116		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B117		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B118		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	STRIDE	22		
B119		3' - 0"	7' - 2"	WD	D1	HM	F1	H9	J9/J4	T6	-		•	•		•	•		•	•	•	TOILET	24		
B121		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T4	-		•	•		•	•			•	•	MECHANICAL	18	•	
B121A		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	-	-		•			•			•	•		CUSTODIAL	18	•	
B122		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T6	-		•			•	•			•	•	TOILET	24		
B123		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T2	-		•			•	•				•	MECHANICAL	18	•	
B124		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B125		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B126		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-		•	•		•			•		•	STORAGE	17		
B126A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-		•	•		•	•		•	•	•	CUSTODIAL	17	•	
B127		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	CLASSROOM	22		
B128		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	MATH	22		
B130		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B130A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•	•	•	•			18	•	
B131		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B131A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•	•	•	•			18	•	
B132		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B132A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•	•	•	•			18	•	
B133		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	21		
B133A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•	•	•	•		MECHANICAL	18	•	
B134		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7				•			•					•	ART	22		
B135		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J4	-			•			•					•	SCIENCE	22		
B135A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	PREP	21		
B136		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T6	-		•	•		•	•		•	•	•	TOILET	24		
B137		3' - 0"	7' - 2"	WD	D1	HM	F2A	H7	J7	-			•	•		•					•	WORKROOM	19		
B138.1		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF10	1/A5.02	1/A5.02	T4	-		•			•	•				•	FLEX LABORATORY			
B138.2		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	SF10	1/A5.02	1/A5.02	T4	-		•			•	•				•	FLEX LABORATORY			
B201		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7	-			•			•					•	SCIENCE	22		
B201A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	PREP	21		
B202		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	T6	-		•	•		•	•		•	•	•	CUSTODIAL	17	•	
B203		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	FLEX CLASSROOM	22		
B203A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	45 MIN		•	•		•			•	•	•	MECHANICAL/ELECTRICAL	18	•	
B203B		3' - 0"	7' - 2"	HM	D1	HM	F1	H11			-		•	•		•	•		•	•		MECHANICAL ROOF ACCESS	18	•	
B204		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B204A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•			18	•	
B205		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B205A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•	•	MECHANICAL	18	•	
B206		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B206A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•			18	•	
B207		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B207A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•	•	MECHANICAL	18	•	
B209		3' - 0"	7' - 2"	WD	D2	HM	F1	H9	J9	-			•			•					•	SMALL GROUP INSTRUCTION	22		
B210		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	READING	22		
B211		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	CLASSROOM	22		
B212		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B213		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B214		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	STRIDE	22		
B215		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	-	-		•	•		•			•		•	CUSTODIAL	17	•	
B215A		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T1	-		•	•		•			•		•	MECHANICAL	18	•	
B216		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T6	-		•	•		•	•			•	•	TOILET	24		
B217		3' - 0"	7' - 2"	WD	D1	HM	F1	H2	J2	-	45 MIN		•	•		•			•		•	ELECTRICAL	18	•	
B218		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	WOMENS RESTROOM			
B219		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-			•			•	•	•	•	•	MENS RESTROOM			
B220		3' - 0"	7' - 2"	WD	D1	HM	F1	H9	J9	-	-		•	•		•			•	•	•	STORAGE	17		
B220A		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T2	-		•	•		•	•		•	•	•	MECHANICAL	18	•	
B220B		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	T6	-		•	•		•	•		•	•	•	CUSTODIAL	17	•	
B221		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	CLASSROOM	22		
B222		3' - 0"	7' - 2"	WD	D1	HM	F2A	H9	J9	-			•			•					•	MATH	22		
B224		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B224A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•			18	•	
B225		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B225A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•			•	•	MECHANICAL	18	•	
B226		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B226A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•			18	•	
B227		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•			•					•	CLASSROOM	22		
B227A	•	4' - 8"	7' - 2"	WD	D1	HM	F1	H2	J2	T2			•	•		•	•		•	•	•	MECHANICAL	18	•	
B228		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	T1			•			•	•				•	ART	22		
B228A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	KILN	17		
B229		3' - 0"	7' - 2"	WD	D1	HM	F3	H7	J7	-			•			•					•	SCIENCE	22		
B229A		3' - 0"	7' - 2"	WD	D2	HM	F1	H1	J1	-			•			•					•	PREP	21		
B229B		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	-	-		•	•		•					•	IT	19	•	
B230		3' - 0"	7' - 2"	WD	D1	HM	F1	H7	J7	T6	-		•	•		•	•		•	•	•	TOILET	24		
B231		3' - 0"	7' - 2"	WD	D2	HM	F1	H7	J7	-			•		•	•					•	SENSORY			
B232		3' - 0"	7' - 2"	WD	D1	HM	F2	H7	J7	-			•	•		•				•	•	WORKROOM	19		
B232A		3' - 0"	7' - 2"	WD	D1	HM	F1	H1	J1	T6	-		•	•		•	•	•	•	•	•	TOILET	23		

DOOR AND FRAME SCHEDULE - AREA A&B

NUMBER	DOUBLE LEAF DOOR	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR TYPE/MATERIAL MATERIAL	DOOR TYPE/MATERIAL TYPE	FRAME TYPE/MATERIAL MATERIAL	FRAME TYPE/MATERIAL TYPE	FRAME HEAD DETAIL	FRAME JAMB DETAIL	FRAME SADDLE DETAIL	FIRE RATING (MINUTES)	HARDWARE - SEE SPECIFICATIONS FIRECODE PANIC RELEASE LATCH	FIRECODE POSITIVE LATCHING	FIRECODE CLOSER	FIRECODE E.M. HOLD OPEN	DISABLED LEVER U-HANDLE	DISABLED ACCESSIBLE THRESHOLD	PUSH/PULL	KICKPLATE	SIGNAGE ACCESSIBILITY SYMBOL	SIGNAGE SIGNAGE REQUIRED	SIGNAGE TEXT	HARDWARE SET NUMBER	CARD READER	REMARKS
C101		21' - 6"	11' - 0"					9/A4.04	10/A4.32	-	120 Minute Fire Rating											WON-DOOR MFW			MOVABLE FIRE WALL
C102	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW11	2/A5.01	1/A5.01	T12	-	•		•			•			•	•	EXIT		•	
C103	•	5' - 9"	7' - 2"	ALUM/GL	D4	ALUM	CW12	2/A5.01	1/A5.01	T12	-	•		•			•			•	•	EXIT		•	
C104	•	6' - 2 1/2"	7' - 2"	ALUM/GL	D4	ALUM	CW13	2/A5.01	2/A5.01	T12	-	•		•			•			•	•	EXIT		•	
C105	•	6' - 0"	7' - 2"	HM	D4	HM	F1	H2	J2	-		•		•						•	•	PLANETARIUM			
C106	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW10	2/A5.01	1/A5.01	T10	-	•		•			•			•		EXIT		•	
C108		3' - 0"	7' - 2"	HM	D1	HM	F1	H1	J1	-	-		•	•	•					•		MEZZ ACCESS		•	
M121		4' - 0"	6' - 8"	HM	D1	HM	F1	H11		15/A1.41	60 MIN	•		•					•		•	ROOF ACCESS - MEZZ		•	
M140		4' - 0"	6' - 8"	HM	D1	HM	F1	H11		15/A1.41	60 MIN	•		•					•		•	ROOF ACCESS - MEZZ		•	
S001		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW25	2/A5.01	2/A5.01	T10	-	•		•			•			•	•	STAIR - 1 EXIT		•	
S001.1		3' - 0"	7' - 2"	HM	D1	HM	F5	H10	J10	T11	-	•		•	•		•			•	•	STAIR - 1 EXIT			
S002	•	5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•			•	•	STAIR - 2			
S002.1	•	6' - 0"	7' - 2"	HM	D4	HM	F1	H5	7/A4.34	T12		•		•			•			•	•	STAIR - 2 EXIT		•	
S003	•	5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•	•		•	•	STAIR - 3			
S003.1	•	6' - 0"	7' - 2"	HM	D4	HM	F1	H5	7/A4.34	T12		•		•			•			•	•	STAIR - 3 EXIT		•	
S004		3' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW24	2/A5.01	2/A5.01	T12	-	•		•			•				•	STAIR - 4 EXIT		•	
S102	•	5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•			•	•	STAIR - 2			
S103	•	5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•			•	•	STAIR - 3			
S201.1	•	8' - 0"	9' - 2"	HM	D1	HM	F1	H2	J2		60 MIN	•		•	•										
S201.2	•	7' - 0"	9' - 2"	HM	D1	HM	F1	H2	J2		60 MIN	•		•	•										
S202	•	5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•			•	•	STAIR - 2			
S203		5' - 6"	7' - 2"	HM	D1	HM	F1	H2	J2	T1		•		•	•		•			•	•	STAIR - 3			
V100.1	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW1	2/A5.01	6/A4.31	T10	-	•		•			•								
V100.2	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW1	2/A5.01	2/A5.01	T10	-	•		•			•								
V100.3	•	6' - 0"	7' - 2"	ALUM/GL	D4	ALUM	CW1	2/A5.01	2/A5.01	T10	-	•		•			•								•	
V100.4	•	6' - 1 1/2"	7' - 2"	ALUM/GL	D4	ALUM	SF1	1/A5.02	1/A5.02	T11	-	•		•			•								
V100.5	•	6' - 1 1/2"	7' - 2"	ALUM/GL	D4	ALUM	SF1	1/A5.02	1/A5.02	T11	-	•		•			•								
V100.6	•	6' - 1 1/2"	7' - 2"	ALUM/GL	D4	ALUM	SF1	1/A5.02	1/A5.02	T11	-	•		•			•								•	

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ARCHITECTURE | PLANNING | INTERIORS

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

DOOR SCHEDULE - AREA B & C

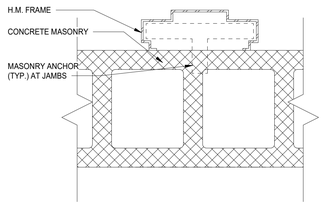
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

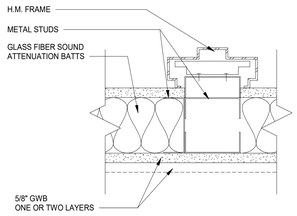
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

A11.02

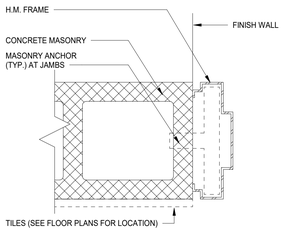
5/18/2026 3:32:02 PM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-Arch_BIM360-R26.rvt



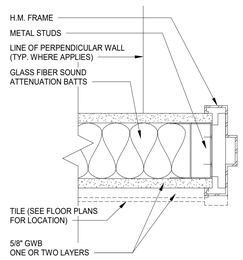
J4 **NOTE: SEE PARTITION TYPES**



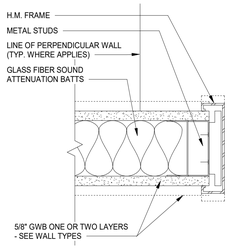
J3 **NOTE: SEE PARTITION TYPES**



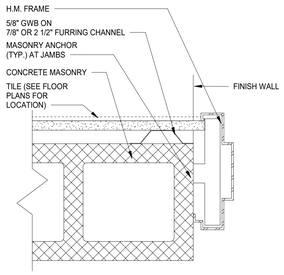
H2 J2 **NOTE: SEE PARTITION TYPES**



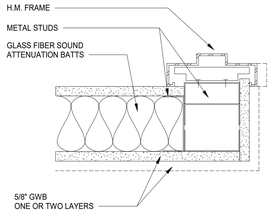
H1 J1 **NOTE: SEE PARTITION TYPES**



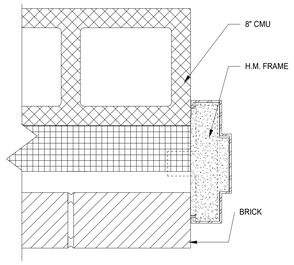
H8 J8 **NOTE: SEE PARTITION TYPES**



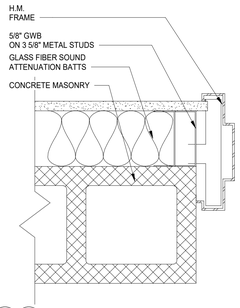
H7 J7 **NOTE: SEE PARTITION TYPES**



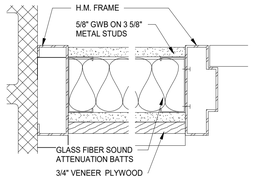
J6 **NOTE: SEE PARTITION TYPES**



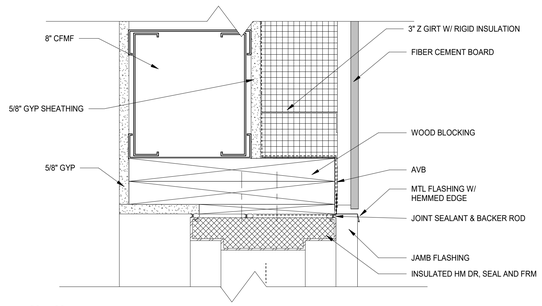
H5 **HEAD DETAIL @ EXTERIOR MASONRY WALL**



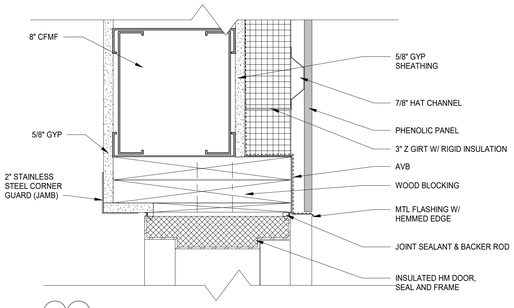
H9 J9 **NOTE: SEE PARTITION TYPES**



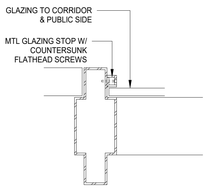
H10 J10 **HEAD & JAMB @ DOOR B004B**



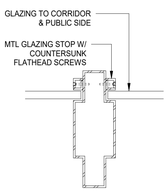
H11 J11 **HEAD / JAMB DETAIL @ EXTERIOR FIBER CEMENT WALL**



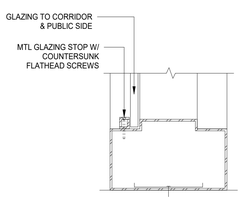
H12 J12 **HEAD / JAMB DETAIL@ EXTERIOR PHENOLIC WALL**



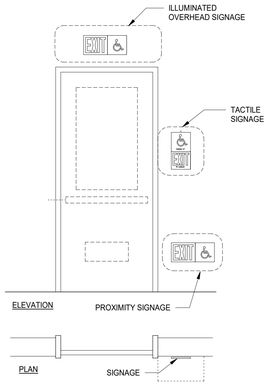
M1 **STANDARD HOLLOW METAL INTERMEDIATE MULLION/DOOR JAMB (WHERE APPLICABLE)**



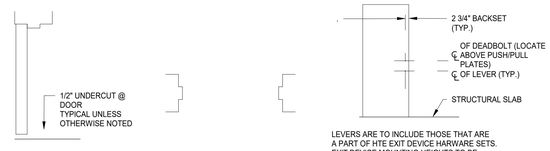
M2 **STANDARD HOLLOW METAL INTERMEDIATE MULLION (WHERE APPLICABLE)**



M3 **STANDARD HOLLOW METAL DOOR FRAME SILL**



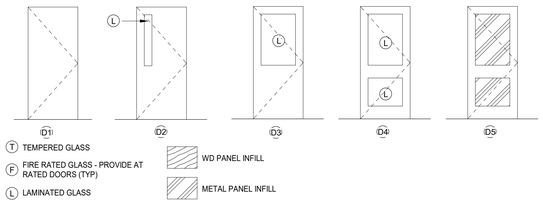
TYPICAL SIGNAL CONFIGURATION



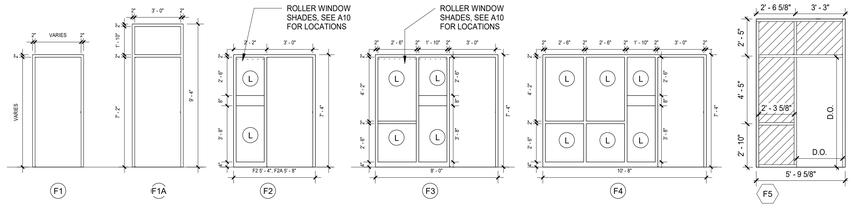
TYPICAL DOOR SIZE DIMENSIONS

TYPICAL HARDWARE MOUNTING HEIGHTS

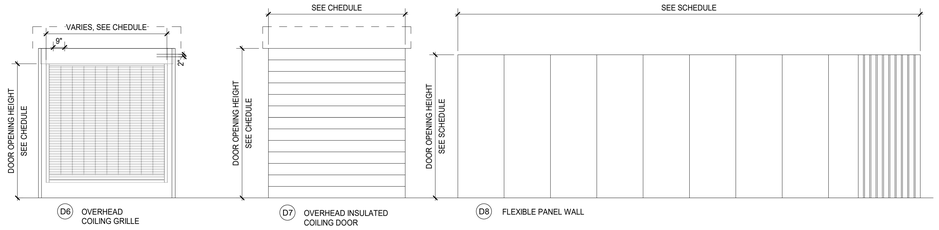
TYPICAL MOUNTING HEIGHTS



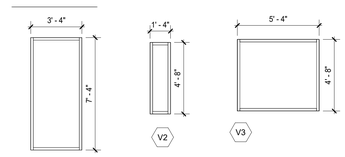
DOOR TYPES



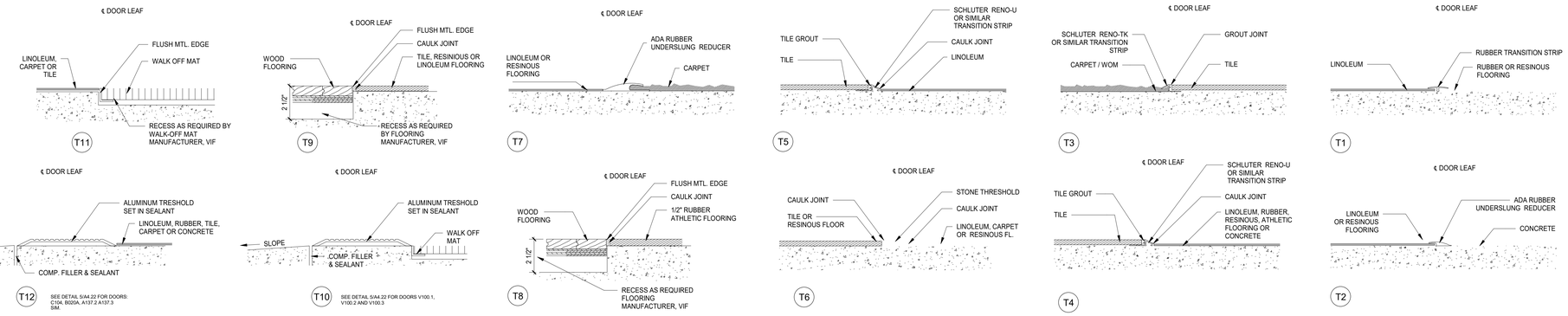
DOOR FRAMES



SPECIALTY DOORS



VISION FRAMES



THRESHOLD TYPES

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530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

DOOR FRAME TYPES AND DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
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APPROVED BY	Approver

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1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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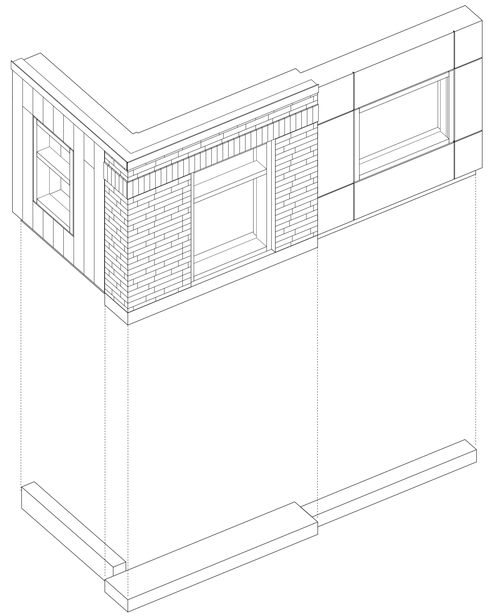
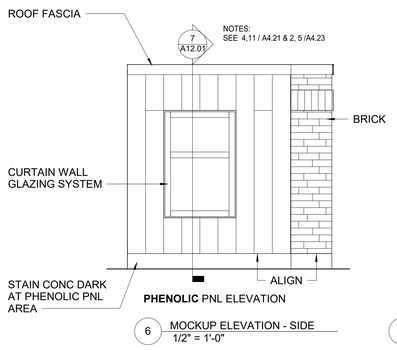


MOCKUP - AXONOMETRIC
SCALE: 1/2" = 1'-0"



PHENOLIC PNL ELEVATION

6 MOCKUP ELEVATION - SIDE
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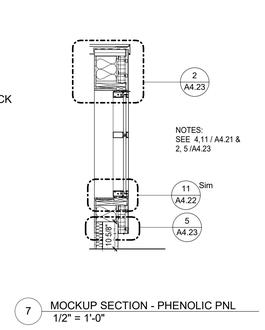
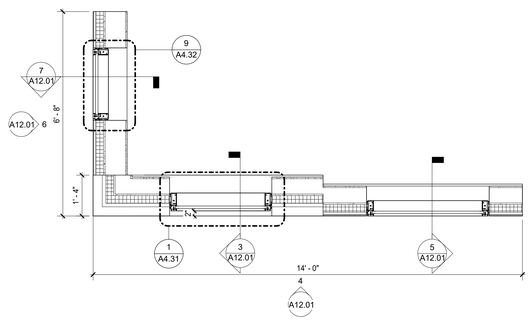
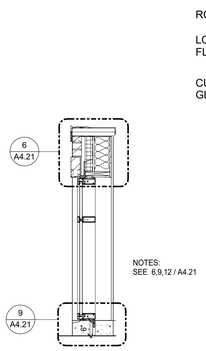


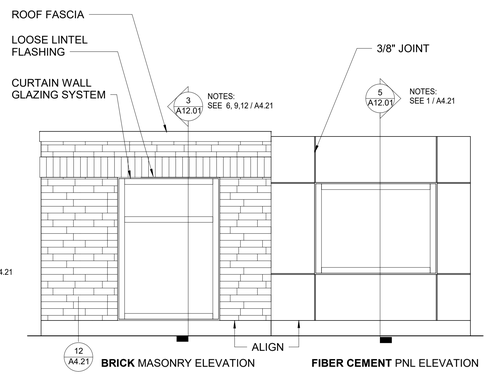
7 MOCKUP SECTION - PHENOLIC PNL
1/2" = 1'-0"



1 MOCKUP PLAN
SCALE: 1/2" = 1'-0"



3 MOCKUP SECTION - BRICK
1/2" = 1'-0"



BRICK MASONRY ELEVATION **FIBER CEMENT** PNL ELEVATION

4 MOCKUP ELEVATION - FRONT
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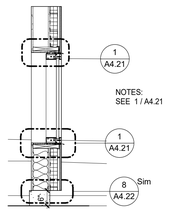
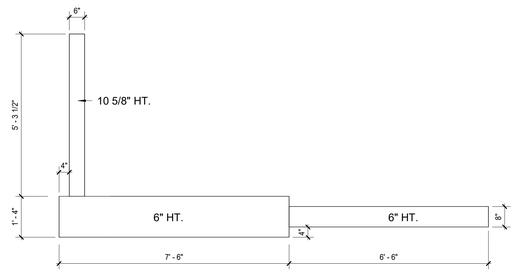


5 MOCKUP- FIBER CEMENT PNL
1/2" = 1'-0"



1B MOCKUP FND PLAN
SCALE: 1/2" = 1'-0"

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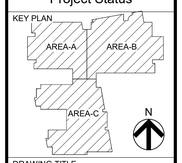
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MOCK UP PLANS

STATE PROJ. NO.	144-0108N
PROJ. NO.	250501
SCALE	1/2" = 1'-0"
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APPROVED BY	Approver

ISSUE DATES

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1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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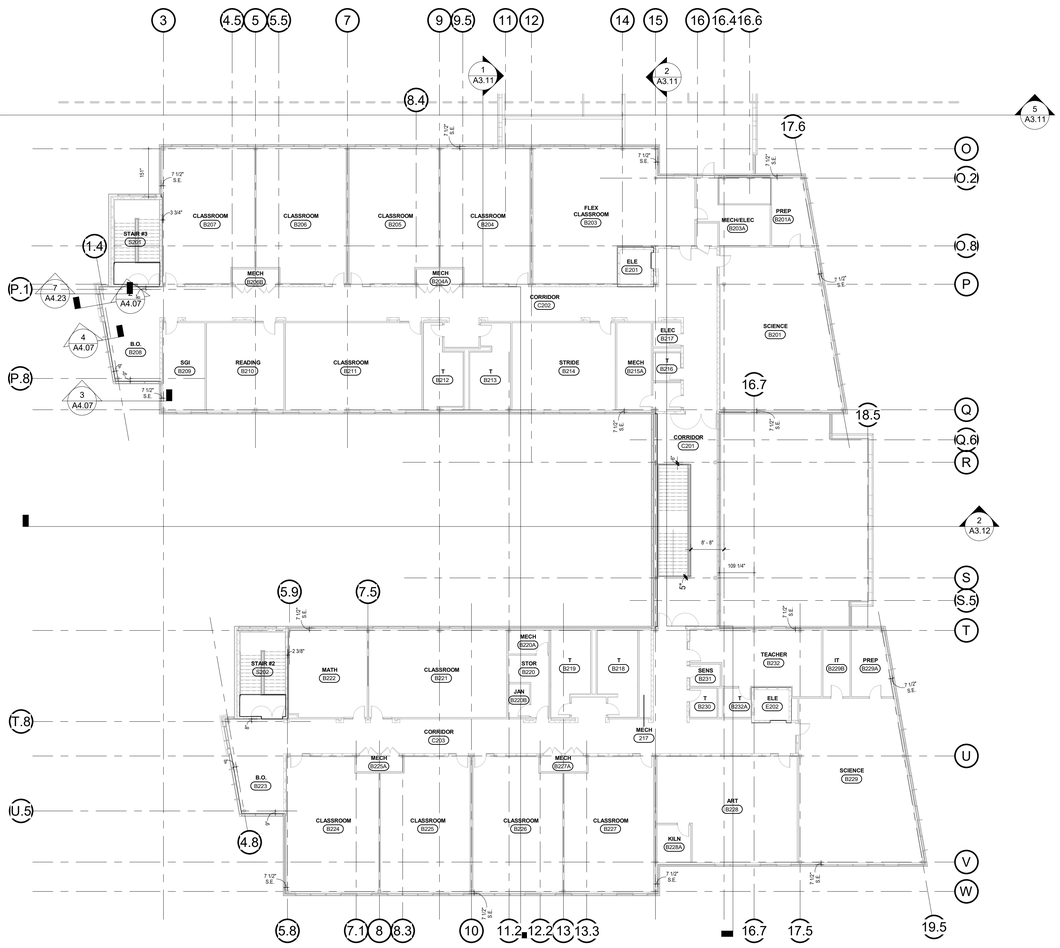
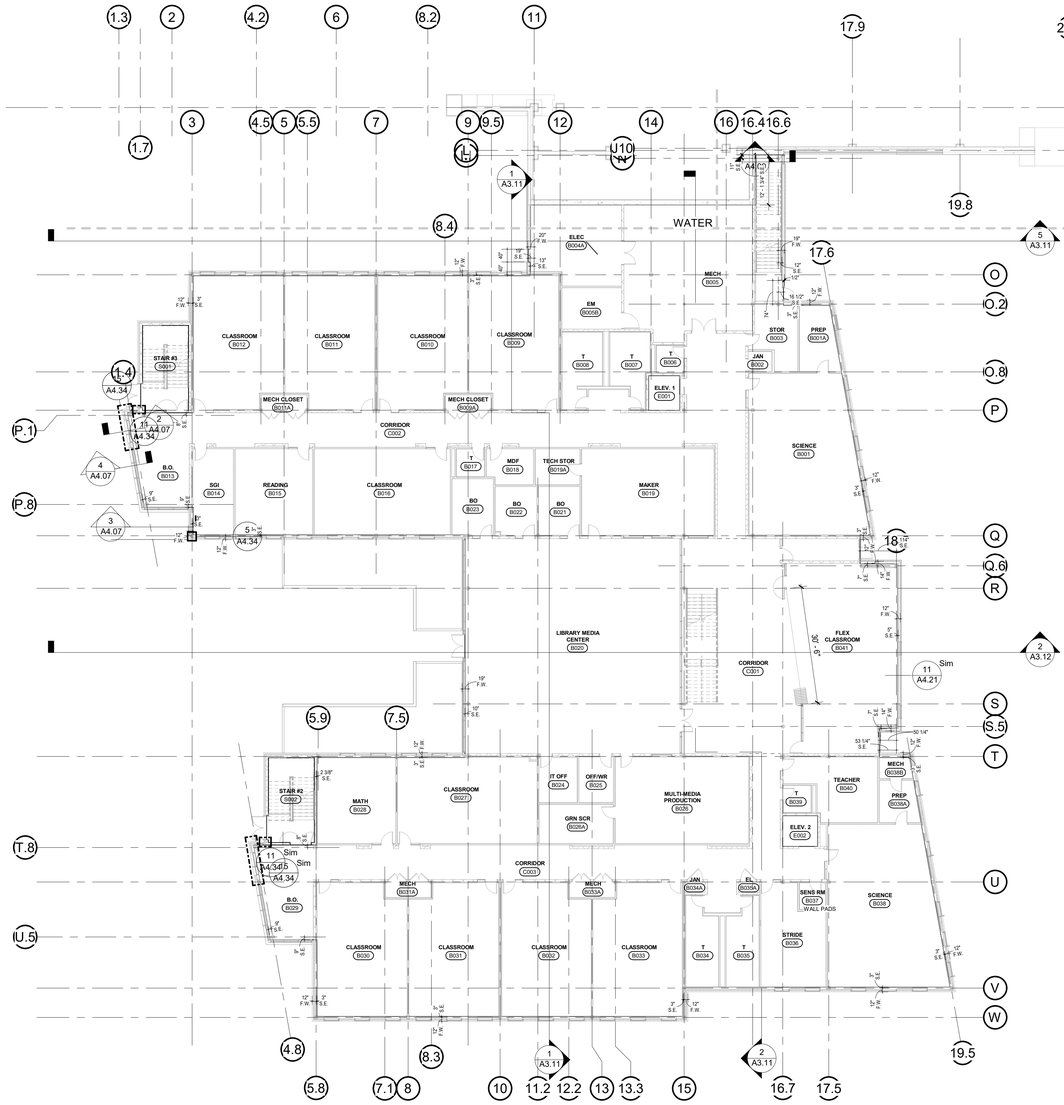


2 UPPER LEVEL - EDGE OF SLAB PLAN
1/16" = 1'-0"



1 LOWER LEVEL - EDGE OF SLAB PLAN
1/16" = 1'-0"

EDGE OF SLAB LEGEND

S.E.	SLAB EDGE
F.W.	FOUNDATION WALL
	SLAB DEPRESSION

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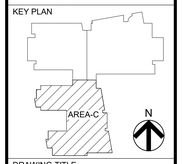
530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

LOWER & UPPER LEVEL - EDGE OF SLAB

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
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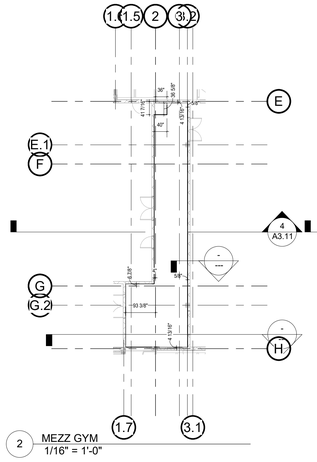

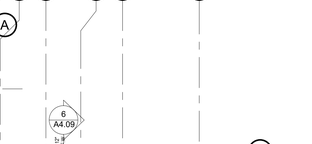

EDGE OF SLAB LEGEND

S.E.	SLAB EDGE
F.W.	FOUNDATION WALL
	SLAB DEPRESSION

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KEY PLAN



DRAWING TITLE

MAIN LEVEL - EDGE OF SLAB

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
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ISSUE DATES

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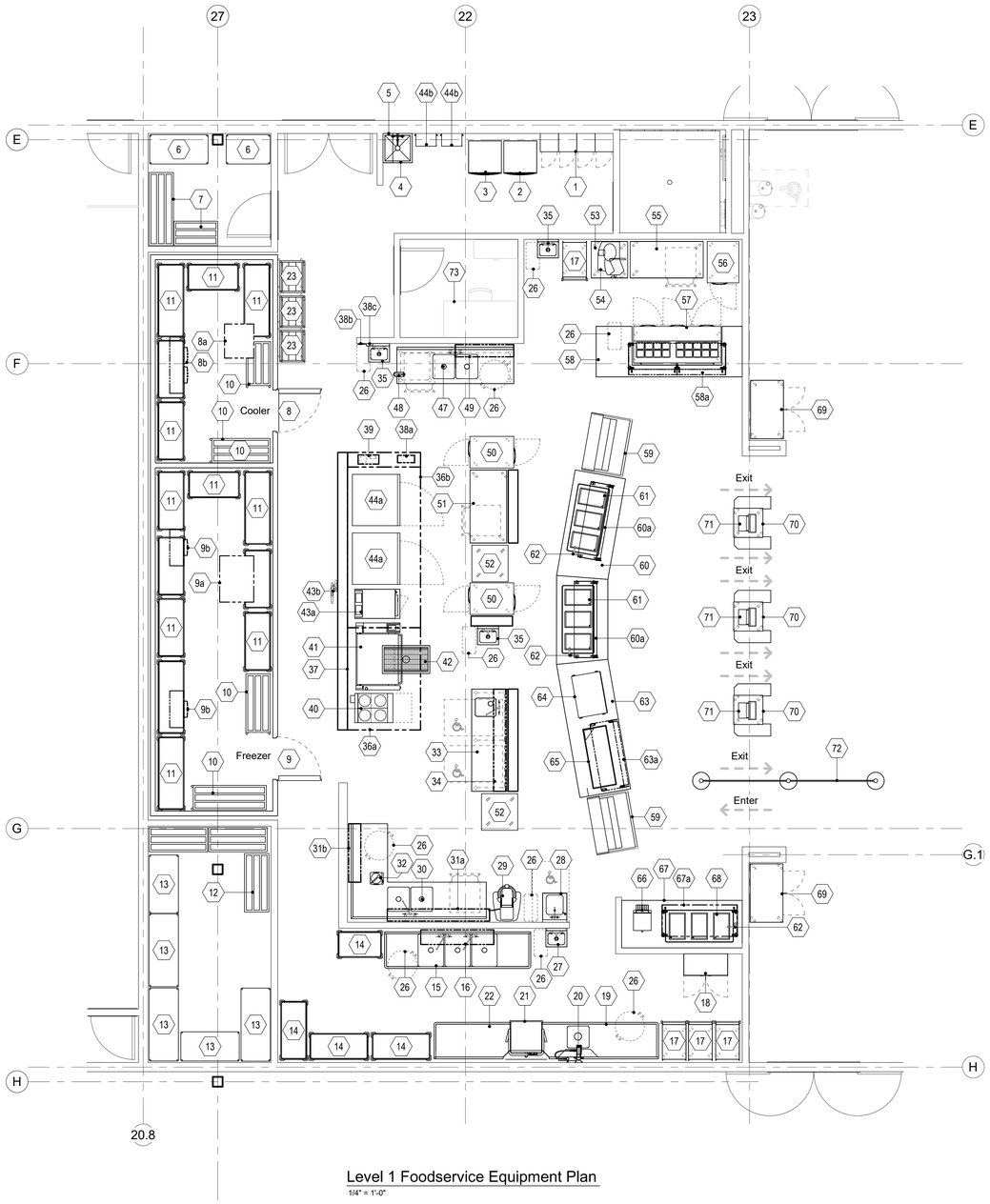

Level 1 Foodservice Equipment Plan

1/4" = 1'-0"

SCHEDULE OF FOODSERVICE EQUIPMENT & CONNECTIONS

Item	Qty	Description	Plumbing	Electrical	Mechanical / Equipment Remarks
1	4	Lockers (by GC)			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
2	1	Front load ventless dryer		1.2 KW - 208-240/1 - NEMA L6-30P	
3	1	Front load washer	1/2" H&CW; 7/8" IW to Standpipe W	5 KW - 208-240/1 - NEMA L6-30P	
4	1	Mop sink (by PC)	1/2" H&CW, drain in floor		Seal unit to the floor and tile in place
5	1	Utility shelf with mop hangers			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
6	2	Storage shelving, five-tier			
7	2	Dunnage racks, stationary			
8	1	Walk-in cooler		1 KW - 120/1 (lights, temp alarm)	Requires a 7" recess by GC (see Special Conditions Plan)
8a	1	Cooler condensing unit, water cooled, above walk-in room	3/8" 85° F condening water supply; 5/8" return	8 A - 208/3	Located above the refrigerated room
8b	1	Cooler evaporator coil, water-cooled	1" IW to FFD by KEC	1.8 A - 115/1	Remote refrigeration lines from item 8a by KEC
9	1	Walk-in freezer		2 KW - 120/1 (lights, temp alarm and pressure relief port); (2) 20 A - circuit - 120/1 DR (drain heat trace)	Requires a 7" recess by GC (see Special Conditions Plan)
9a	1	Freezer condensin unit, water-cooled, above walk-in room	3/8" 85° F condening water supply; 5/8" return	15.5 A - 208/3	Located above the refrigerated room
9b	2	Freezer evaporator coil, water cooled	1" IW to FFD by KEC	4.6 A - 208/1	Remote refrigeration lines from item 9a by KEC
10	4	Dunnage racks, mobile			
11	14	Mobile shelving units, four-tier			
12	1	Dunnage racks, stationary			
13	5	Storage shelving, five-tier			
14	4	Mobile shelving units, four-tier			
15	1	Three-compartment sink	(2) 3/4" 120°F H&CW; (3) 2" W manifold thru GI by PC		
16	1	Wall shelf			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
17	4	Utility cart			
18	1	Detergent storage cabinet			
19	1	Soiled ware table with scrapping sink	2" W		
20	1	Hose reel assembly	1/2" H&CW		Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
21	1	Ventless warewasher with booster heater	3/4" 50°-75° F CW; 1/2" CW (drain tempering); 1-1/2" IW to FS	20 A - 480/3	
22	1	Clean dish table			
23	3	Mobile sheet pan racks			
24	1	-Spare Number-			
25	1	-Spare Number-			
26	10	Waste cans (by Owner)			
27	1	Hand sink with side splashes	1/2" H&CW; 1-1/2" W		Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
28	1	ADA hand sink	1/2" H&CW; 1-1/2" W		Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
29	1	Forty-qurat mixer		5.6 A - 208/3 - NEMA L15-20P	
30	1	Prep table with sinks	1/2" H&CW; 2" IW to FS	(2) 20 A circuit - 120/1 wall mounted convenience DR by EC	
31a	1	Wall shelf			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
31b	1	Wall shelf			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
32	1	Food processor		12 A - 120/1 - NEMA 5-15P (power from item 30)	
33	1	ADA work table with sink	1/2" H&CW; 1-1/2" IW to FS	(2) 20 A circuits - 120/1 DR wall mounted by EC	Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
34	1	Wall shelf			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
35	3	Hand sink with side splashes	1/2" H&CW; 1-1/2" W		Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
36a	1	Exhaust ventilator, Type 1 grease		0.3 KW - 120/1 (from item 38a)	Exhasut 1,330 CFM's thru a 14" x 16" collar @ -0.291" SP; Requires support from above (see Special Conditions Plan)
36b	1	Exhaust ventilator, Type 2 vapor		0.5 KW - 120/1 (from item 38a)	Exhasut 1,870 CFM's thru a 20" x 14" collar @ -0.129" SP; Requires support from above (see Special Conditions Plan)
37	1	Stainless steel wall flashing			
38a	1	Ventilator demand control system processor		15 A circuit - 120/1 (See Note E-20 / FS2.12)	Control for Ites 36a and 36b, Mounted in hood cabinet
38b	1	Ventilator control interface panel		Cable from item 38a	See Note E-1 on rough-in utility plans
38c	1	Room temperature sensor		Wiring from Item 38a	See Note E-1 on rough-in utility plans
39	1	Fire suppression system		20 A - 120/1; J-box for connection to building alarm system and equipment shutdown alarm system & equipment shutdown	Protection for Items 36a and 36b; Mounted in hood cabinet
40	1	Range with oven		13 KW (16.3 A) - 480/3	
41	1	Forty-gallon tilt braising pan	1/2" H&CW	27.9 KW (33.6 A) - 480/3	
42	1	Floor pan and grate	3" W conn 7" BFF		Requires floor recess by GC (see Special Conditions Plan)
43a	1	Steamer, ten-pans	(2) 3/4" CW (from item 43b); 1-1/2" IW to FS	33 KW - (39.8 A) - 480/3	
43b	1	Water filter assembly (for tiem 43a)	3/4" CW		Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
44a	2	Combi-ovens, double-stacked	3/4"CW (RO water from item 44b); 3/4" (unfiltered water from item 44b for spary wash); (2) 1" IW to FS	24 KW (28.9 A) - 480/3 (total 4 connections)	
44b	2	Reverse osmosis filtration system (for item 44a)	3/4" CW; 3/8" IW to mop sink		
45	1	-Spare Number-			
46	1	-Spare Number-			
47	1	Prep table with sinks	1/2" H&CW; (2) 2" IW to FS	(2) 20 A circuit - 120/1 wall mounted convenience DR	
48	1	Manual can opener			
49	1	Wall shelf			Requires wall blocking by GC in non-masonry walls (see Special Conditions Plan)
50	2	Refrigerator, pass-thru		5.5 A - 115/1 - NEMA 5-15P (from item 51)	
51	1	Mobile work table		(3) 20 A circuit - 120/1 wall mounted convenience DR by EC	
52	2	Heated holding cabinet, pass-thru		13.8 A - 120/1 - NEMA 5-15P (from item 51)	
53	1	Mobile equipment stand			
54	1	Automatic slicer		5.6 A - 120/1 - cord and plug	
55	1	Mobile work table		20 A circuit - 120/1 wall mounted DR by EC	
56	1	Refrigerator, reach-in		5.9 A - 115/1 - NEMA 5-15P	
57	1	Refrigerated sandwich table		6 A - 115/1 - NEMA 5-15P	
58	1	Serving counter, deli		20 A circuit - 120/1; mounted DR by KEC	
58a	1	Self-service food protector, two-tier			
59	2	Refrigerated display case		16 A - 120/1 - NEMA 6-15P (power from serving counter 60 and 63)	
60	1	Serving counter		(stub-up) 20 A circuit - 120/1; mounted DR by KEC; (1) 16 A - 120/1 (for item 50); (2) 12.3 A - 208/1 (for item 61)	
60a	2	Full service food protector			
61	2	Drop-in heated/refrigerated food wells	3/4" IW to FS	12.3 A - 208/1 - NEMA L14-20P (power from item 60)	
62	3	Fill faucet	(stub-up) 1/2" CW		
63	1	Serving counter, pizza		(stub-up) 20 A circuit - 120/1; mounted DR by KEC; 16 A - 120/1 (for item 59); 15 A - 120/1 (for item 64); 5.5 A - 120/1 (for item 65)	
63a	1	Convertible service food protector			
64	1	Heated food slide display merchandiser		15 A - 120/1 - NEMA 5-20P (power from item 63)	
65	1	Drop-in heated food merchandiser		5.5 A - 120/1 - NEMA 5-15P (power from item 63)	
66	1	Conveyor toaster		14.9 A - 120/1 - NEMA 5-15P	
67	1	Serving counter, salad bar			
67a	1	Self-service food protector, two-tier			
68	1	Drop-in heated/refrigerated food wells	3/4" IW to FS	12.3 A - 208/1 - NEMA L14-20P	
69	2	Mobile condiment counter			
70	3	Mobile cashier stand			
71	3	Cashier terminal (by Owner)		(stub-up) 20 A circuit - 120/1 DR (flush in floor); Data conn. in floor	
72	1	Traffic barrier, mobile			
73	1	Office furniture (by GC)		Power and data by EC	

Abbreviations used:

A	Amperes	DR	Duplex receptacle	IW	Indirect Waste
AFF	Above finished floor	EC	Electrical contractor	KEC	Kitchen Equip. Contractor
ATC	Automatic Temp. Controls Contractor	EXH	Exhaust	KW	Kilowatt
		FD	Floor drain	MBTU	BTU per hour/1000
BFF	Below finished floor	FFD	Funnel floor drain	MC	Mechanical Contractor
BMS	Building Management System	FHW	Fahrenheit hot water	MUA	Make-up air
		FS	Floor sink	NIC	Not In Contract
BTC	Branch to connection	G	Gas	PC	Plumbing Contractor
C&P	Cord & plug provided	GC	General Contractor	QD	Quick disconnect
CFM	Cubic feet per minute	GI	Grease interceptor	SP	Static pressure (WG)
CR	Condensate return	HP	Horsepower	SR	Single receptacle
CW	Cold water	HW	Hot water	SS	Steam supply
DFA	Drop from above	H&CW	Hot & cold water	W	Waste (direct conn.)

PLAN NOTES

1) IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO FIELD VERIFY THE DELIVERY PATH OF ALL EQUIPMENT WITHIN THEIR SCOPE WITH BUILDING CONDITIONS PRIOR TO ORDERING TO CONFIRM ALL EQUIPMENT FITS WITHIN THE DESIGNATED SPACE AS LOCATED ON PLANS.
2) KITCHEN EQUIPMENT CONTRACTOR SHALL COORDINATE WITH THE GENERAL CONTRACTOR AS NECESSARY FOR OPENINGS IN BUILDING, WALL LEAVE OUTS, DOOR WIDTHS AND HEADER HEIGHTS REQUIRED FOR DELIVERY AND INSTALLATION MEANS.
3) FINISHES TO ALL WALLS, FLOORS AND CEILINGS ARE TO BE PROVIDED BY THE GENERAL CONTRACTOR AS SPECIFIED BY THE PROJECT ARCHITECT TO MEET THE REQUIREMENTS OF THE LOCAL HEALTH DEPARTMENT.
4) REVISIONS TO THESE PLANS DUE TO FIELD CONDITIONS MUST BE SUBMITTED TO THE PROJECT DESIGN TEAM FOR REVIEW AND APPROVAL PRIOR TO PROCEEDING WITH CONSTRUCTION.
5) FLOORING MATERIAL SPECIFIED BY THE ARCHITECT MUST BE PROVIDED WITH A COVED BASE AT ALL WALLS TO INCLUDE THE INTERIOR AND EXTERIOR OF WALK-IN REFRIGERATED ROOMS.
6) ALL FOODSERVICE EQUIPMENT AND CUSTOM FABRICATED ITEMS MUST MEET THE STANDARDS OF THE NATIONAL SANITATION FOUNDATION AND SHALL BE LABELED ACCORDINGLY.

SCHEDULE NOTES

1) UTILITIES SHOWN IN THESE SCHEDULES ARE SPECIFIC TO THE PRIME MANUFACTURER LISTED IN THE WRITTEN SPECIFICATION SECTION 114000. IF EQUIPMENT FROM AN ALTERNATE MANUFACTURER IS PROVIDED, IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO COORDINATE AND SUBMIT TO THE PROJECT DESIGN TEAM FOR REVIEW.
2) UTILITIES LISTED ON THIS SCHEDULE FOR OWNER FURNISHED OR VENDOR SUPPLIED EQUIPMENT ARE ESTIMATES ASSUMED FOR ENGINEERING PURPOSES ONLY. IT IS THE RESPONSIBILITY OF THE OWNER TO PROVIDE EQUIPMENT CUT SHEETS OF THIS EQUIPMENT TO CRABTREE-MCGRATH ASSOCIATES PRIOR TO CONSTRUCTION.
3) INSTALLING SUB-CONTRACTORS MUST NOTIFY CRABTREE-MCGRATH ASSOCIATES IF A UTILITY REQUIREMENT LISTED ON THIS EQUIPMENT SCHEDULE IS NOT AVAILABLE.
4) REFER TO THE ABBREVIATIONS NOTES PROVIDED ON THIS SHEET FOR CLARIFICATION OF ABBREVIATIONS USED WITHIN THIS EQUIPMENT SCHEDULE.

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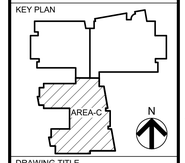
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

FOODSERVICE EQUIPMENT PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	03/16/2026
DRAWN BY	WM
APPROVED BY	RM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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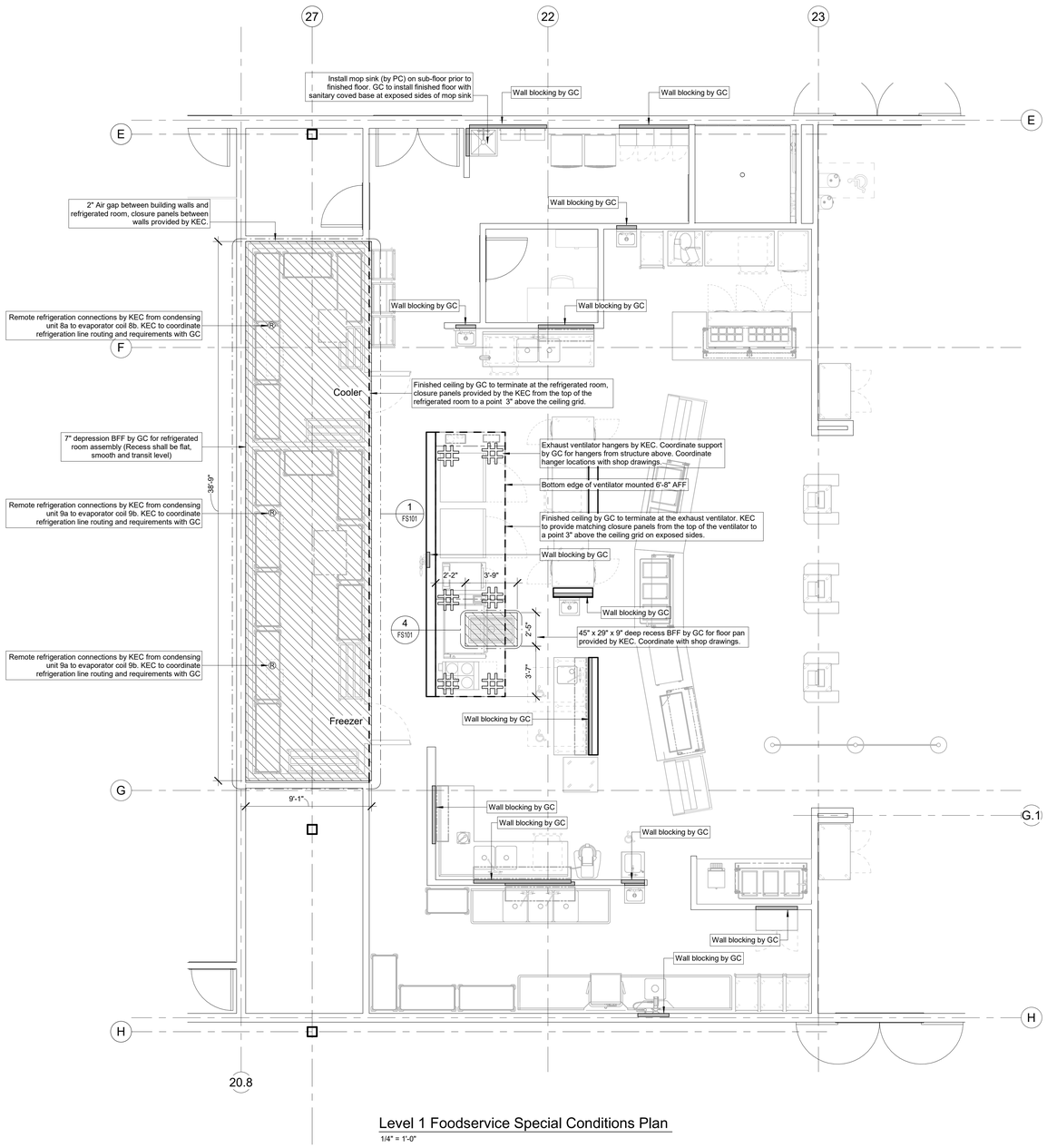
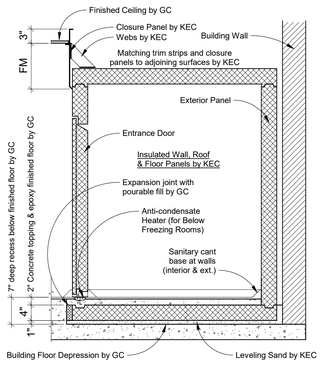
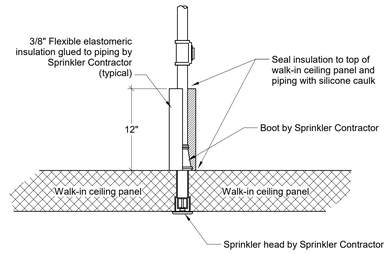


Level 1 Foodservice Special Conditions Plan

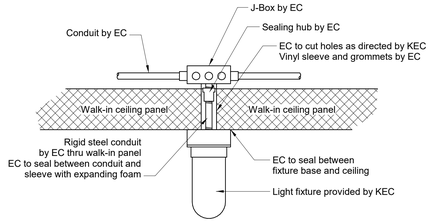
1/4" = 1'-0"



1 Detail - Refrigerated Room
FS101 NTS

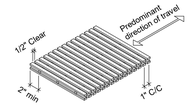


2 Typical Detail - Refrigerated Room Fire Sprinkler
FS101 NTS

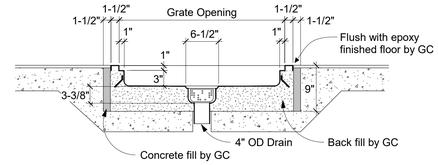


Notes:
1. All light fixtures to be furnished by KEC
2. Mounting light fixtures, all conduit and interwiring by EC
3. All conduit to be on exterior of walk-in by EC
4. All penetrations thru walk-in panels to be thoroughly sealed by EC

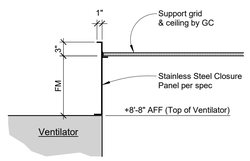
3 Typical Detail - Refrigerated Room Light Fixture
FS101 NTS



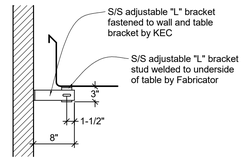
Fiberglass Grating



4 Section - Floor Trough & ADA Grate, Epoxy Floor
FS101 NTS



5 Detail - Closure Panel
FS101 NTS



6 Section - Wall Bracket
FS101 NTS

Abbreviations used:

A	Amperes	DR	Duplex receptacle	IW	Indirect Waste
AFF	Above finished floor	EC	Electrical contractor	KEC	Kitchen Equip. Contractor
ATC	Automatic Temp. Controls Contractor	EXH	Exhaust	KW	Kilowatt
		FD	Floor drain	MBTU	BTU per hour/1000
BFF	Below finished floor	FFD	Funnel floor drain	MC	Mechanical Contractor
BMS	Building Management System	FHW	Fahrenheit hot water	MUA	Make-up air
		FS	Floor sink	NIC	Not In Contract
BTC	Branch to connection	G	Gas	PC	Plumbing Contractor
C&P	Cord & plug provided	GC	General Contractor	QD	Quick disconnect
CFM	Cubic feet per minute	GI	Grease interceptor	SP	Static pressure (WG)
CR	Condensate return	HP	Horsepower	SR	Single receptacle
CW	Cold water	HW	Hot water	SS	Steam supply
DFA	Drop from above	H&CW	Hot & cold water	W	Waste (direct conn.)

SPECIAL CONDITIONS NOTES

1) DIMENSIONS ON THIS PLAN ARE PROVIDED FOR DESIGN INTENT. IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO VERIFY AND COORDINATE ALL DIMENSIONS AND HEIGHTS LISTED IN THE FIELD WITH THE EQUIPMENT BEING PROVIDED.

2) WALK-IN REFRIGERATED ROOM SLAB DEPRESSIONS MUST BE SMOOTH AND LEVEL, SIZED AS SHOWN ON PLAN.

3) THE GENERAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING WALL BLOCKING AS INDICATED FOR SUPPORTING WALL MOUNTED EQUIPMENT. KITCHEN EQUIPMENT CONTRACTOR SHALL VERIFY AND COORDINATE ALL LOCATIONS AND HEIGHTS PROVIDED IN THE FIELD.

4) WALL FLASHING, WHERE SPECIFIED, MUST BE A MINIMUM OF 20 GAUGE STAINLESS STEEL, PROVIDED AND INSTALLED BY THE KITCHEN EQUIPMENT CONTRACTOR. STAINLESS STEEL TO BE CUT IN THE LARGEST SHEETS POSSIBLE TO MINIMIZE JOINTS. ALL SEAMS TO BE COVERED WITH BATTEN STRIPS AND CAP STRIPS PROVIDED AT FLASHING ENDS. PROVIDE CAREFULLY PUNCHED HOLES AT SERVICE LOCATIONS. ALL WALL FLASHING DIMENSIONS MUST BE FIELD VERIFIED BY THE KITCHEN EQUIPMENT CONTRACTOR PRIOR TO FABRICATION.

5) CORNER GUARDS, WHERE SPECIFIED, MUST BE A MINIMUM OF 14 GAUGE STAINLESS STEEL PROVIDED AND INSTALLED BY THE KITCHEN EQUIPMENT CONTRACTOR. BREAK LONG EDGES SO THAT THE GUARDS "HUG" THE WALL AND SECURE TO THE WALL WITH A SUITABLE ADHESIVE. ALL CORNER GUARD DIMENSIONS AND ANGLES MUST BE FIELD VERIFIED BY THE KITCHEN EQUIPMENT CONTRACTOR PRIOR TO FABRICATION.

6) KITCHEN EQUIPMENT CONTRACTOR IS RESPONSIBILE FOR THE INSTALLATION OF THE REMOTE REFRIGERATION LINE RUNS AND COORDINATION OF THE COMPLETE REMOTE REFRIGERATION SYSTEM WITH THE GENERAL CONTRACTOR.

7) EXHAUST HOODS MUST BE HUNG AND MOUNTED WITH THE BOTTOM OF THE HOOD AT 6'-8" ABOVE FINISH FLOOR. HVAC CONTRACTOR IS RESPONSIBLE FOR FINAL CONNECTIONS FROM THE EXHAUST HOOD COLLAR TO THE DUCTWORK. FINAL CONNECTIONS SHALL BE FULLY WELDED AND LIQUID TIGHT.

8) HVAC CONTRACTOR TO PROVIDE AND INSTALL ALL FANS, DUCTWORK AND CURBS AS REQUIRED FOR A COMPLETE AND FUNCTIONING VENTILATIO SYSTEM. START-UP AND AIR BALANCING OF THESE SYSTEMS MUST BE COMPLETED BY THE HVAC CONTRACTOR.

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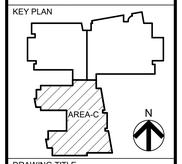
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

FOODSERVICE SPECIAL CONITIONS PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	03/16/2026
DRAWN BY	WM
APPROVED BY	RM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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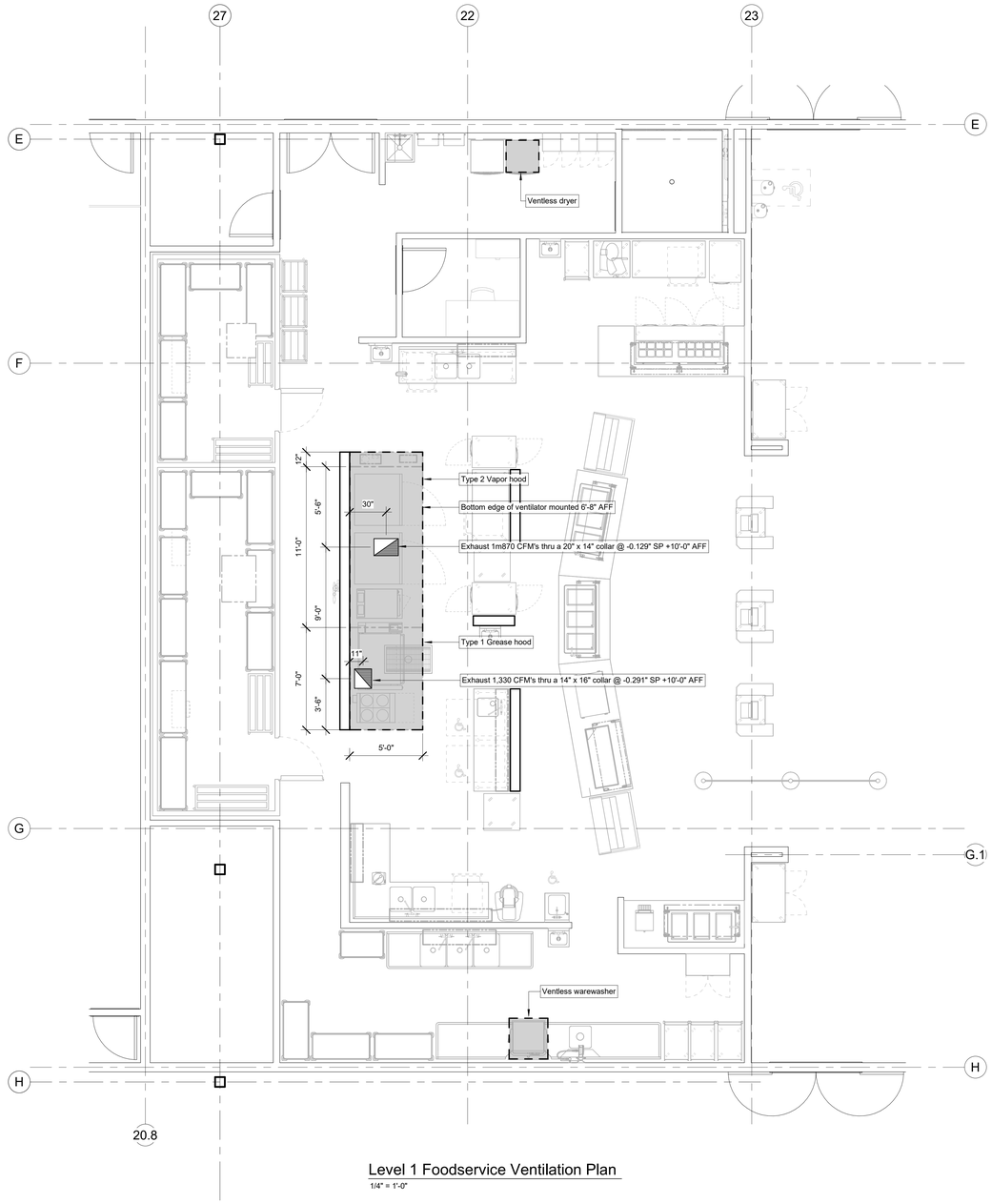

Level 1 Foodservice Ventilation Plan

1/4" = 1'-0"

Abbreviations used:

A	Amperes	DR	Duplex receptacle	IW	Indirect Waste
AFF	Above finished floor	EC	Electrical contractor	KEC	Kitchen Equip. Contractor
ATC	Automatic Temp. Controls Contractor	EXH	Exhaust	KW	Kilowatt
		FD	Floor drain	MBTU	BTU per hour/1000
BFF	Below finished floor	FFD	Funnel floor drain	MC	Mechanical Contractor
BMS	Building Management System	FHW	Fahrenheit hot water	MUA	Make-up air
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C&P	Cord & plug provided	GC	General Contractor	QD	Quick disconnect
CFM	Cubic feet per minute	GI	Grease interceptor	SP	Static pressure (WG)
CR	Condensate return	HP	Horsepower	SR	Single receptacle
CW	Cold water	HW	Hot water	SS	Steam supply
DFA	Drop from above	H&CW	Hot & cold water	W	Waste (direct conn.)

VENTILATION NOTES

1) DIMENSIONS ON THIS PLAN ARE PROVIDED FOR DESIGN INTENT. IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO VERIFY AND COORDINATE ALL DIMENSIONS AND HEIGHTS LISTED IN THE FIELD WITH THE EQUIPMENT BEING PROVIDED.

2) EXHAUST HOODS MUST BE HUNG AND MOUNTED WITH THE BOTTOM OF THE HOOD AT 6'-8" ABOVE FINISH FLOOR. HVAC CONTRACTOR IS RESPONSIBLE FOR FINAL CONNECTIONS FROM THE EXHAUST HOOD COLLAR TO THE DUCTWORK. FINAL CONNECTIONS SHALL BE FULLY WELDED AND LIQUID TIGHT.

3) HVAC CONTRACTOR TO PROVIDE AND INSTALL ALL FANS, DUCTWORK AND CURBS AS REQUIRED FOR A COMPLETE AND FUNCTIONING VENTILATION SYSTEM. START-UP AND AIR BALANCING OF THESE SYSTEMS MUST BE COMPLETED BY THE HVAC CONTRACTOR.

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PROFESSIONAL SEAL

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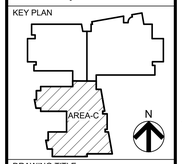
Project Status

KEY PLAN



DRAWING TITLE

FOODSERVICE VENTILATION PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	03/16/2026
DRAWN BY	WM
APPROVED BY	RM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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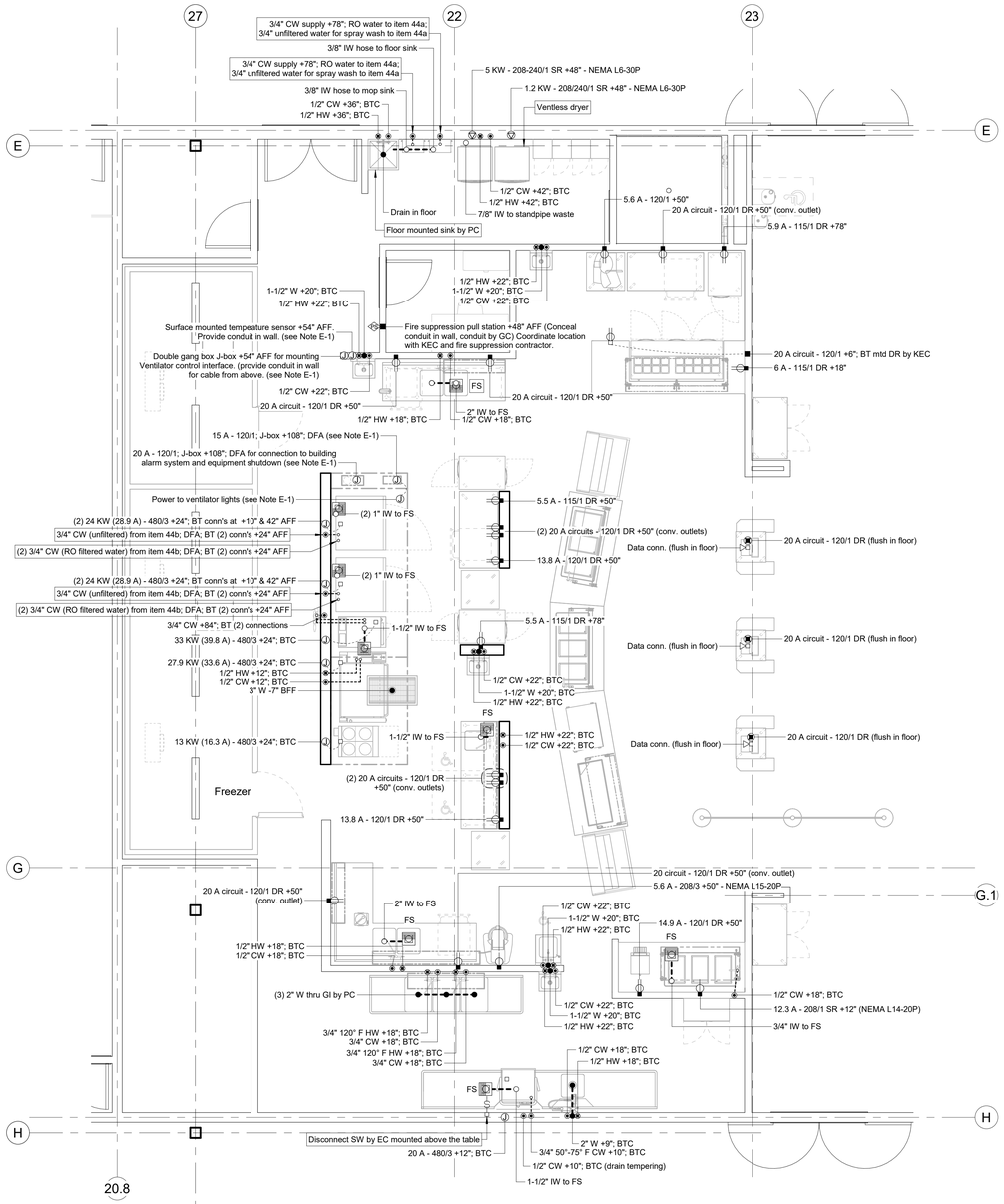
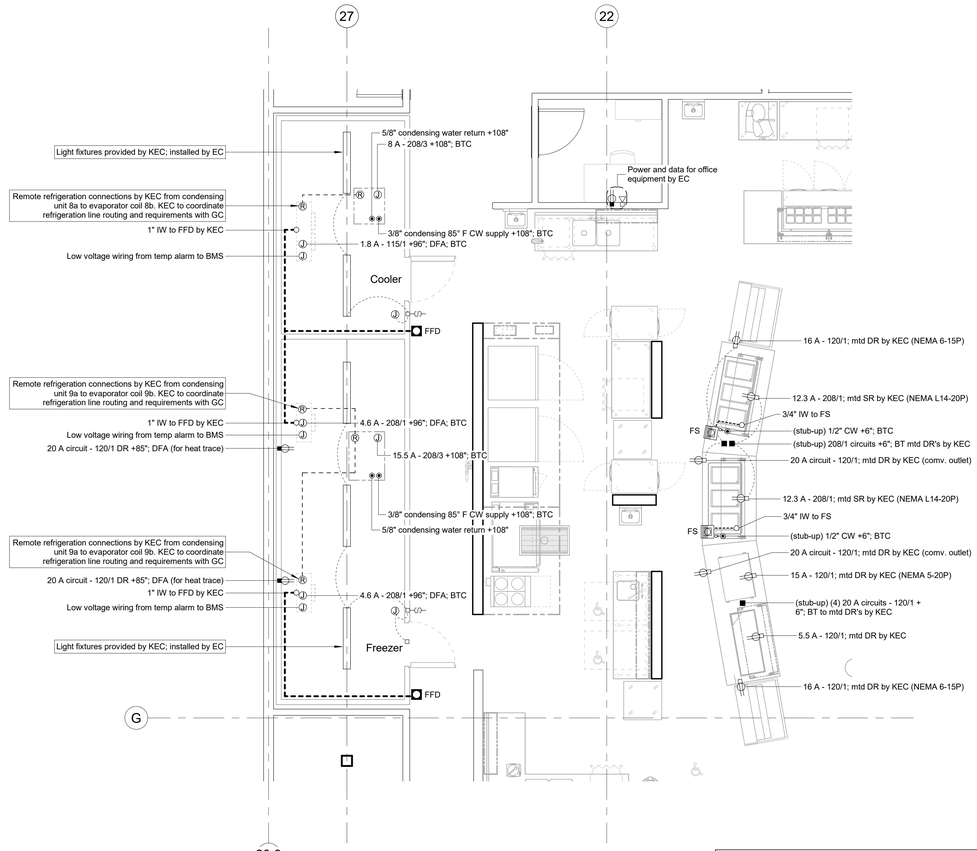


Level 1 Foodservice Utility Rough-in Plan

1/4" = 1'-0"



Level 1 Foodservice Utility Rough-in Plan (Detail Areas)

1/4" = 1'-0"

Note E-1

15 A circuit - 120/1 DFA for conn to ventilator control & hood lights at Item 38A.
Microswitch wiring from fire suppression system (Item 39);
EC to provide CAT5 connection to remote touch screen (Item 38B - cable supplied with system);
EC to provide high voltage conns from VFDs to EHX fan & MUA unit;
MC/ATC to provide wiring to temp sensors at hood;
MC/ATC to provide wiring to room temp sensors (Item 38C);
MC/ATC to provide wiring from building management system remote control

ELECTRICAL ROUGH-IN LEGEND

	DUPLEX RECEPTACLE
	DUPLEX RECEPTACLE (TABLE MOUNTED)
	SIMPLEX RECEPTACLE
	SIMPLEX RECEPTACLE (TABLE MOUNTED)
	SPECIAL PURPOSE RECEPTACLE
	FLOOR RECEPTACLE
	JUNCTION BOX
	DROP CORD
	ELECTRICAL CONDUIT
	FIELD CONNECTION
	SWITCH
	LIGHT FIXTURE
	FIRE PULL STATION
	FIELD WIRING

PLUMBING ROUGH-IN LEGEND

	HOT WATER
	COLD WATER
	WASTE - DIRECT CONNECTED
	WASTE - INDIRECT
	GAS
	AREA FD (SUGGESTED LOCATION)
	FLOOR DRAIN
	FUNNEL FLOOR DRAIN
	FLOOR SINK
	FLOOR SINK (3/4 GRATE)
	FLOOR SINK (1/2 GRATE)
	FIELD CONNECTION
	FIELD PIPING (WASTE)
	FIELD PIPING (WATER)

ELECTRICAL NOTES

1) DIMENSIONS ON THIS PLAN ARE PROVIDED FOR DESIGN INTENT. IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO VERIFY AND COORDINATE ALL DIMENSIONS AND HEIGHTS LISTED IN THE FIELD WITH THE EQUIPMENT BEING PROVIDED.
2) ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ALL FINAL CONNECTIONS TO EQUIPMENT THAT REQUIRES A BRANCH TO CONNECTION (BTC), OR WHERE INTER-WIRING IS INDICATED ON THE PLAN IN A DASHED LINE.
3) ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR REVIEWING ALL MANUFACTURER'S SHOP DRAWINGS AND EQUIPMENT CUT SHEETS SUBMITTED TO CONFIRM SCOPE REQUIREMENTS AND EXPECTATIONS.
4) ELECTRICAL PANELS PROVIDED SHALL BE DESIGNED WITH A MINIMUM OF 20% SPARE CAPACITY FOR FUTURE EXPANSION UNLESS OTHERWISE APPROVED BY THE OWNER.
5) ELECTRICAL CONTRACTOR TO INSTALL DROP CORDS AS LOCATED ON PLANS WITH THE CORD ADJUSTED TO HANG 78" ABOVE FINISH FLOOR. PLASTIC WIRE TIES ARE NOT ACCEPTABLE FOR THIS WORK. DROP CORDS MUST BE PROVIDED WITH STRAIN RELIEF.
6) ELECTRICAL CONNECTIONS ON THIS PLAN ARE PROVIDED AS IT RELATES SPECIFICALLY TO FOOD SERVICE EQUIPMENT. CONVENIENCE OUTLETS ARE PROVIDED IN SPECIFIC LOCATIONS AS REQUESTED BY OWNER. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO PROVIDE AND INSTALL ANY OTHER ELECTRICAL OUTLETS AS REQUIRED TO MEET CODE REQUIREMENTS BY LOCAL AUTHORITY HAVING JURISDICTION.
7) WALK-IN REFRIGERATED ROOM LIGHT FIXTURES ARE TO BE PROVIDED BY THE KITCHEN EQUIPMENT CONTRACTOR. LIGHTS ARE TO BE MOUNTED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.
8) IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO CONFIRM WITH THE WALK-IN REFRIGERATED ROOM MANUFACTURER THAT THE QUANTITY AND LOCATIONS OF THE LIGHTING LAYOUT WILL MEET 20 FOOT CANDLES OF LIGHT AT A DISTANCE OF 30" ABOVE FINISH FLOOR AS REQUIRED IN WALK-IN REFRIGERATED ROOMS BY THE NATIONAL FOOD CODE.
9) DRAIN PIPING WITHIN A WALK-IN FREEZER SHALL BE PROVIDED WITH A DRAIN LINE HEATER AND INSULATION. FINAL CONNECTION OF THE DRAIN LINE HEATER MUST BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
10) ELECTRICAL CONTRACTOR TO INSTALL UTILITIES CONCEALED IN WALLS AND STUB-OUT AT TERMINATION POINTS.
11) ELECTRICAL CONTRACTOR TO PROVIDE AND INSTALL WIRING BETWEEN EXHAUST VENTILATORS, AND ASSOCIATED FAN SYSTEMS, CONTROL PANELS, MAGNETIC STARTERS, FIRE SUPPRESSION SYSTEMS, PULL STATIONS AND SWITCHES AS REQUIRED.
12) CONTROL AND POWER WIRING BETWEEN CONTROL PANELS AND GARBAGE DISPOSALS, WASTE PULPERS, TROUGH COLLECTORS ETC. ARE TO BE PROVIDED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.
13) ELECTRICAL CONTRACTOR MUST PROVIDE ELECTRICAL POWER TO ANY COOKING EQUIPMENT THROUGH A SHUNT TRIP SYSTEM.
14) FOOD PREPARATION AREAS MUST BE PROVIDED WITH 50 FOOT CANDLES OF LIGHTING AS REQUIRED BY THE NATIONAL FOOD CODE.
15) ELECTRICAL CONTRACTOR MUST VERIFY REMOTE FIRE SUPPRESSION PULL STATION LOCATIONS WITH THE LOCAL FIRE INSPECTOR PRIOR TO INSTALLATION.
16) FOODSERVICE EQUIPMENT CAN NOT BLOCK ACCESS TO GFI RECEPTACLES. CRABTREE-MCGRATH ASSOCIATES STRONGLY RECOMMENDS THAT THE ELECTRICAL CONTRACTOR PROVIDE GFI PROTECTION AT THE CIRCUIT BREAKER PANEL. THIS WILL ALSO LIMIT NUISANCE TRIPPING THAT IS COMMON WITH COMMERCIAL FOODSERVICE EQUIPMENT.

PLUMBING NOTES

1) DIMENSIONS ON THIS PLAN ARE PROVIDED FOR DESIGN INTENT. IT IS THE RESPONSIBILITY OF THE KITCHEN EQUIPMENT CONTRACTOR TO VERIFY AND COORDINATE ALL DIMENSIONS AND HEIGHTS LISTED IN THE FIELD WITH THE EQUIPMENT BEING PROVIDED.
2) PLUMBING CONTRACTOR IS RESPONSIBLE FOR ALL FINAL CONNECTIONS TO EQUIPMENT THAT REQUIRE A BRANCH TO CONNECTION (BTC), OR WHERE PLUMBING INTERCONNECTION IS INDICATED ON THE PLAN WITH A DASHED LINE.
3) PLUMBING CONTRACTOR IS RESPONSIBLE FOR REVIEWING ALL MANUFACTURER'S SHOP DRAWINGS AND EQUIPMENT CUT SHEETS SUBMITTED TO CONFIRM SCOPE REQUIREMENTS AND INSTALLATION EXPECTATIONS.
4) ALL FLOOR SINKS AND DRAINS MUST BE PROVIDED AND INSTALLED BY THE PLUMBING CONTRACTOR. AREA DRAINS, IF LOCATED LOCATED ON THESE PLANS, ARE TO BE CONSIDERED RECOMMENDED AREAS. IT IS THE RESPONSIBILITY OF THE PLUMBING CONTRACTOR TO CONFIRM QUANTITIES AND LOCATIONS OF AREA DRAINS WITH THE LOCAL AUTHORITY HAVING JURISDICTION.
5) FLOOR SINKS LOCATED UNDER COUNTERS WITH LIMITED ACCESSIBILITY MUST BE INSTALLED 50% EXPOSED AND EASILY ACCESSIBLE FOR CLEANING. IF A FLOOR SINK CAN NOT BE INSTALLED 50% EXPOSED, THE UNDER SHELF OF THE CABINET MUST BE FULLY REMOVABLE OR BE PROVIDED WITH AN ACCESS PANEL LARGE ENOUGH TO REMOVE THE DRAIN GRATE FOR CLEANING.
6) CONDENSATE DRAIN LINES FROM WALK-IN REFRIGERATED ROOM EVAPORATOR COILS SHALL BE INSTALLED BY THE KITCHEN EQUIPMENT CONTRACTOR. DRAIN LINES MUST BE COPPER AND INSTALLED 1" OFF THE WALLS WITH A MINIMUM PITCH OF 1/2" PER FOOT. KITCHEN EQUIPMENT CONTRACTOR TO PROVIDE AND INSTALL A COPPER UNION WITHIN 24" OF THE CONNECTION TO THE EVAPORATOR COIL. FOR INSTALLATION OF DRAIN LINES IN A FREEZER, THE DRAIN SHALL EXIT THE FREEZER AT THE EARLIEST DISTANCE POSSIBLE. DRAIN PENETRATIONS THROUGH THE WALK-IN REFRIGERATED ROOM WALL PANEL MUST BE APPROPRIATELY SEALED TO INCLUDE A VAPOR SEAL AND PROVIDED WITH CHROME ESCUTCHEON PLATES AT ALL EXPOSED POINTS WHERE PIPING PENETRATES THE WALL. DRAINS MUST BE "P" TRAPPED OUTSIDE OF THE REFRIGERATED ROOM WALL TO AVOID ENTRANCE OF WARM AIR AND TERMINATED 1" ABOVE THE FLOOR DRAIN OR AS REQUIRED BY LOCAL CODE.
7) PLUMBING CONTRACTOR TO INSTALL UTILITIES CONCEALED IN WALLS AND STUB-OUT AT TERMINATION POINTS.
8) PLUMBING CONTRACTOR IS RESPONSIBLE FOR INSTALLATION OF ALL DRAINS, FAUCETS, PIPING TRAPS, VALVES, SHUT-OFFS, GAUGES, WATER PRESSURE REDUCERS, REGULATORS AND BACKFLOW PREVENTION, ETC. AS REQUIRED BY LOCAL AUTHORITY HAVING JURISDICTION.
9) IT IS THE RESPONSIBILITY OF THE PLUMBING CONTRACTOR TO FLUSH ALL WATER LINES PRIOR TO FINAL CONNECTION TO FOODSERVICE EQUIPMENT.
10) THE PLUMBING CONTRACTOR IS RESPONSIBLE FOR LOCATION OF GREASE TRAPS AS REQUIRED BY LOCAL AUTHORITY HAVING JURISDICTION. GREASE TRAPS MUST BE LOCATED IN A MANNER THAT DOES NOT INTERFERE WITH FOODSERVICE EQUIPMENT LAYOUT.

Abbreviations used:

A	Amperes	DR	Duplex receptacle	IW	Indirect Waste
AFF	Above finished floor	EC	Electrical contractor	KEC	Kitchen Equip. Contractor
ATC	Automatic Temp. Controls Contractor	EXH	Exhaust	KW	Kilowatt
		FD	Floor drain	MBTU	BTU per hour/1000
BFF	Below finished floor	FFD	Funnel floor drain	MC	Mechanical Contractor
BMS	Building Management System	FHW	Fahrenheit hot water	MUA	Make-up air
		FS	Floor sink	NIC	Not In Contract
BTC	Branch to connection	G	Gas	PC	Plumbing Contractor
C&P	Cord & plug provided	GC	General Contractor	QD	Quick disconnect
CFM	Cubic feet per minute	GI	Grease interceptor	SP	Static pressure (WG)
CR	Condensate return	HP	Horsepower	SR	Single receptacle
CW	Cold water	HW	Hot water	SS	Steam supply
DFA	Drop from above	H&CW	Hot & cold water	W	Waste (direct conn.)

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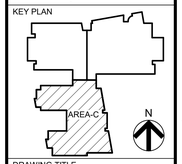
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

FOODSERVICE UTILITY ROUGH-IN PLANS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	03/16/2026
DRAWN BY	WM
APPROVED BY	RM

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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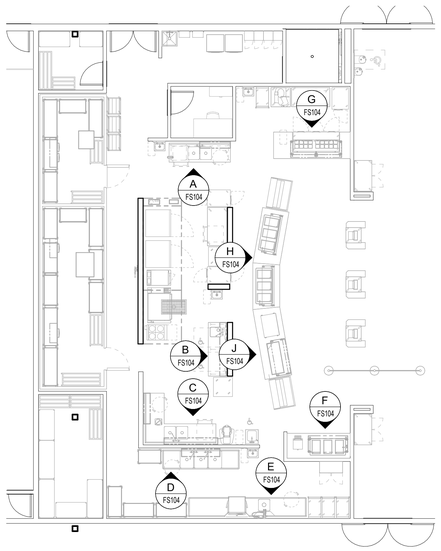

Level 1 Foodservice Equipment Key Plan
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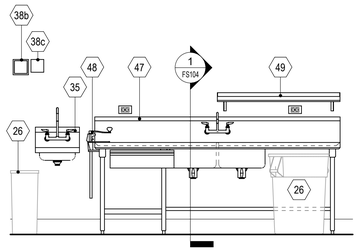
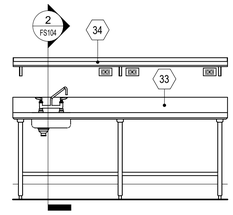
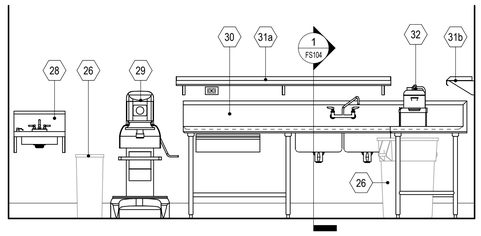


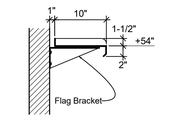
A FS104 Elevation - Prep Table with Sinks
1/2" = 1'-0"



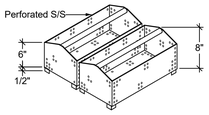
B FS104 Elevation - ADA Prep Table with Sink
1/2" = 1'-0"



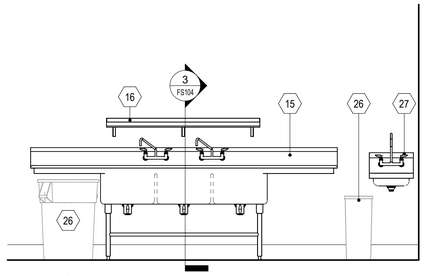
C FS104 Elevation - Corner Prep Table with Sinks
1/2" = 1'-0"



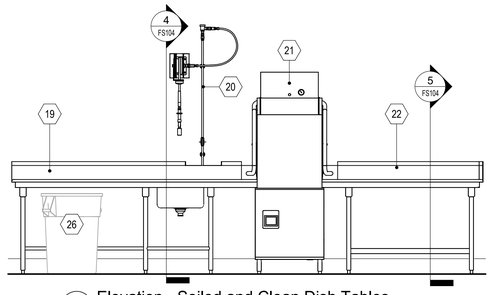
Section - Wall Shelf
1" = 1'-0"



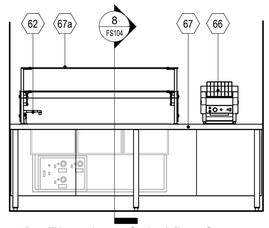
Detail - Scrap Baskets
1" = 1'-0"



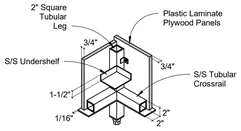
D FS104 Elevation - Three-Compartment Sink
1/2" = 1'-0"



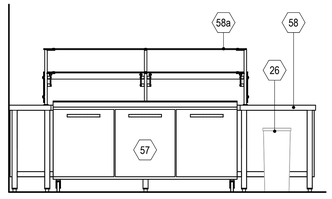
E FS104 Elevation - Soiled and Clean Dish Tables
1/2" = 1'-0"



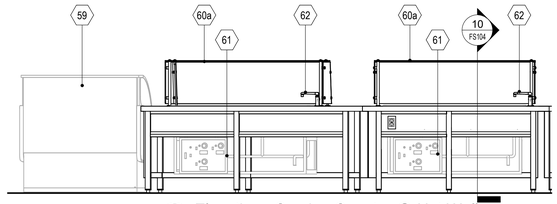
F FS104 Elevation - Salad Bar Counter
1/2" = 1'-0"



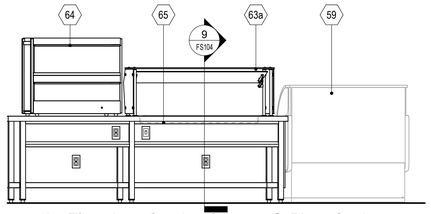
Detail - Serving Counter Corner
1" = 1'-0"



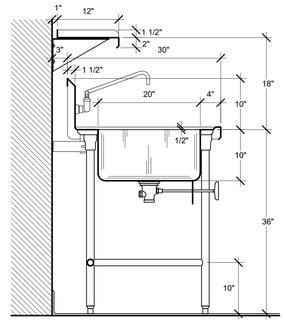
G FS104 Elevation - Deli Counter
1/2" = 1'-0"



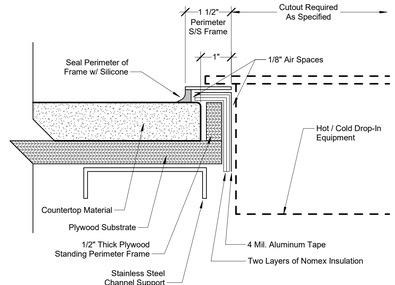
H FS104 Elevation - Serving Counter @ Hot Wells
1/2" = 1'-0"



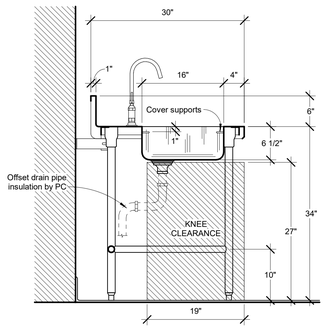
J FS104 Elevation - Serving Counter @ Pizza Station
1/2" = 1'-0"



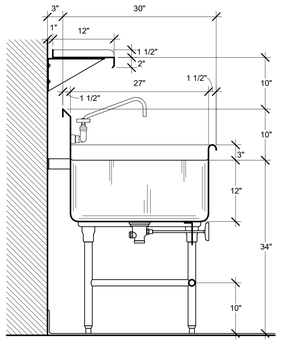
1 FS104 Section - Prep Table @ Sink
1" = 1'-0"



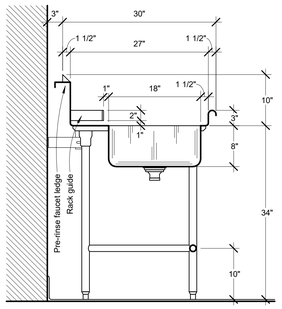
Detail - Counter Cutout Edge @ Drop-In Equipment
6" = 1'-0"



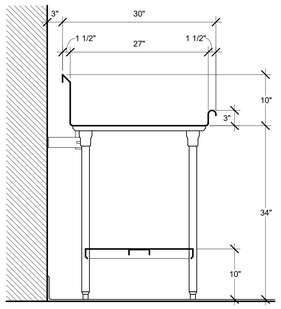
2 FS104 Section - Accessible Prep Station @ Sink
1" = 1'-0"



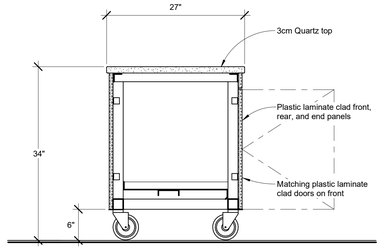
3 FS104 Section - Three-Compartment Sink
1" = 1'-0"



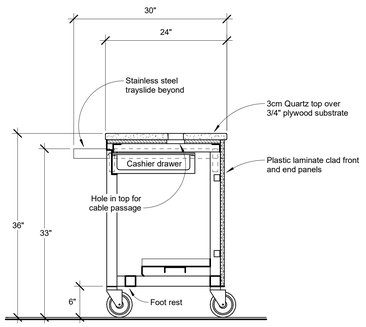
4 FS104 Section - Soiled Ware Table @ Scrap Sink
1" = 1'-0"



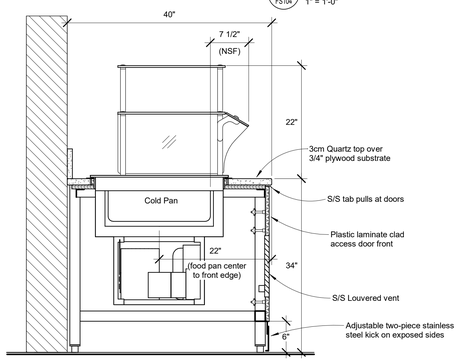
5 FS104 Section - Clean Ware Table
1" = 1'-0"



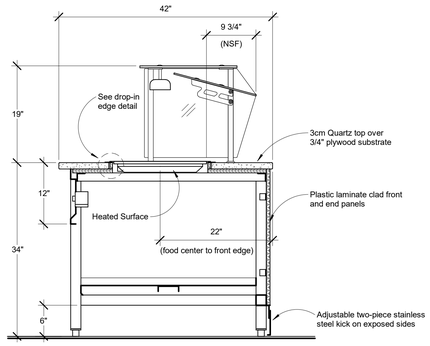
6 FS104 Section - Condiment Counter
1" = 1'-0"



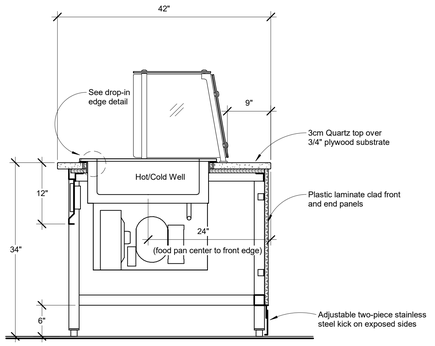
7 FS104 Section - Mobile Cashier Stand
1" = 1'-0"



8 FS104 Section - Salad Bar Counter @ Cold Pan
1" = 1'-0"



9 FS104 Section - Serving Counter @ Heated Surface
1" = 1'-0"



10 FS104 Section - Serving Counter @ Hot/Cold Well
1" = 1'-0"

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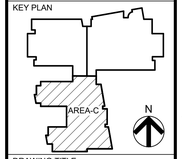
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

FOODSERVICE EQUIPMENT DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	03/16/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	09/18/2025	100% CD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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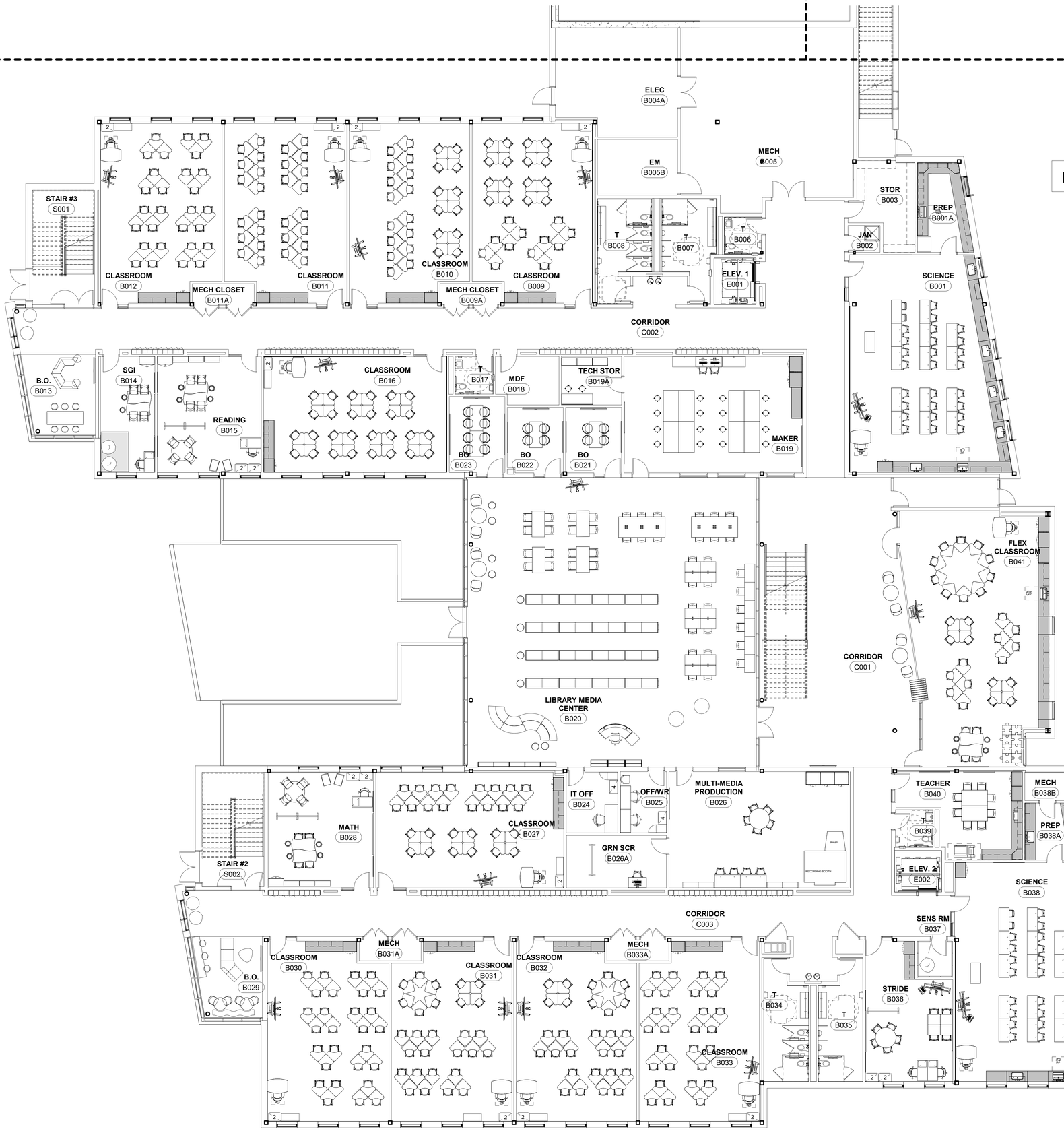

FOR REFERENCE ONLY

1 LOWER LEVEL FF&E

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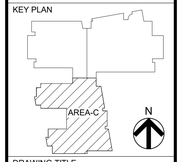
Project Status

KEY PLAN



DRAWING TITLE

LOWER LEVEL FF&E PLAN

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DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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5	05/19/2026	100% CD

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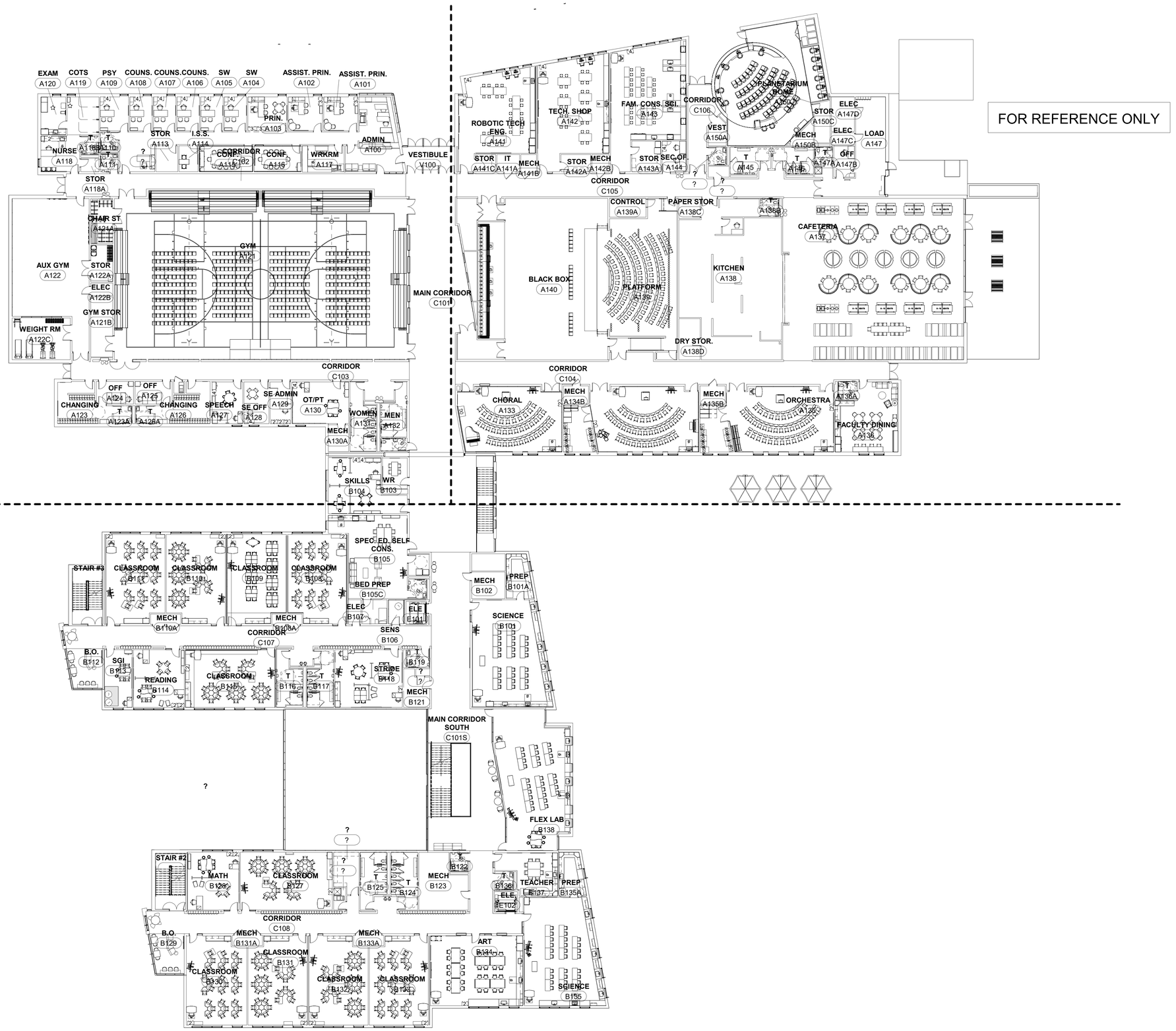

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1 MAIN LEVEL FF&E OVERALL

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TRUMBULL HILLCREST MIDDLE SCHOOL

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Project Status

KEY PLAN

DRAWING TITLE

MAIN LEVEL FF&E OVERALL PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	Issue Date
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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2	12/15/2025	DD Pricing Set
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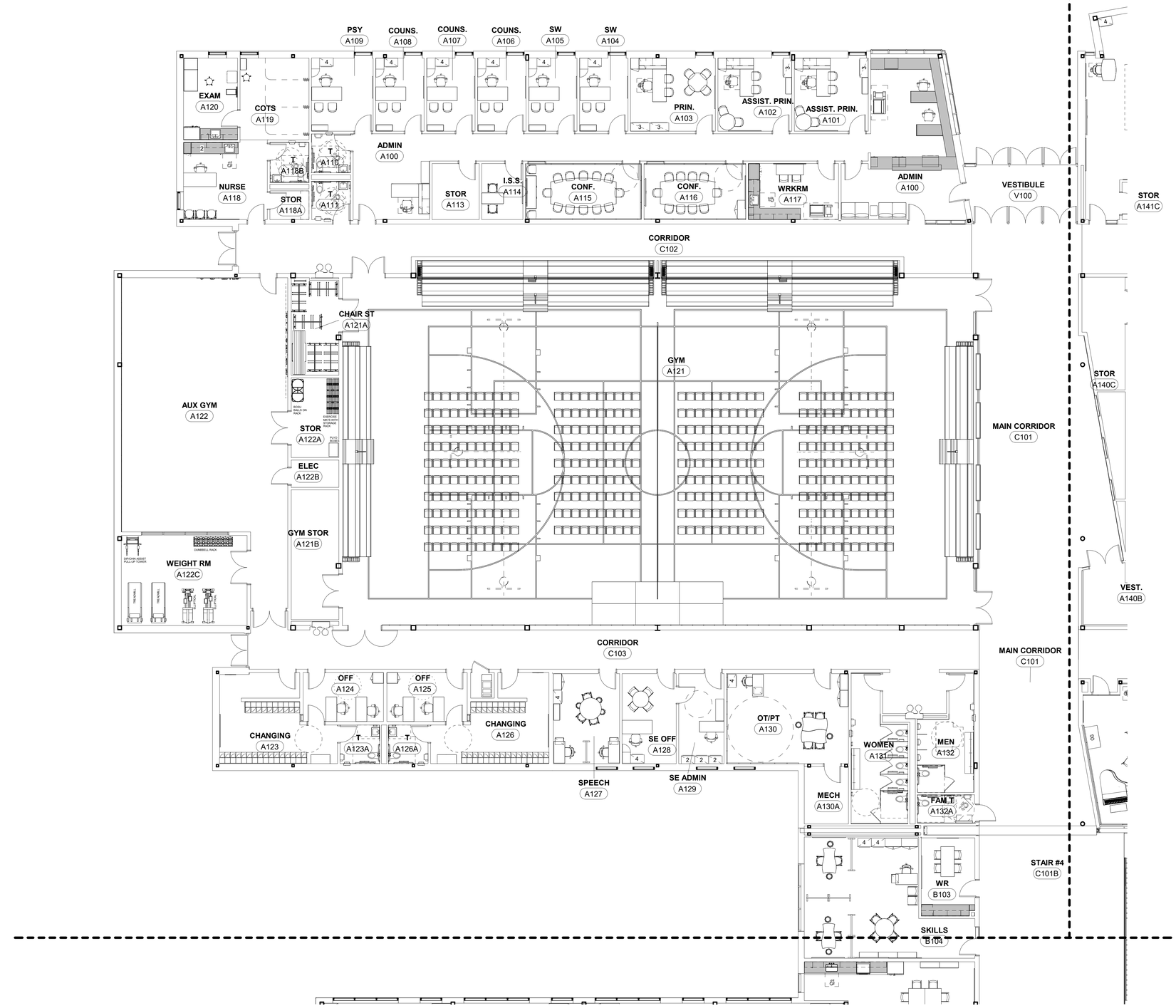

1 MAIN LEVEL FF&E - AREA A

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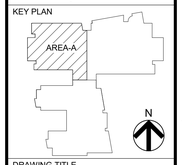
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN



DRAWING TITLE

MAIN LEVEL FF&E PLAN - AREA A

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OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	Issue Date
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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VESTIBULE V100
MAIN CORRIDOR C101
ROBOTIC TECH ENG. A141
TECH. SHOP A142
FAM. CONS. SCI. A143
STOR A141C
IT A141A
MECH A141B
STOR A142A
MECH A142B
STOR A143A
SEC.OF. A144
CORRIDOR C106
PLANETARIUM DOME A150
PLANETARIUM SEATING FOR 50
STOR A150D
STOR A150C
ELEC A147D
VEST A150A
MECH A150B
ELEC A147C
LOAD A147
T A148
T A145
T A446
T A147A
OFF A147B
JAN A149
CORRIDOR C105
VEST. A140A
BLACK BOX A140
CONTROL A139A
PAPER STOR A138C
OFFICE A138A
T A138B
STOR A140C
KITCHEN A138
SOFFIT ABOVE
TRASH SORTING STATION
6 - 10 SEATS
CAFETERIA A137
287 SEATS
PLATFORM A139
DRY STOR. A138D
VEST. A140B
MAIN CORRIDOR C101
CORRIDOR C104
CHORAL A133
MECH A134B
BAND A134
MECH A135B
ORCHESTRA A135
T A136A
FACULTY DINING A136
STOR. A134A
STOR. A135A
STAIR #4 C101B

1 MAIN LEVEL FF&E - AREA B

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TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

Project Status

KEY PLAN

AREA-B

N

DRAWING TITLE

MAIN LEVEL FF&E PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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SKILLS B104
STAIR #3 2
CLASSROOM B111
CLASSROOM B110
CLASSROOM B109
CLASSROOM B108
MECH B110A
MECH B108A
CORRIDOR C107
L B105A
SPEC. ED. SELF CONS. B105
T B105B
ELEC B107
BED PREP B105C
ELE E101
SENS B106
MECH B102
PREP B101A
SCIENCE B101
B.O. B112
SGI B113
READING B114
CLASSROOM B115
T B116
T B117
STRIDE B118
T B119
MECH B121
MAIN CORRIDOR SOUTH C101S
FLEX LAB B138
STAIR #2 3
MATH B128
CLASSROOM B127
STOR B126
T B125
T B124
MECH B123
T B122
TEACHER B137
T B136
PREP B135A
ELE E102
CORRIDOR C108
SCIENCE B135
CLASSROOM B130
MECH B131A
CLASSROOM B131
CLASSROOM B132
MECH B133A
CLASSROOM B133
ART B134
B.O. B129

1 MAIN LEVEL FF&E - AREA C

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530 Daniels Farm Road, Trumbull, CT 06611

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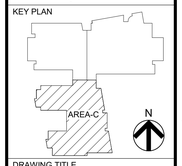
KEY PLAN



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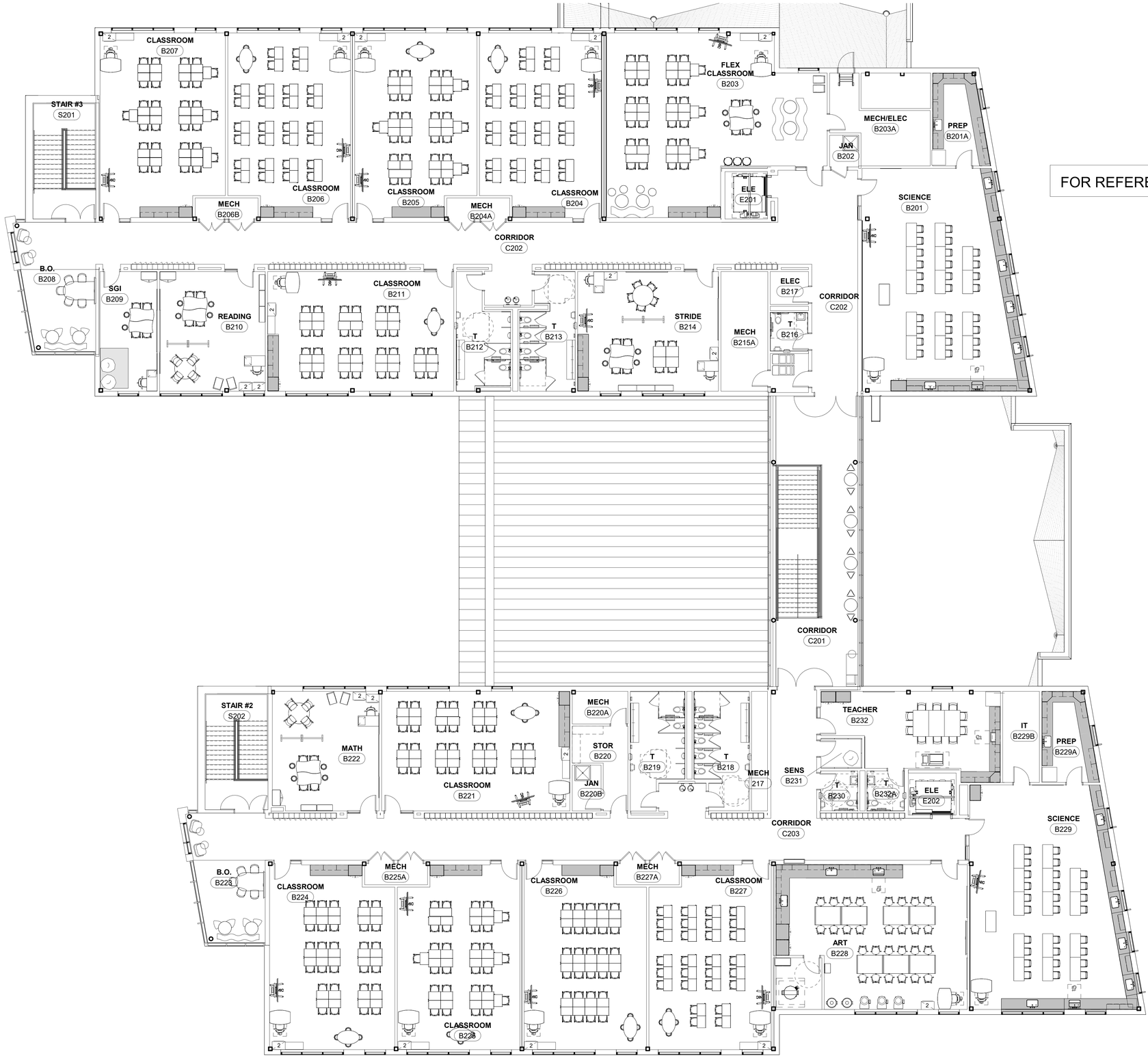

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1 UPPER LEVEL FF&E

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GENERAL

GOVERNING CODE: 2022 CONNECTICUT STATE BUILDING CODE, (2021 INTERNATIONAL BUILDING CODE).

DESIGN LOADS: CITY OF TRUMBULL

CONSTRUCTION LIVE LOADS: 20 PSF
PRE-COMPOSITE LOAD FOR CONCRETE PLACEMENT BY HOSE AND FINISHING. CONTRACTOR IS RESPONSIBLE FOR ANY SHORING REQUIRED OF THE DECK FOR HEAVIER LOADS DURING CONCRETE PLACEMENT.

MINIMUM LIVE LOADS:

OFFICES:		50 PSF + 15 PSF PARTITION
CORRIDORS:		1ST FLOOR: 100 PSF
		2ND FLOOR: 80 PSF
STAIRS:		100 PSF
PARTITIONS:		20 PSF
CLASSROOMS:		40 PSF
STORAGE:		125 PSF

ROOF LOAD:

ROOF SNOW LOAD CRITERIA:
Pg = 30 PSF
Ce = 0.9
Is = 1.1
Ct = 1.0
Pf = 23.1 PSF

WITH INCREASES FOR SNOW DRIFTING, UNBALANCES AND SLIDING PER SECTION 1608 (2021 IBC).

MINIMUM ROOF LIVE LOAD = 30 PSF

ROOF DEAD LOAD = 23 PSF (15 PSF +8 PSF PV PANEL)

WIND LOAD CRITERIA: SECTION 1609 (2021 IBC)
ULTIMATE WIND SPEED V_u = 130 MPH
NOMINAL DESIGN WIND V_{ASD} = 101 MPH
RISK CATEGORY III, Ie = 1.0
EXPOSURE CLASSIFICATION "C".

MINIMUM WIND LOAD ON PRIMARY STRUCTURE = 16 PSF

WIND LOADS ON SECONDARY ELEMENTS SHALL CONFORM WITH ASCE 7-16.

COMPONENT AND CLADDING DESIGN WIND PRESSURES:

ROOF ZONE 1:	POSITIVE: 28.16 PSF NEGATIVE: -85.99 PSF
ROOF ZONE 2e:	POSITIVE: 28.16 PSF NEGATIVE: -85.99 PSF
ROOF ZONE 2n:	POSITIVE: 28.16 PSF NEGATIVE: -125.31 PSF
ROOF ZONE 2r:	POSITIVE: 28.16 PSF NEGATIVE: -125.31 PSF
ROOF ZONE 3e:	POSITIVE: 28.16 PSF NEGATIVE: -125.31 PSF
ROOF ZONE 3r:	POSITIVE: 28.16 PSF NEGATIVE: -149.03 PSF
WALL ZONE 4:	POSITIVE: 46.52 PSF NEGATIVE: -50.50 PSF
WALL ZONE 5:	POSITIVE: 46.52 PSF NEGATIVE: -62.28 PSF
ROOF OVERHANG ZONE 1:	-98.84 PSF
ROOF OVERHANG ZONE 2:	-138.01 PSF
ROOF OVERHANG ZONE 3e:	-161.57 PSF
ROOF OVERHANG ZONE 3r:	-189.27 PSF

DESIGN WIND PRESSURE IS COMPUTED BASED ON ULTIMATE WIND SPEED USING 10 SQUARE FOOT OF AREA.

SEISMIC LOAD CRITERIA: AS PER SECTION 1613 (2021 IBC) WITH:
RISK CATEGORY = III
SEISMIC IMPORTANCE FACTOR, Ie = 1.25
Ss = 0.210g, S1 = 0.054g
SOIL SITE CLASS = C
SPECTRAL RESPONSE COEFFICIENTS, Sds = 0.182G, Sd1 = 0.054g
SEISMIC DESIGN CATEGORY: B
BASIC SEISMIC-FORCE-RESISTING SYSTEM: STEEL SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE
SEISMIC RESPONSE COEFFICIENT, Cs = 0.0659
DESIGN BASE SHEAR, V = Cs x W
RESPONSE MODIFICATION FACTOR, R = 3
ANALYSIS PROCEDURE USED: EQUIVALENT LATERAL FORCE PROCEDURE

ASSUMED BEARING PRESSURE ON UNDISTURBED SOIL: 4000 PSF
PREPARED SOIL PER GEOTECHNICAL REPORT OR GROUND IMPROVEMENT SYSTEM

1. SHOULD ANY OF THE DETAILED INSTRUCTIONS SHOWN ON THE PLANS CONFLICT WITH THE GENERAL STRUCTURAL NOTES, THE SPECIFICATIONS, OR WITH EACH OTHER, THE STRICTEST PROVISION SHALL GOVERN.
2. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO INSURE THE SAFETY OF THE BUILDING AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, SHEETING, TEMPORARY BRACING, GUYS OR TIEDOWNS WHICH MIGHT BE NECESSARY. SUCH MATERIAL SHALL REMAIN THE CONTRACTOR'S PROPERTY AFTER COMPLETION OF THE PROJECT.
3. THE STRUCTURE UTILIZES SHEAR WALLS TO PROVIDE LATERAL STABILITY. THEREFORE, TEMPORARY BRACING, GUYS, ETC. MUST BE MAINTAINED UNTIL ALL MASONRY SHEAR WALLS HAVE BEEN ERECTED AND ATTACHED TO STEEL FRAMING.
4. LOADS, OPENINGS AND STRUCTURE IN ANY WAY RELATED TO REQUIREMENTS OF OTHER (NON-STRUCTURAL) DISCIPLINES ARE SHOWN FOR BIDDING PURPOSES ONLY. THE CONTRACTOR SHALL OBTAIN FROM THE HEATING AND VENTILATING, ELECTRICAL, PLUMBING AND OTHER SUBCONTRACTORS THE FINAL APPROVED SIZE AND LOCATION OF ALL OPENINGS AND WORK TO BE PROVIDED FOR THEIR TRADE IN ROOFS, FLOORS AND WALLS, WHETHER SHOWN OR NOT SHOWN ON STRUCTURAL DRAWINGS. CONTRACTOR SHALL BE RESPONSIBLE FOR TRANSMISSION OF REQUIREMENTS, LOCATIONS AND DETAILS TO STRUCTURAL SUBCONTRACTORS. EXCESS COST RELATED TO VARIATION IN MECHANICAL REQUIREMENTS ARE NOT TO BE BORNE BY THE OWNER.
5. MECHANICAL EQUIPMENT WEIGHTS USED IN DESIGN OF SUPPORTING ELEMENTS HAVE BEEN INDICATED ON THE DRAWINGS. CONTRACTOR SHALL NOTIFY THE ARCHITECT PRIOR TO INSTALLATION IF ACTUAL WEIGHT EXCEEDS WEIGHT SHOWN ON DRAWINGS.
6. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO FOLLOW ALL APPLICABLE SAFETY CODES AND REGULATIONS DURING ALL PHASES OF CONSTRUCTION.
7. SHOP DRAWINGS ARE TO BE CHECKED BY THE CONTRACTOR AND SUBCONTRACTOR AND BEAR CHECKER'S INITIALS BEFORE BEING SUBMITTED TO THE ARCHITECT FOR APPROVAL.
8. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES AND EXISTING CONDITIONS BEFORE PROCEEDING WITH ANY WORK.
9. ALL SECTIONS AND DETAILS SHALL BE CONSIDERED TYPICAL AND APPLY FOR THE SAME AND SIMILAR SITUATIONS THROUGHOUT THE BUILDING, UNLESS OTHERWISE SPECIFICALLY NOTED.
10. CONTRACTOR SHALL REVIEW ALL ARCHITECTURAL AND STRUCTURAL DRAWINGS PRIOR TO SUBMITTING THEIR BID FOR REFERENCE TO ALL NOTES ON ARCHITECTURAL DRAWINGS REFERRING TO "SEE STRUCTURAL DRAWINGS". IF THE SIZE OF ELEMENTS AND DETAILING OF MEMBERS IS NOT INDICATED, THE CONTRACTOR SHALL CONTACT THE ARCHITECT TO REQUEST THE MISSING INFORMATION IN PREPARATION OF THEIR BID. THESE REFERENCED ITEMS SHALL BE PART OF THE BASE BID.
11. IN CASES OF DISCREPANCIES BETWEEN CONTRACT DOCUMENTS AND SUBMITTED SHOP DRAWINGS, THE CONTRACT DOCUMENTS SHALL GOVERN INSTALLATION OF MATERIALS.

CONTRACTOR'S DELEGATED DESIGN

1. CONTRACTOR SHALL RETAIN THE SERVICES OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF CONNECTICUT TO PERFORM THE DESIGN OF THE FOLLOWING:
   - A. STRUCTURAL STEEL CONNECTIONS, INCLUDING BRACING AND MOMENT FRAMES
   - B. COLD-FORMED METAL EXTERIOR WALL FRAMING
   - C. GLU-LAMINATED WOOD CONNECTIONS
   - D. STAIR STRINGER, RAILING AND LANDING DESIGN
   - E. MECHANICAL EQUIPMENT CURB ATTACHMENT TO STEEL FRAMING.
   - F. GYM EQUIPMENT AND THEIR CONNECTIONS
   - G. PIPE RAIL SYSTEM, PLANETARIUM DOME

   ALL CALCULATIONS SHALL BE SIGNED AND SEALED BY THE ENGINEER AND SUBMITTED FOR REVIEW.

FOUNDATIONS

1. BACKFILLING SHALL BE ACCOMPLISHED TO EQUAL HEIGHTS ON BOTH SIDES OF FOUNDATION WALLS TO PREVENT MOVEMENTS DUE TO UNBALANCED EARTH PRESSURE. WHERE EARTH IS ON ONE SIDE ONLY, BACKFILLING AND COMPACTION SHALL NOT START UNTIL FLOOR SLAB OR ADEQUATE BRACING IS PROVIDED FOR WALL SUPPORT (EXCEPT AT RETAINING WALLS).
2. ALL FOOTINGS ARE TO REST ON NATURALLY DEPOSITED, UNDISTURBED GLACIAL TILL; OR COMPACTED STRUCTURAL FILL OR CRUSHED STONE WRAPPED IN GEOTEXTILE FABRIC OVERLYING NATURALLY DEPOSITED, UNDISTURBED GLACIAL TILL, , AS DEFINED IN THE SPECIFICATIONS, OR CONTROLLED COMPACTED FILL, REGARDLESS OF ELEVATIONS SHOWN ON DRAWINGS. FOOTING BOTTOM ELEVATIONS SHALL NOT BE HIGHER THAN INDICATED ON THE FOUNDATION PLAN, NOR LESS THAN 3'-6" BELOW FINISH GRADES.
3. IF FILL MATERIALS ARE ENCOUNTERED AT FOOTING BEARING ELEVATIONS, ALL FILL MATERIAL SHALL BE EXCAVATED AND DISPOSED OF LEGALLY OFF-SITE. THE OVER EXCAVATION SHALL BE BACKFILLED WITH CONTROLLED COMPACTED FILL TO THE BOTTOM OF FOOTING ELEVATION AS REQUIRED.
4. ALL CONTROLLED COMPACTED BACKFILL UNDER FOOTINGS AND WITHIN THE FOOTPRINT OF THE STRUCTURE SHALL BE COMPACTED TO 95% OF THE MODIFIED OPTIMUM DENSITY.
5. BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE AT LEAST 3'-6" BELOW FINISHED GRADE. PRIOR TO PROCEEDING WITH FOOTING EXCAVATION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF FINISH GRADES AND BOTTOM OF EXTERIOR FOOTING ELEVATIONS TO MAINTAIN THE 3'-6" FROST PROTECTION.
6. ALL SOIL SURROUNDING AND UNDER ALL FOOTINGS SHALL BE PROTECTED FROM FREEZING AND FROST ACTION DURING THE COURSE OF CONSTRUCTION.
7. FOOTING BOTTOMS SHALL STEP AT THE RATE OF 1 UNIT VERTICAL TO 2 UNITS HORIZONTAL WITH A MAXIMUM VERTICAL STEP OF 2'-0".
8. WHERE SUBSURFACE PIPING PASSES THROUGH FOUNDATION WALLS, THE TOP OF THE FOOTINGS SHALL BE AT LEAST 8" BELOW THE INVERT ELEVATION OF THE PIPING AND CONDUITS. COORDINATE ALL INVERTS WITH MECHANICAL, PLUMBING, FIRE PROTECTION, ELECTRICAL, SITE AND SITE UTILITY DRAWINGS.
9. WHERE FOOTINGS ARE IN CLOSE PROXIMITY OF SUBSURFACE PIPING OR CONDUIT, BOTTOM OF FOOTINGS SHALL BE AT LEAST 8" BELOW INVERT ELEVATION OF PIPING OR CONDUITS.
10. KEEP FOUNDATION EXCAVATIONS FREE OF WATER AT ALL TIMES.
11. USE LEAN CONCRETE (fc=1500) OR CONTROLLED COMPACTED FILL FOR OVER-EXCAVATION OF FOOTINGS.
12. PLACEMENT OF ALL COMPACTED FILL MATERIALS MUST BE UNDER SUPERVISION OF AN APPROVED TESTING LABORATORY (SEE SPECIFICATIONS). CONCRETE FOUNDATIONS SHALL NOT BE PLACED UNTIL SUBGRADE HAS BEEN CHECKED IN PLACE AND APPROVED BY TESTING LABORATORY.
13. EXISTING ON-SITE EXCAVATED MATERIALS SHALL NOT BE ACCEPTABLE BACKFILL MATERIAL BELOW BUILDING FOUNDATIONS, SLABS ON GRADE, OR FOR BACKFILLING OF FOUNDATION WALLS, OR WITHIN 2 FEET OF PAVEMENT GRADES UNLESS APPROVED BY THE GEOTECHNICAL ENGINEER OF RECORD.
14. WHERE REQUIRED, CONSTRUCTION JOINTS SHALL BE KEYED AND OCCUR AT CONTROL JOINT INTERVALS. PROVIDE BENTONITE WATERSTOP FULL HEIGHT IN ALL WALL CONSTRUCTION JOINTS WHERE THERE IS A DIFFERENCE IN GRADE.
15. SEE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF BRICK OR CONCRETE MASONRY BLOCK SHELF ELEVATIONS IN THE FOUNDATION WALLS.
16. THE FOUNDATION DESIGN OF THE STRUCTURE HAS BEEN PREPARED BASED ON THE SOIL BORINGS, SOILS REPORT AND RECOMMENDATIONS PROVIDED BY THE GEOTECHNICAL ENGINEER, GZA GEOENVIRONMENTAL, INC., DATED JUNE 3, 2025. IT IS THE CONTRACTORS RESPONSIBILITY TO REVIEW THE MATERIAL PRIOR TO PREPARING HIS BID TO ASSURE HE UNDERSTANDS THE SOIL CONDITIONS AND THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER.
17. THE FOUNDATION DESIGN OF THE STRUCTURE HAS BEEN PREPARED BASED ON THE SITE GRADING PLAN PREPARED BY STANTEC CONSULTING SERVICES, INC., DATED OCTOBER 21, 2025. IT IS THE CONTRACTORS RESPONSIBILITY TO REVIEW THE DRAWING PRIOR TO PREPARING HIS BID TO ASSURE HE UNDERSTANDS THE SITE CONDITIONS AND THE REQUIREMENTS OF THE SITE ENGINEER.
18. FOUNDATION DESIGN SITE PREPARATION: THE FOUNDATION DESIGN AS INDICATED ON THE STRUCTURAL DRAWINGS HAS BEEN BASED ON THE FOLLOWING SITE PREPARATION. THE SITE HAS BEEN PREPARED BY THE EXCAVATION AND REMOVAL FROM THE SITE OF ALL EXISTING FILL AND CONTAMINATED SOILS. ALL FOUNDATIONS TO BEAR ON NATURALLY DEPOSITED, UNDISTURBED GLACIAL TILL; OR COMPACTED STRUCTURAL FILL OR CRUSHED STONE WRAPPED IN GEOTEXTILE FABRIC OVERLYING NATURALLY DEPOSITED, UNDISTURBED GLACIAL TILL THE FOUNDATION DESIGN IS BASED ON THE CONTROLLED BACKFILLING OF THE SITE EXCAVATION WITH CONTROLLED FILL COMPACTED TO AT LEAST 95% OF THE MODIFIED OPTIMUM DENSITY IN ACCORDANCE WITH ASTM D1557.
19. PROVIDE CONTINUOUS BENTONITE WATERSTOPS BETWEEN THE TOP OF FOOTING AND BOTTOM OF ALL WALLS WHERE THE SLAB ON GRADE IS BELOW THE FINISH GRADE. PLACE THE WATERSTOP WITH A MINIMUM OF 2" CLEAR FROM THE FACE OF WALL, OR PER THE MANUFACTURERS WRITTEN INSTALLATION INSTRUCTIONS. ATTACH WATERSTOP TO THE CONCRETE PER THE MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS.

SLAB ON GRADE

1. ALL SLABS ON GRADE SHALL BEAR ON A 15 MIL, CLASS A, VAPOR RETARDER OVER A MINIMUM OF 6 INCHES OF 3/4" COMPACTED PROCESSED AGGREGATE FILL, OVER A MINIMUM OF 6 INCHES OF COMPACTED CONTROLLED/STRUCTURAL FILL.

   ALL JOINTS OF THE VAPOR RETARDER SHALL BE SEALED WITH TAPE. TURN THE VAPOR BARRIER UP AT ALL TERMINATIONS AGAINST FOUNDATION WALLS AND SEAL JOINT BY CONTINUOUSLY TAPING.
2. IF FILL MATERIALS ARE ENCOUNTERED SLAB SUBGRADE ELEVATIONS, ALL FILL MATERIAL SHALL BE EXCAVATED AND DISPOSED OF LEGALLY OFF- SITE. THE OVER EXCAVATION SHALL BE BACKFILLED WITH CONTROLLED COMPACTED FILL TO THE BOTTOM OF THE SLAB SUBGRADE AS REQUIRED. ALL CONTROLLED COMPACTED BACKFILL UNDER SLABS WITHIN THE FOOTPRINT OF THE STRUCTURE SHALL BE COMPACTED TO 95% OF THE MODIFIED OPTIMUM DENSITY.
3. EXISTING ON-SITE EXCAVATED MATERIALS SHALL NOT BE ACCEPTABLE BACKFILL MATERIAL BELOW BUILDING SLABS ON GRADE UNLESS APPROVED BY THE GEOTECHNICAL ENGINEER OF RECORD.
4. CONTROL JOINTS ARE TO BE CREATED IN SLABS ON GRADE. JOINTS SHALL BE SAW CUT 1/8" WIDE AND TO A DEPTH EQUAL TO 1/4 OF THE SLAB THICKNESS. LOCATE JOINTS A MAXIMUM OF 12'-0" ON CENTER IN EACH DIRECTION, IN ADDITION TO THOSE LOCATIONS INDICATED ON PLAN.
5. CONSTRUCTION JOINTS AS REQUIRED SHALL BE KEYED AND DOWELED AND LOCATED AT INTERVALS OF A MAXIMUM OF 75 FEET ON CENTER.
6. SEE ARCHITECTURAL DRAWINGS FOR LOCATION AND SIZE OF DEPRESSED AREAS IN CONCRETE SLABS AND FOR CONCRETE PADS. MAINTAIN FULL SLAB THICKNESS IN DEPRESSED AREAS, UNLESS OTHERWISE SHOWN.
7. SEE ARCHITECTURAL DRAWINGS FOR LOCATION OF ALL MASONRY WALLS FOR WHICH NO FOOTING IS SHOWN. SEE DETAILS FOR SLAB REINFORCING REQUIREMENTS AT ALL WALL LOCATIONS.
8. CONTRACTOR SHALL CONSOLIDATE ALL SLAB CONCRETE USING VIBRATIONAL METHODS IN CONFORMANCE WITH ACI 309, AGUIDE FOR CONSOLIDATION OF CONCRETE.
9. ALL CONDUIT AND PIPING ARE TO BE PLACED BELOW THE SLAB VAPOR BARRIER, ANY STUB-UPS SHOULD BE TAPED WITH APPROVED TAPE.

CONCRETE

MATERIALS:

CONCRETE SHALL MEET THE REQUIREMENTS OF THE EXPOSURE CATEGORY LISTED BELOW PER ACI 318 CHAPTER 19, AND SHALL HAVE THE MAXIMUM WATER TO CEMENT RATIO, TARGET AIR CONTENT AND DEVELOP STRENGTH IN 28 DAYS AS FOLLOWS:

LOCATION	EXPOSURE CATEGORY	STRENGTH (PSI)	MAXIMUM WATER TO CEMENT RATIO	TARGET AIR CONTENT
FOUNDATIONS	F2	4500	0.45	6%
SLABS ON GRADE	F0	3500	N/A	N/A
SLABS ON METAL DECK	F0	4000 LW	N/A	N/A

* INCLUDES ANY EXTERIOR CONCRETE PADS, SLABS, ETC. NOTED ON THE STRUCTURAL DRAWINGS. REFER TO SITE CONCRETE SPECIFICATIONS FOR ALL OTHER EXTERIOR CONCRETE REQUIREMENTS.

1. ALL DETAILING, FABRICATION AND ERECTION OF REINFORCING BARS MUST FOLLOW ACI 318-14.
2. CONTRACTOR IS RESPONSIBLE FOR FOLLOWING ACI GUIDELINES FOR HOT AND COLD WEATHER CONCRETE AND SHALL SUBMIT PROCEDURES FOR RECORD PRIOR TO COMMENCING WORK.
3. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
4. NO TACK WELDING OF REINFORCING WILL BE PERMITTED.
5. UNLESS NOTED OTHERWISE, ALL LAP SPLICES SHALL BE CLASS B, IN ACCORDANCE WITH ACI 318-14.
6. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A-185.
7. WIRE MESH REINFORCEMENT MUST LAP ONE MESH SIZE AT SIDES AND ENDS AND BE WIRED TOGETHER.
8. WELDED WIRE FABRIC SIDE LAPS SHALL BE STAGGERED TO AVOID FOUR MESH THICKNESS AT COINCIDING END LAP AND SIDE LAP LOCATION.
9. NO CALCIUM CHLORIDE OR ADMIXTURES CONTAINING MORE THAN 0.1% CHLORIDE BY WEIGHT OF ADMIXTURE SHALL BE USED IN THE CONCRETE.
10. BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE AT LEAST 3'-6" BELOW FINISHED GRADE. PRIOR TO PROCEEDING WITH FOOTING FORMWORK, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF BOTTOM OF EXTERIOR FOOTING ELEVATIONS WITH THE FINISH GRADES AND MAINTAINING THE 3'-6" FROST PROTECTION. WHERE SUBSURFACE PIPING PASSES THROUGH FOUNDATION WALLS, THE TOP OF FOOTINGS SHALL BE AT LEAST 8' BELOW THE INVERT ELEVATION OF THE PIPING AND CONDUITS. COORDINATE ALL INVERTS WITH MECHANICAL, PLUMBING, FIRE PROTECTION, ELECTRICAL, SITE AND SITE UTILITY DRAWINGS. PIPING OR CONDUITS SHALL NOT PASS THROUGH COLUMNS OR PIERS.
11. CONTRACTOR SHALL ANTICIPATE DEFLECTION OF STEEL MEMBERS AT SUPPORTED ELEVATED SLABS OF 1 INCH MAXIMUM, AND PROVIDE ADDITIONAL CONCRETE AS REQUIRED.
12. ALL HORIZONTAL STEEL SHOWN IN SECTIONS AND DETAILS SHALL BE CONTINUOUS, UNLESS OTHERWISE NOTED. ALL LAPS SHALL BE CLASS A@@ SPLICES IN ACCORDANCE WITH ACI 318.
13. AT INTERSECTIONS OF REINFORCED CONCRETE WALLS, PROVIDE CORNER DOWELS OF SAME SIZE AND AT THE SAME SPACING AS THE SMALLER HORIZONTAL REINFORCING. DOWELS SHALL HAVE A CLASS B LAP WITH HORIZONTAL REINFORCING IN EACH DIRECTION.
14. PROVIDE DRILLED AND EPOXIED DOWELS OF SAME SIZE TO MATCH NEW REINFORCING WHERE NEW CONSTRUCTION ABUTS EXISTING CONCRETE CONSTRUCTION. LENGTH SHALL BE THE REQUIRED EMBEDMENT DEPTH PER THE ANCHOR BOLT/EPOXY MANUFACTURER PLUS A CLASS B LAP SPLICE FOR THE SIZE OF BAR.
15. PROVIDE CORROSION RESISTANT ACCESSORIES IN ALL EXPOSED CONSTRUCTION.
16. ALL KEYS IN CONCRETE WALLS SHALL BE 2 X 4 UNLESS NOTED OTHERWISE.
17. CONCRETE PIERS: PLACE CONCRETE PIERS AND WALLS TOGETHER. SET PIER REINFORCING AND SET WALL REINFORCING THROUGH PIER VERTICAL BARS. PROVIDE DOWELS WITH STANDARD HOOK FROM FOOTING AT ALL PIERS. SIZE AND QUANTITY OF DOWELS TO MATCH VERTICAL PIER REINFORCING, PROVIDE CLASS "B" SPLICE.
18. SEE ARCHITECTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION, ELECTRICAL, SITE, SITE UTILITY AND EQUIPMENT DRAWINGS FOR CONCRETE PADS, SLEEVES, OPENINGS, RECESSES, AND BUILT-IN WORK IN CONCRETE ELEMENTS.
19. THE CONTRACTOR SHALL FURNISH, LOCATE AND INSTALL ALL ACCESSORIES FOR PROPER ANCHORAGE OF WOOD AND METAL FRAMING, WOOD BLOCKING, BRICK WORK AND MASONRY UNITS. HE SHALL BE SOLELY RESPONSIBLE FOR FURNISHING, LOCATING AND ENSURING PROPER QUANTITY OF ALL FASTENING DEVICES.
20. ALL CONCRETE TO REMAIN EXPOSED TO VIEW SHALL RECEIVE A SMOOTH RUBBED FINISH (SEE SPECIFICATIONS).
21. ALL CONCRETE CORNERS WITH BOTH SIDES EXPOSED TO VIEW SHALL BE SQUARE UNLESS OTHERWISE SHOWN OR NOTED. THE EDGE SHALL BE RUBBED, PRODUCING A SMOOTH, DENSE SURFACE WITHOUT PITS OR IRREGULARITIES.
22. PROVIDE CONTINUOUS VERTICAL DOVETAIL SLOTS AT 16 INCH CENTERS HORIZONTALLY FOR ALL CONCRETE WALLS ABUTTING A MASONRY WALL OR MASONRY VENEER, UNLESS OTHERWISE NOTED.
23. PROVIDE CLEARANCE FROM EDGE OF REINFORCING TO EDGE OF CONCRETE AS FOLLOWS:

FOOTINGS (AGAINST EARTH)	3"
BEAMS (LONGITUDINAL REINFORCING)	2"
COLUMNS AND PIERS (VERTICAL REINFORCING)	2"
WALLS, EXTERIOR FACE (#5 AND SMALLER)	1 1/2"
WALLS, EXTERIOR FACE (#6 AND LARGER)	2"
SLABS (INTERIOR)	3/4"
SLABS (EXTERIOR)	1 1/2"
SLABS ON GRADE (W.W.F.)	1/3 X THK, FROM TOP SURFACE

24. PROVIDE 2 -#4 BARS IN TOP OF ALL CONCRETE BEAMS WITH STIRRUPS THAT DO NOT HAVE ANY OTHER TOP STEEL SPECIFIED.
25. NO SLEEVES, HOLES OR INSERTS SHALL BE PLACED IN SLABS WITHIN 2'-0" OF THE EDGE OF COLUMNS, OR ANYWHERE IN BEAMS, COLUMNS OR JOISTS WITHOUT APPROVAL OF THE ARCHITECT.
26. PROVIDE LENGTH OF BEARING ON MASONRY WALLS AS FOLLOWS, UNLESS NOTED OTHERWISE:

REINFORCED CONCRETE BEAMS:	8 INCHES
SOLID CONCRETE SLABS:	4 INCHES

27. CONCRETE COLUMNS SHALL BE PLACED AT LEAST TWO HOURS IN ADVANCE OF BEAMS, JOISTS AND SLABS.
28. JOINTS NOT INDICATED ON THE DRAWINGS SHALL BE MADE SO AS TO LEAST IMPAIR THE STRENGTH OF THE STRUCTURE. THERE SHALL BE NO HORIZONTAL JOINTS IN BEAMS OR SUSPENDED SLABS.
29. PROVIDE THE FOLLOWING AT OPENINGS IN ALL CONCRETE WALLS AND FRAMED SLABS, UNLESS OTHERWISE INDICATED:

    1 -#5 AT EACH FACE ON EACH SIDE OF OPENING, EXTENDING 2'-0" BEYOND OPENING.

    1 -#5 X 4'-0" LONG AT EACH FACE DIAGONALLY AT EACH CORNER.
30. REINFORCING STEEL SHOP DRAWINGS SHALL INDICATE THE SEQUENCE IN WHICH LAYERS OF CROSSING REINFORCING SHOULD BE PLACED, IN ORDER TO PRODUCE THE CORRECT OUTERMOST LAYER AS INDICATED ON THE DRAWINGS.
31. SHOP DRAWINGS SHALL INDICATE LOCATIONS OF ALL WALL CONTROL AND CONSTRUCTION JOINTS.
32. ALL REINFORCING, THREADED RODS OR BOLTS INDICATED TO BE DRILLED AND EPOXIED SHALL UTILIZE HILTI HIT-HY200 ADHESIVE OR APPROVED EQUAL.

STRUCTURAL STEEL

MATERIALS:

STRUCTURAL STEEL	ASTM A 36
ALL W SHAPES	ASTM A 992, GR.50
STRUCTURAL STEEL TUBING	ASTM A500, GRADE C
STRUCTURAL STEEL PIPE	ASTM A53, GRADE B
BOLTS	ASTM A325
ANCHOR BOLTS	ASTM F1554, GRADE 36
WELDING ELECTRODE	ASTM E 70
WELDABLE REBAR	ASTM A706, GRADE 60

1. DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO AMERICAN INSTITUTE OF STEEL CONSTRUCTION SPECIFICATION, AISC 360-10. ALL REACTIONS SHOWN ON PLAN HAVE BEEN DEVELOPED USING ALLOWABLE STRESS DESIGN.
2. WELDING SHALL CONFORM TO THE CODE FOR "ARC AND GAS WELDING IN BUILDING CONSTRUCTION" OF THE AMERICAN WELDING SOCIETY. ALL WELDING SHALL BE DONE BY A CERTIFIED WELDER.
3. ALL LOOSE BEAM LINTELS SHALL HAVE 8" MINIMUM BEARING. SEE ARCHITECTURAL JAMB DETAILS FOR LENGTHS.
4. FOR MISCELLANEOUS STEEL NOT SPECIFICALLY DETAILED ON STRUCTURAL DRAWINGS, REFER TO ARCHITECTURAL DRAWINGS.
5. PROVIDE LEVELING NUTS FOR ALL COLUMN BASE PLATES WITH FOUR (4) ANCHOR BOLTS AND PROVIDE 1 1/2" MINIMUM, 5000 PSI NON-SHRINK GROUT. PROVIDE TACK WELDED NUT AT THE BOTTOM OF THE ANCHOR BOLT EMBEDDED IN CONCRETE.
6. CONNECTIONS:

   CONNECTIONS SHALL BE DESIGNED BY THE FABRICATOR AND CONSTRUCTED IN ACCORDANCE WITH AISC 360-10. CONNECTIONS SHALL BE PROVIDED TO CONFORM TO THE REQUIREMENTS OF SIMPLE CONNECTIONS UNLESS OTHERWISE DETAILED.

   CONNECTIONS SHALL BE DESIGNED TO ACCOMMODATE THE REACTIONS SHOWN ON THE CONTRACT DOCUMENTS. IF NO REACTIONS ARE GIVEN THEN PROVIDE CONNECTION FOR ONE HALF THE ALLOWABLE UNIFORM LOAD BEAM TABLES, PER THE AISC MANUAL, FOR THE SPAN INDICATED ON THE DRAWINGS. MINIMUM CONNECTION DESIGN LOAD IS 6 KIPS.

   MINIMUM CONNECTION ANGLE THICKNESS SHALL BE 5/16". MINIMUM SHEAR PLATE IS 3/8".

   IN ADDITION TO PROVIDING ADEQUATE BOLTS TO ACCOMMODATE REACTIONS, THE FOLLOWING MINIMUM NUMBER OF BOLT ROWS SHALL BE USED:

MEMBER DEPTH	MINIMUM BOLT ROWS
10" or Less	2
12" to 14"	3
16" to 18"	4
21" to 24"	5
27" to 30"	6
Over 30"	7

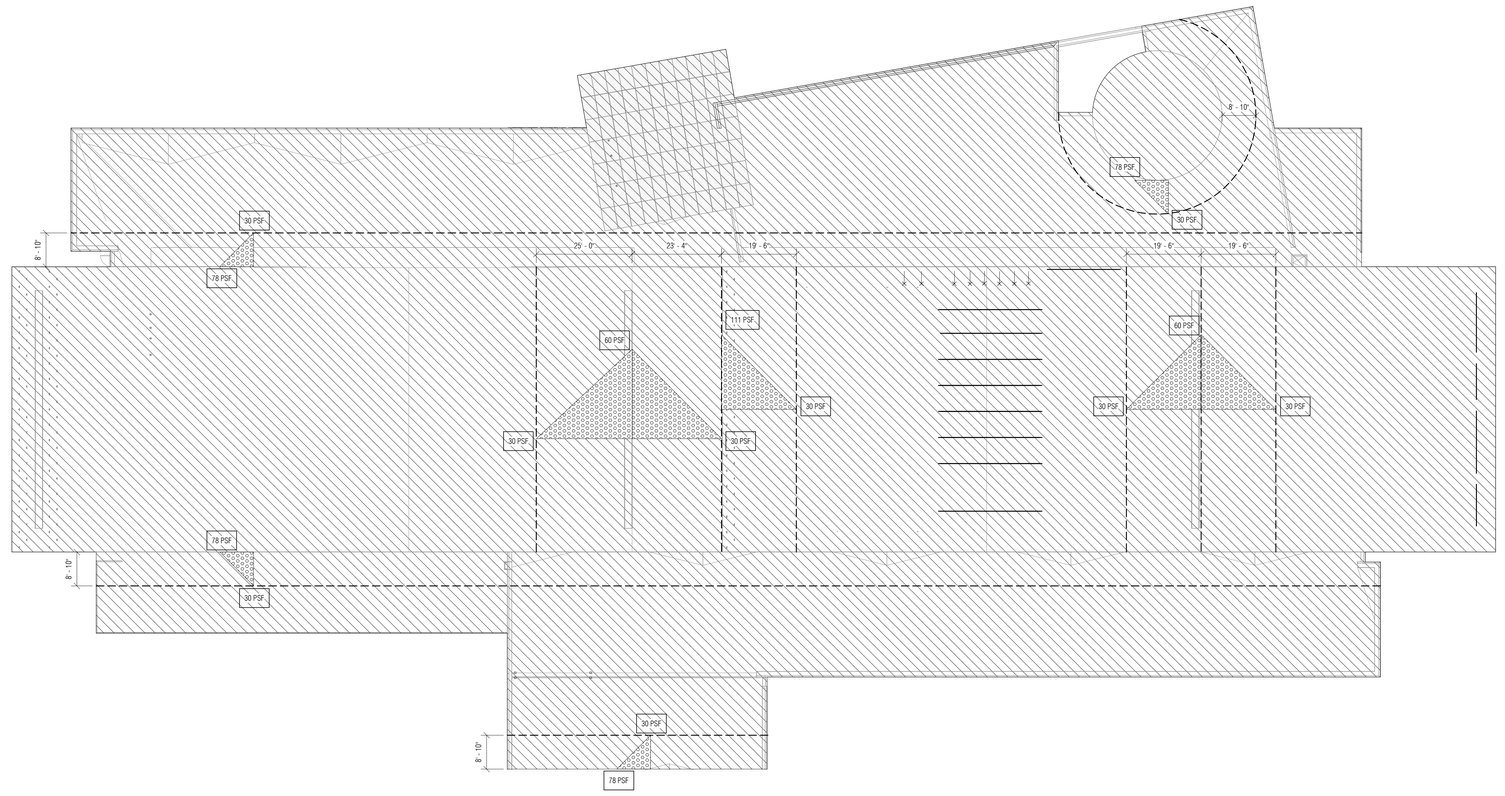
   CONNECTIONS SHALL BE MADE USING 3/4" DIAMETER ASTM A325 BOLTS (SNUG TIGHT OR SLIP CRITICAL) OR WELDS, UNLESS NOTED OTHERWISE. IF TENSION CONTROL BOLTS ARE USED, CONNECTIONS SHALL BE DESIGNED FOR SLIP CRITICAL BOLT ALLOWABLE LOAD VALUES USING CLASS A FAYING SURFACE.

   USE LARGER OF 1/4" FILLET WELDS OR MINIMUM SIZE PER AISC REQUIREMENTS WHERE NO WELD SIZE IS SHOWN ON DRAWINGS.

   WELDS IN EXCESS OF 24" IN LENGTH SHALL BE 3" STITCH WELDS AT 8" ON CENTERS, UNLESS SPECIFICALLY SHOWN ON DRAWINGS TO BE CONTINUOUS.

   MOMENT CONNECTIONS SHALL BE DESIGNED TO DEVELOP FULL MOMENT CAPACITY OF THE ELEMENTS CONNECTED, UNLESS SPECIFIC MOMENT IS INDICATED ON THE DRAWINGS.
7. NO WELDING OR FINAL BOLTING SHALL BE DONE UNTIL AS MUCH OF THE STRUCTURE THAT WILL BE STIFFENED THEREBY HAS BEEN PROPERLY ALIGNED.
8. SEQUENCE OF PLACING WELDS SHALL BE SUCH AS TO AVOID DISTORTION OF MEMBERS.
9. SUBSTITUTION OF STRUCTURAL STEEL MEMBERS IS PERMITTED TO FACILITATE DELIVERY AT NO ADDITIONAL COST TO THE OWNER. SUBSTITUTED MEMBERS MUST BE OF THE SAME NOMINAL DEPTH AS THE MEMBER ORIGINALLY INDICATED AND HAVE A WEIGHT GREATER THAN THAT INDICATED. BEAM FLANGES MUST NOT INFRINGE ON ADJACENT ARCHITECTURAL ELEMENTS.
10. ALL STRUCTURAL STEEL BEAMS AND COLUMNS ADJACENT TO MASONRY SHALL HAVE THE FOLLOWING MASONRY ANCHORAGE:

    16 GAGE GALVANIZED CHANNEL SLOTS (DUR-O-WAL, INC. D/A 901) WELDED TO COLUMNS AND BEAMS WITH 1/4" GALVANIZED STRAP ANCHORS (DUR-O-WAL, INC. D/A 914) SPACED 1'-4" O.C. AT COLUMNS AND 1'-4" AT BEAMS (UNLESS OTHERWISE NOTED). INSTALL PER MANUFACTURER'S SPECIFICATIONS.
12. PROVIDE DEFORMED BAR ANCHORS ON THE TOP OF ALL BEAMS SUPPORTING CONCRETE MASONRY UNIT WALLS OR MULTI-WYTHE BRICK WALLS. THE ANCHORS SHALL BE WELDED AT 24" ON CENTER AND SHALL BE THE SAME SIZE AS THE WALL REINFORCING. DEFORMED BAR ANCHORS SHALL BE PLACED BY A TIMED STUD WELDING MACHINE.
13. STEEL MEMBERS SHOWN CONNECTED TO MASONRY WITH EXPANSION ANCHORS SHALL HAVE 3/4" DIAMETER EXPANSION ANCHORS AT 2'-8" ON CENTERS IN VERTICALLY SLOTTED HOLES, UNLESS OTHERWISE INDICATED.
14. BEAMS BEARING ON MASONRY SHALL HAVE ANGLE WALL ANCHORS WELDED TO THE BEAM, AS DETAILED IN THE A.I.S.C. MANUAL OF STEEL CONSTRUCTION.
15. PROVIDE 8" X 8" X 5/8" BEARING PLATES FOR ALL WALL BEARING BEAMS UNLESS NOTED OTHERWIS

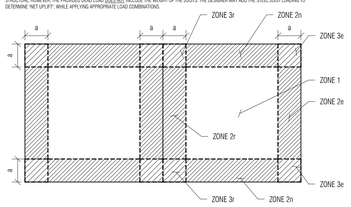


1 ROOF LOADING PLAN AREA A AND B
1/16" = 1'-0"

ROOF WIND LOADING AT AREA A AND B

ROOF ZONE	POSITIVE PRESSURE (PSF)		NEGATIVE PRESSURE (PSF)			DEAD LOAD FOR UPLIFT DESIGN (PSF)
	EFFECTIVE WIND AREA		EFFECTIVE WIND AREA			
	≤10FT²	100FT²	≤10FT²	100FT²	≥500FT²	
ROOF ZONE 1	26.68	17.98	-81.49	-25.38	-25.38	10.0
ROOF ZONE 2e	26.68	17.98	-81.49	-25.38	-25.38	10.0
ROOF ZONE 2n	26.68	17.98	-118.76	-65.40	-65.40	10.0
ROOF ZONE 2r	26.68	17.98	-118.76	-65.40	-65.40	10.0
ROOF ZONE 3e	26.68	17.98	-118.76	-65.40	-65.40	10.0
ROOF ZONE 3r	26.68	17.98	-141.23	-73.95	-73.95	10.0
OVERHANG ZONE 1	N/A	N/A	-93.38	-71.20	-71.20	6.0
OVERHANG ZONE 2e	N/A	N/A	-130.79	-75.68	-75.68	6.0
OVERHANG ZONE 2n	N/A	N/A	-130.79	-75.68	-75.68	6.0
OVERHANG ZONE 2r	N/A	N/A	-130.79	-75.68	-75.68	6.0
OVERHANG ZONE 3e	N/A	N/A	-153.12	-83.67	-83.67	6.0
OVERHANG ZONE 3r	N/A	N/A	-179.37	-85.99	-85.99	6.0

1. WIND LOADING PROVIDED IS COMPONENTS AND CLADDING ULTIMATE LOADING. WHERE ALLOWABLE STRESS DESIGN (ASD) METHODOLOGY IS USED THESE VALUES CAN BE MULTIPLIED BY 0.6 PER THE STANDARD ASD LOAD COMBINATIONS.
2. EFFECTIVE WIND AREA FOR THE COMPONENT BEING DESIGNED IS TO BE DETERMINED BY JOIST DESIGNER. THE EFFECTIVE WIND AREA SHALL BE THE SPAN LENGTH MULTIPLIED BY AN EFFECTIVE WIDTH THAT NEED NOT BE LESS THAN ONE THIRD THE SPAN LENGTH. LINEAR INTERPOLATION IS PERMITTED BETWEEN THE EFFECTIVE WIND AREAS PROVIDED IN THE TABLE.
3. THE DEAD LOAD PROVIDED IN THE TABLE SHOULD BE USED IN COMBINATION WITH THE WIND LOADING TO DETERMINE 'NET UPLIFT' ON THE COMPONENT BEING DESIGNED. DEAD LOAD PROVIDED IS UNFACTORED AND SHOULD BE MULTIPLIED BY THE APPROPRIATE LOAD FACTOR BASED ON THE DESIGN METHODOLOGY BEING USED. THE PROVIDED DEAD LOAD INCLUDES THE WEIGHT OF ALL MATERIALS ANTICIPATED TO REMAIN FOR THE FULL LIFE OF THE STRUCTURE. HOWEVER, THE PROVIDED DEAD LOAD DOES NOT INCLUDE THE WEIGHT OF THE JOISTS. THE DESIGNER MAY ADD THE STEEL JOIST LOADING TO DETERMINE 'NET UPLIFT'; WHILE APPLYING APPROPRIATE LOAD COMBINATIONS.



a= 7.43'
1. WHERE ROOF OVERHANGS EXIST, THE EDGE DISTANCE SHALL BE MEASURED FROM THE OUTSIDE FACE OF THE OVERHANGS. COORDINATE OVERHANG EXTENTS WITH SECTIONS AND ARCHITECTURAL DRAWINGS.

LOADING SCHEDULE

LOAD TYPE	DEAD LOAD	LIVE LOAD	MARK
ROOF + PV	23 PSF	30 PSF (SNOW) REFER TO PLAN FOR DRIFT	

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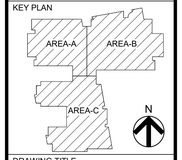
PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF LOADING PLAN - AREA A AND B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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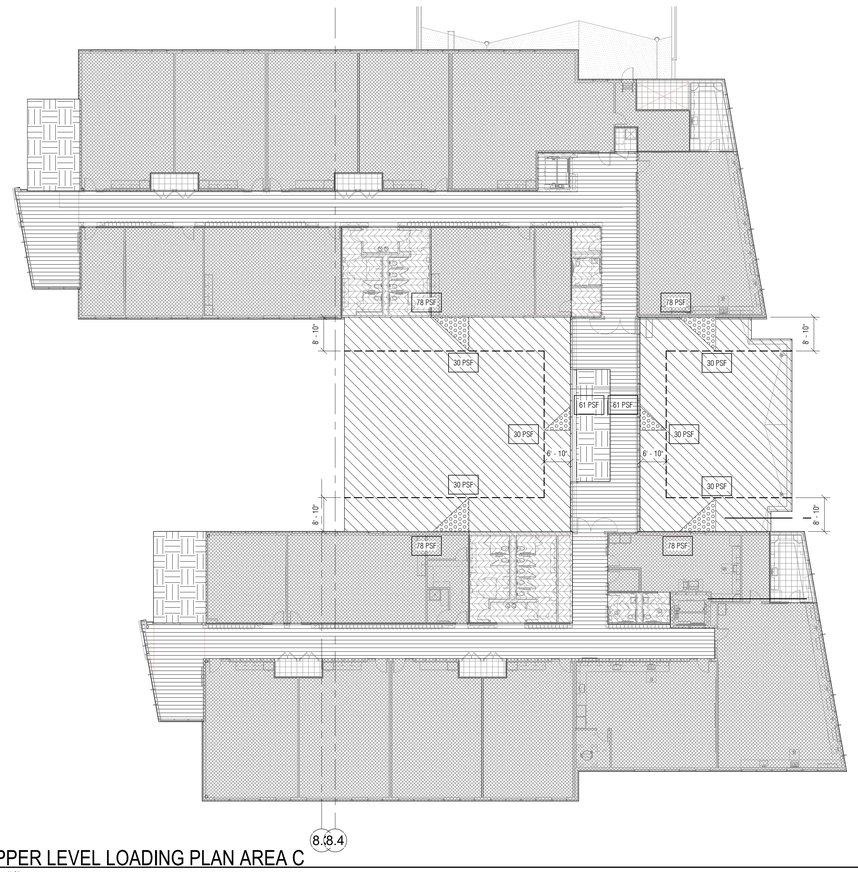
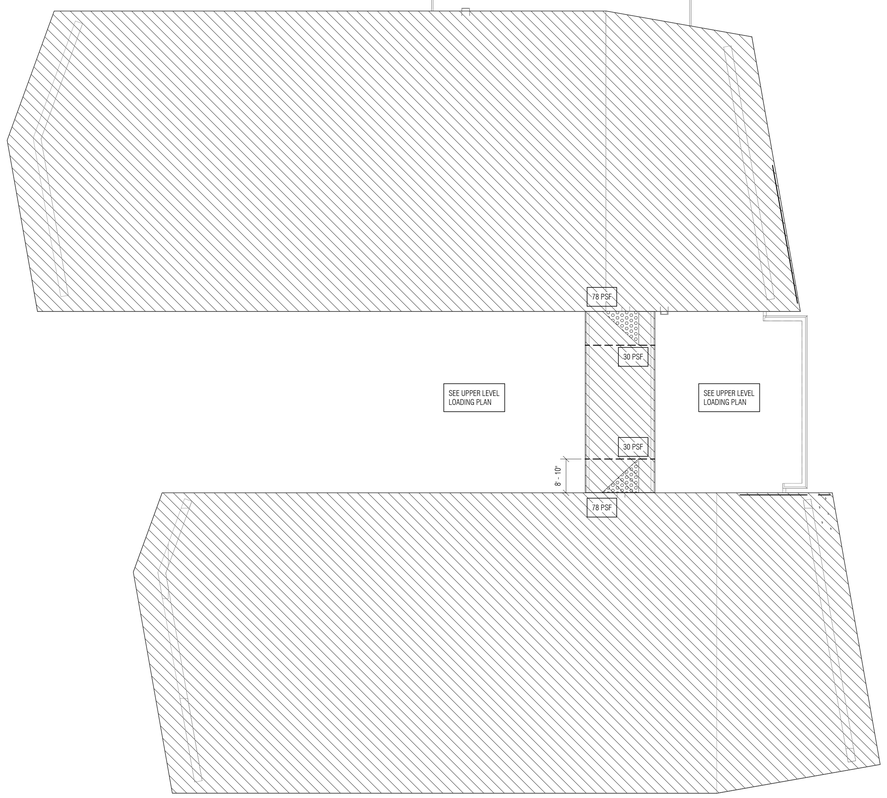
1 MAIN LEVEL LOADING PLAN AREA C
1/16" = 1'-0"


78 PSF
30 PSF
61 PSF
8' - 10"
6' - 10"
8.
8.4

2 UPPER LEVEL LOADING PLAN AREA C
1/16" = 1'-0"

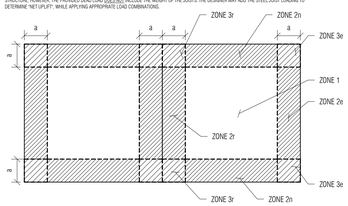


3 ROOF LOADING PLAN AREA C ROOF
1/16" = 1'-0"

ROOF WIND LOADING AT AREA A AND B

ROOF ZONE	POSITIVE PRESSURE (PSF)		NEGATIVE PRESSURE (PSF)			DEAD LOAD FOR UPLIFT DESIGN (PSF)
	EFFECTIVE WIND AREA		EFFECTIVE WIND AREA			
	≤10FT²	100FT²	≤10FT²	100FT²	≥500FT²	
ROOF ZONE 1	28.71	19.35	-87.68	-27.30	-27.30	10.0
ROOF ZONE 2e	28.71	19.35	-87.68	-27.30	-27.30	10.0
ROOF ZONE 2n	28.71	19.35	-127.77	-70.36	-70.36	10.0
ROOF ZONE 2r	28.71	19.35	-127.77	-70.36	-70.36	10.0
ROOF ZONE 3e	28.71	19.35	-127.77	-70.36	-70.36	10.0
ROOF ZONE 3r	28.71	19.35	-151.95	-79.56	-79.56	10.0
OVERHANG ZONE 1	N/A	N/A	-100.47	-76.60	-76.60	6.0
OVERHANG ZONE 2e	N/A	N/A	-140.72	-80.34	-80.34	6.0
OVERHANG ZONE 2n	N/A	N/A	-140.72	-80.34	-80.34	6.0
OVERHANG ZONE 2r	N/A	N/A	-140.72	-80.34	-80.34	6.0
OVERHANG ZONE 3e	N/A	N/A	-164.74	-90.02	-90.02	6.0
OVERHANG ZONE 3r	N/A	N/A	-192.98	-92.51	-92.51	6.0

1. WIND LOADING PROVIDED IS COMPONENTS AND CLADDING ULTIMATE LOADING, WHERE ALLOWABLE STRESS DESIGN (ASD) METHODOLOGY IS USED THESE VALUES CAN BE MULTIPLIED BY 0.6 PER THE STANDARD ASD LOAD COMBINATIONS.
2. EFFECTIVE WIND AREA FOR THE COMPONENT BEING DESIGNED IS TO BE DETERMINED BY JOIST DESIGNER. THE EFFECTIVE WIND AREA SHALL BE THE SPAN LENGTH MULTIPLIED BY AN EFFECTIVE WIDTH THAT NEED NOT BE LESS THAN ONE THIRD THE SPAN LENGTH. LINEAR INTERPOLATION IS PERMITTED BETWEEN THE EFFECTIVE WIND AREAS PROVIDED IN THE TABLE.
3. THE DEAD LOAD PROVIDED IN THE TABLE SHOULD BE USED IN COMBINATION WITH THE WIND LOADING TO DETERMINE "NET UPLIFT" ON THE COMPONENT BEING DESIGNED. THE DEAD LOAD VALUES ARE BASED ON THE ASD METHODOLOGY AND THEREFORE NOT MULTIPLIED BY THE 0.6 FACTOR AS THE ULTIMATE METHODOLOGY BEING USED. THE PROVIDED DEAD LOAD INCLUDES THE WEIGHT OF ALL MATERIALS ANTICIPATED TO REMAIN FOR THE FULL LIFE OF THE STRUCTURE; HOWEVER, THE PROVIDED DEAD LOAD DOES NOT INCLUDE THE WEIGHT OF THE JOISTS. THE DESIGNER MAY ADD THE STEEL JOIST LOADING TO DETERMINE "NET UPLIFT", WHILE APPLYING APPROPRIATE LOAD COMBINATIONS.



1. WHERE ROOF OVERHANGS EXIST, THE EDGE DISTANCE SHALL BE MEASURED FROM THE OUTSIDE FACE OF THE OVERHANGS. COORDINATE OVERHANG EXTENTS WITH SECTIONS AND ARCHITECTURAL DRAWINGS.

LOADING SCHEDULE

LOAD TYPE	DEAD LOAD	LIVE LOAD	MARK
CLASSROOM	15 PSF	40 PSF	
CORRIDOR	15 PSF	1ST FLOOR: 100 PSF OTHER: 80 PSF	
MEP/ STORAGE	15 PSF	125 PSF	
BATHROOM	15PSF	75 PSF	
STAIR/ ASSEMBLY	15 PSF	100 PSF	
ROOF + PV	23 PSF	30 PSF (SNOW) REFER TO PLAN FOR DRIFT	

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PAUL J SHEEHAN
No. 0035406
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

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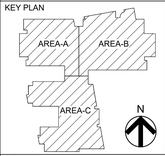
KEY PLAN



DRAWING TITLE

LOADING PLANS - AREA C 2ND FLOOR, 3RD FLOOR AND ROOF

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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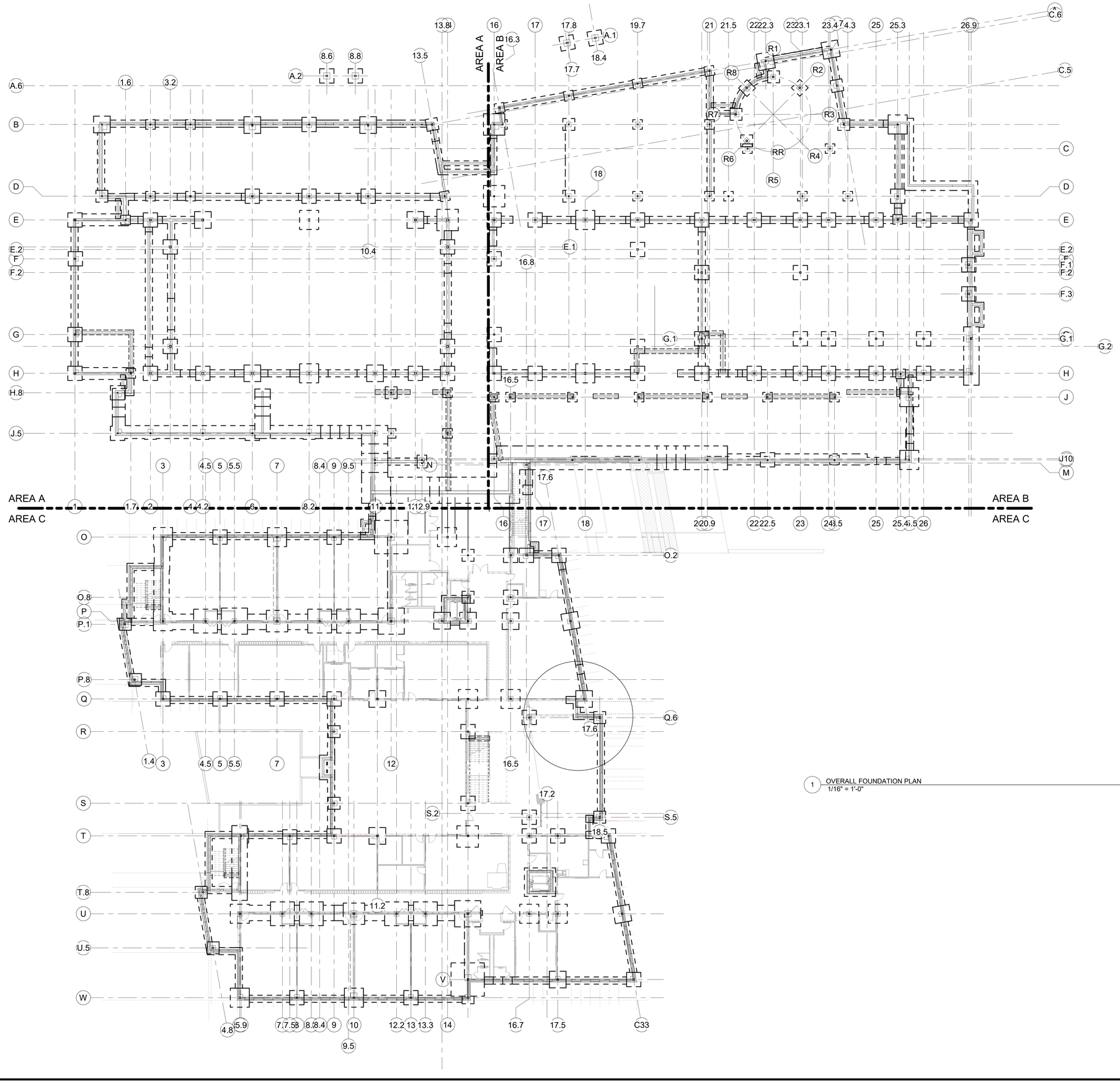

1 OVERALL FOUNDATION PLAN
1/16" = 1'-0"

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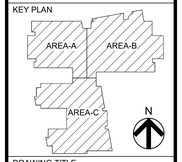
KEY PLAN



DRAWING TITLE

OVERALL FOUNDATION PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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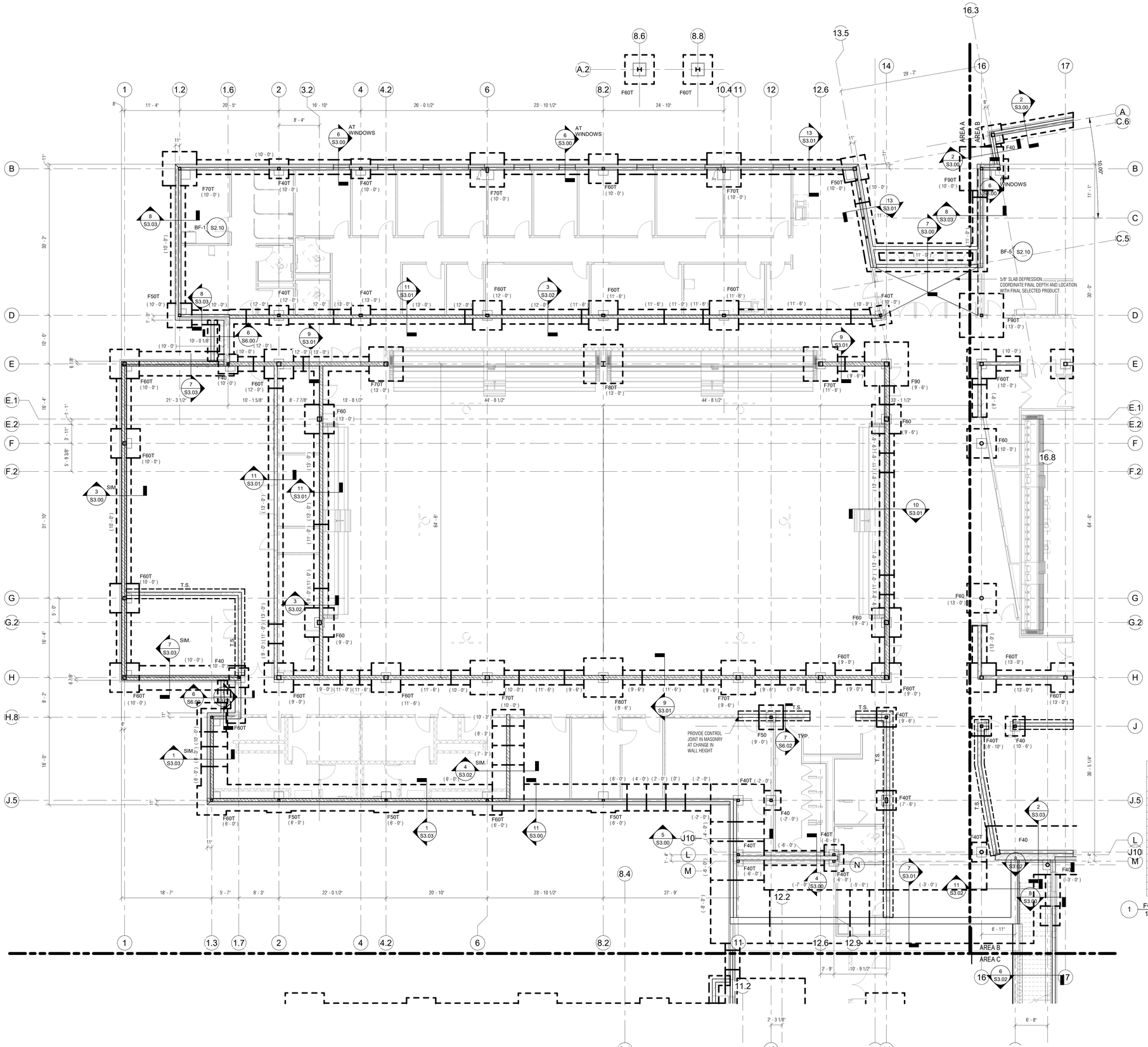

FOOTING SCHEDULE 2.0 TONS/SF

Mark	Footing Size			Reinf Each Way		Remarks
	Length	Width	Thickness	No.	Size	
	<varies>	<varies>	<varies>	<varies>	<varies>	<varies>
F40	4' - 0"	4' - 0"	1' - 3"	8	#4	
F40T	4' - 0"	4' - 0"	1' - 3"	8	#4	REINF. TOP AND BOTTOM EACH WAY
F50	5' - 0"	5' - 0"	1' - 3"	9	#4	
F50T	5' - 0"	5' - 0"	1' - 3"	9	#4	REINF. TOP AND BOTTOM EACH WAY
F60	6' - 0"	6' - 0"	1' - 3"	10	#4	
F60T	6' - 0"	6' - 0"	1' - 3"	10	#4	REINF. TOP AND BOTTOM EACH WAY
F70	7' - 0"	7' - 0"	1' - 6"	9	#5	
F70T	7' - 0"	7' - 0"	1' - 6"	9	#5	REINF. TOP AND BOTTOM EACH WAY
F80	8' - 0"	8' - 0"	1' - 9"	10	#6	
F80T	8' - 0"	8' - 0"	1' - 9"	10	#6	REINF. TOP AND BOTTOM EACH WAY
F90	9' - 0"	9' - 0"	2' - 0"	9	#7	
F100T	10' - 0"	10' - 0"	2' - 0"	10	#7	REINF. TOP AND BOTTOM EACH WAY
F110T	11' - 0"	11' - 0"	2' - 3"	12	#7	REINF. TOP AND BOTTOM EACH WAY
F140T	14' - 0"	14' - 0"	2' - 0"	14	#7	REINF. TOP AND BOTTOM EACH WAY

1 FOUNDATION PLAN AREA A
1/8" = 1'-0"

FOUNDATION NOTES:

1. TOP OF CONCRETE SLAB ELEVATION= REFER TO PLAN
2. FLOOR CONSTRUCTION: 5" NORMAL WEIGHT CONCRETE SLAB REINF. WITH 6X6-W2.9XW2.9 W.W.F. (CHAIRED). REFER TO GENERAL NOTES FOR SUBGRADE REQUIREMENTS.
3. PROVIDE SAWCUT JOINTS IN SLAB ON GRADE PER NOTE #4 ON DRAWINGS S0.00 , AND 'TYPICAL SLAB ON GRADE DETAILS' ON SHEET S6.00
4. TOP OF FOOTING ELEVATION (X'-X") GIVEN FROM DATUM ELEVATION (0'-0").
5. COORDINATE ALL SLAB ON GRADE DEPRESSIONS WITH ARCH'L DRAWINGS.
6. COORDINATE ALL PLUMBING INVERTS AND LOCATIONS WITH PLUMBING & SITE DRAWINGS REFER TO TYPICAL DETAIL ON DRAWING S6.00 FOR SUB SURFACE PIPING THROUGH FOUNDATION WALLS.
7. "C.J." INDICATES FOUNDATION WALL CONTROL JOINT. REFER TO TYPICAL DETAL ON DRAWING S6.00
8. R INDICATES RADON REMOVAL PIT. COORDINATE WITH PLUMBING DRAWINGS.
9. INDICATES MASONRY SHEAR WALL. REFER TO WALL ELEVATIONS AND TYPICAL DETAILS FOR REINFORCING REQUIREMENTS.

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FOUNDATION PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

S1.01A

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FOUNDATION NOTES:

1. TOP OF CONCRETE SLAB ELEVATION= REFER TO PLAN
2. FLOOR CONSTRUCTION: 5" NORMAL WEIGHT CONCRETE SLAB REINF. WITH 6X6-W2.9XW2.9 W.W.F. (CHAIRED). REFER TO GENERAL NOTES FOR SUBGRADE REQUIREMENTS.
3. PROVIDE SAWCUT JOINTS IN SLAB ON GRADE PER NOTE #4 ON DRAWINGS S0.00 , AND "TYPICAL SLAB ON GRADE DETAILS" ON SHEET S6.00
4. TOP OF FOOTING ELEVATION (X'-X") GIVEN FROM DATUM ELEVATION (0'-0").
5. COORDINATE ALL SLAB ON GRADE DEPRESSIONS WITH ARCHL DRAWINGS.
6. COORDINATE ALL PLUMBING INVERTS AND LOCATIONS WITH PLUMBING & SITE DRAWINGS REFER TO TYPICAL DETAIL ON DRAWING S6.00 FOR SUB SURFACE PIPING THROUGH FOUNDATION WALLS.
7. "C.J." INDICATES FOUNDATION WALL CONTROL JOINT. REFER TO TYPICAL DETAIL ON DRAWING S6.00
8. R — INDICATES RADON REMOVAL PIT. COORDINATE WITH PLUMBING DRAWINGS.
9. INDICATES MASONRY SHEAR WALL. REFER TO WALL ELEVATIONS AND TYPICAL DETAILS FOR REINFORCING REQUIREMENTS.

5/8" SLAB DEPRESSION. COORDINATE FINAL DEPTH AND LOCATION WITH FINAL SELECTED PRODUCT.

7" SLAB RECESS. COORDINATE FINAL DEPTH AND SIZE WITH FINAL SELECTED FOOD SERVICE EQUIPMENT

STAIR LANDING CAN BE CONNECTED TO STEEL COLUMN OR FASTENED TO EITHER CONCRETE FOUNDATION WALL

1 FOUNDATION PLAN AREA B
1/8" = 1'-0"

2 LOWER LEVEL AREA B - Callout 1
1/2" = 1'-0"

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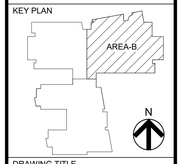
STATE OF CONNECTICUT — PAUL J SHEEHAN — No. 0033406 — LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FOUNDATION PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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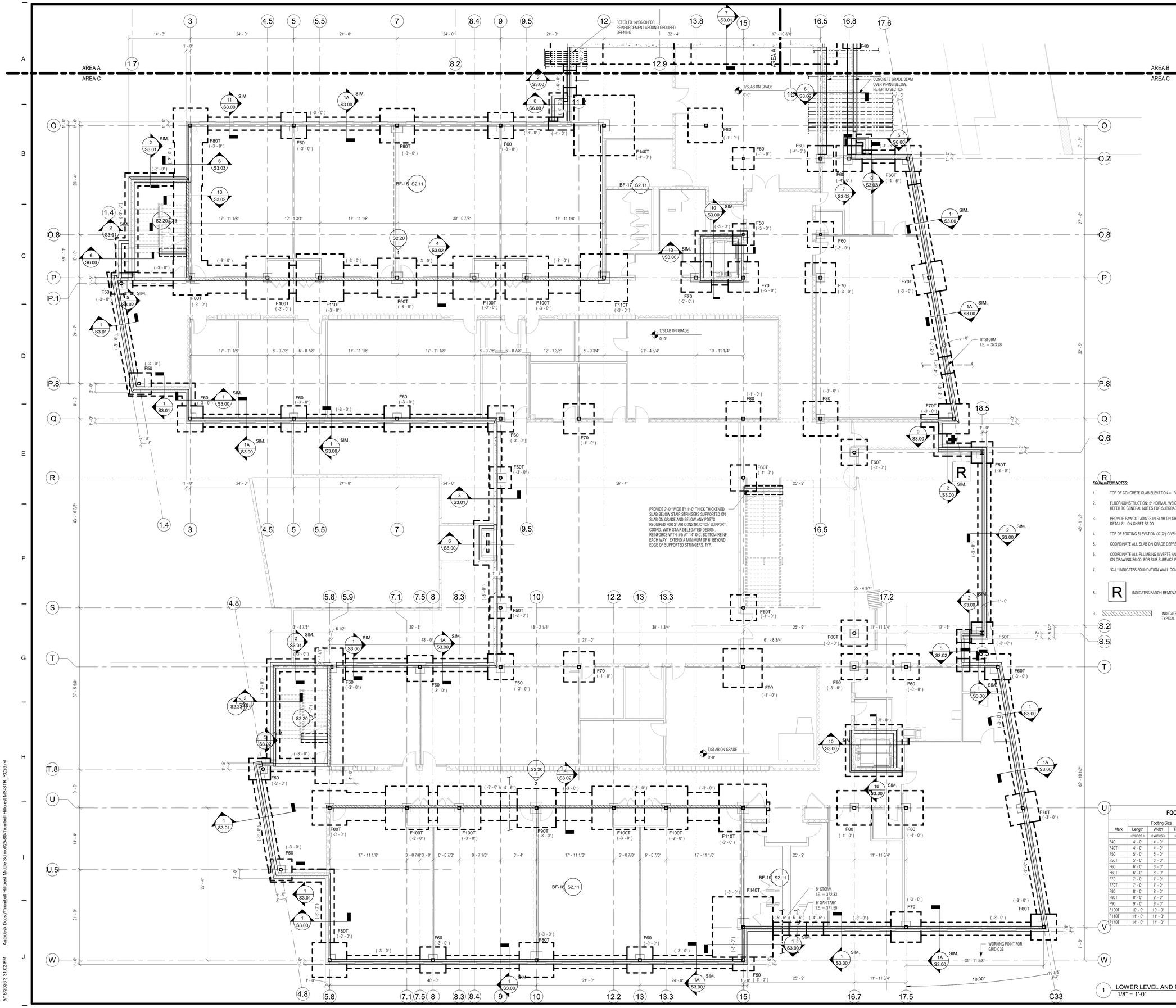

1 LOWER LEVEL AND FOUNDATION PLAN
1/8" = 1'-0"

FOUNDATION NOTES:

1. TOP OF CONCRETE SLAB ELEVATION = REFER TO PLAN
2. FLOOR CONSTRUCTION: 5" NORMAL WEIGHT CONCRETE SLAB REINF. WITH 6X6-W2.9XW2.9 W.W.F. (CHAIRED). REFER TO GENERAL NOTES FOR SUBGRADE REQUIREMENTS.
3. PROVIDE SAWCUT JOINTS IN SLAB ON GRADE PER NOTE #4 ON DRAWINGS S0.00 , AND "TYPICAL SLAB ON GRADE DETAILS" ON SHEET S6.00
4. TOP OF FOOTING ELEVATION (X'-X") GIVEN FROM DATUM ELEVATION (0'-0").
5. COORDINATE ALL SLAB ON GRADE DEPRESSIONS WITH ARCH'L DRAWINGS.
6. COORDINATE ALL PLUMBING INVERTS AND LOCATIONS WITH PLUMBING & SITE DRAWINGS REFER TO TYPICAL DETAIL ON DRAWING S6.00 FOR SUB SURFACE PIPING THROUGH FOUNDATION WALLS.
7. "C.J." INDICATES FOUNDATION WALL CONTROL JOINT. REFER TO TYPICAL DETAIL ON DRAWING S6.00
8. R INDICATES RADON REMOVAL PIT. COORDINATE WITH PLUMBING DRAWINGS.
9. INDICATES MASONRY SHEAR WALL. REFER TO WALL ELEVATIONS AND TYPICAL DETAILS FOR REINFORCING REQUIREMENTS.

FOOTING SCHEDULE 2.0 TONS/SF

Mark	Footing Size Length	Width	Thickness	Reinf Each Way No.	Size	Remarks
	<varies>	<varies>	<varies>	<varies>	<varies>	<varies>
F40	4' - 0"	4' - 0"	1' - 3"	8	#4	
F40T	4' - 0"	4' - 0"	1' - 3"	8	#4	REINF. TOP AND BOTTOM EACH WAY
F50	5' - 0"	5' - 0"	1' - 3"	9	#4	
F50T	5' - 0"	5' - 0"	1' - 3"	9	#4	REINF. TOP AND BOTTOM EACH WAY
F60	6' - 0"	6' - 0"	1' - 3"	10	#4	
F60T	6' - 0"	6' - 0"	1' - 3"	10	#4	REINF. TOP AND BOTTOM EACH WAY
F70	7' - 0"	7' - 0"	1' - 6"	9	#5	
F70T	7' - 0"	7' - 0"	1' - 6"	9	#5	REINF. TOP AND BOTTOM EACH WAY
F80	8' - 0"	8' - 0"	1' - 9"	10	#6	
F80T	8' - 0"	8' - 0"	1' - 9"	10	#6	REINF. TOP AND BOTTOM EACH WAY
F90	9' - 0"	9' - 0"	2' - 0"	9	#7	
F100T	10' - 0"	10' - 0"	2' - 0"	10	#7	REINF. TOP AND BOTTOM EACH WAY
F110T	11' - 0"	11' - 0"	2' - 3"	12	#7	REINF. TOP AND BOTTOM EACH WAY
F140T	14' - 0"	14' - 0"	2' - 0"	14	#7	REINF. TOP AND BOTTOM EACH WAY

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

AREA-C · N

DRAWING TITLE

LOWER LEVEL FOUNDATION PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

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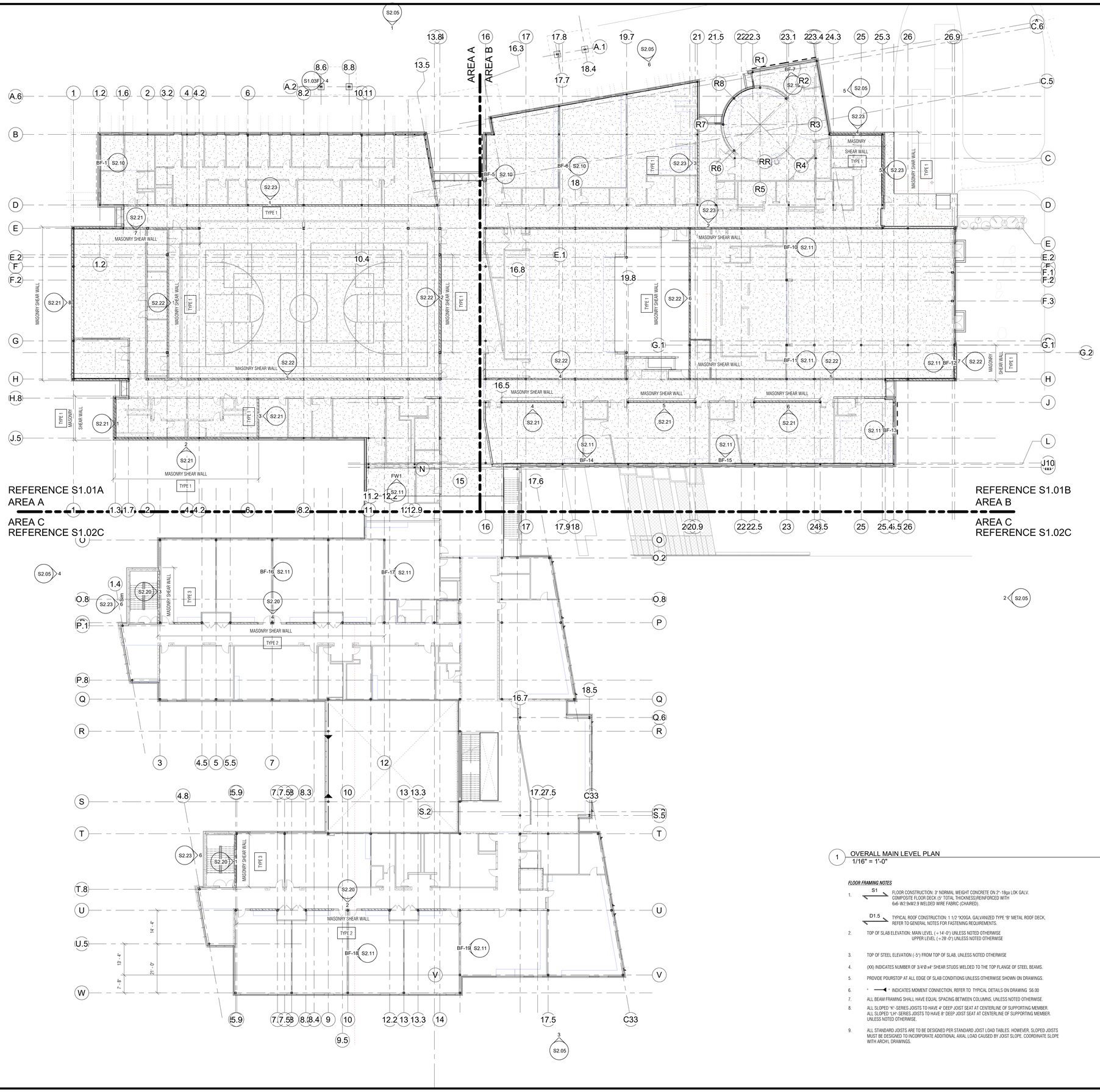

1 OVERALL MAIN LEVEL PLAN
1/16" = 1'-0"

FLOOR FRAMING NOTES

1. S1 — FLOOR CONSTRUCTION: 3" NORMAL WEIGHT CONCRETE ON 2"-18ga LOK GALV. COMPOSITE FLOOR DECK (5" TOTAL THICKNESS)/REINFORCED WITH 6x6-W2.9xW2.9 WELDED WIRE FABRIC (CHAIRED).
   D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
2. TOP OF SLAB ELEVATION: MAIN LEVEL (+14'-0") UNLESS NOTED OTHERWISE
   UPPER LEVEL (+28'-0") UNLESS NOTED OTHERWISE
3. TOP OF STEEL ELEVATION (-5") FROM TOP OF SLAB, UNLESS NOTED OTHERWISE
4. (XX) INDICATES NUMBER OF 3/4"Ø x4" SHEAR STUDS WELDED TO THE TOP FLANGE OF STEEL BEAMS.
5. PROVIDE POURSTOP AT ALL EDGE OF SLAB CONDITIONS UNLESS OTHERWISE SHOWN ON DRAWINGS.
6. " —◄ " INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.00
7. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
8. ALL SLOPED "K"-SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED "LH"-SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.
9. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCH'L DRAWINGS.

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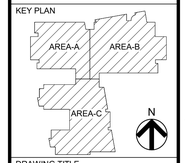
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

MAIN LEVEL FRAMING PLAN - OVERALL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
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ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S1.02

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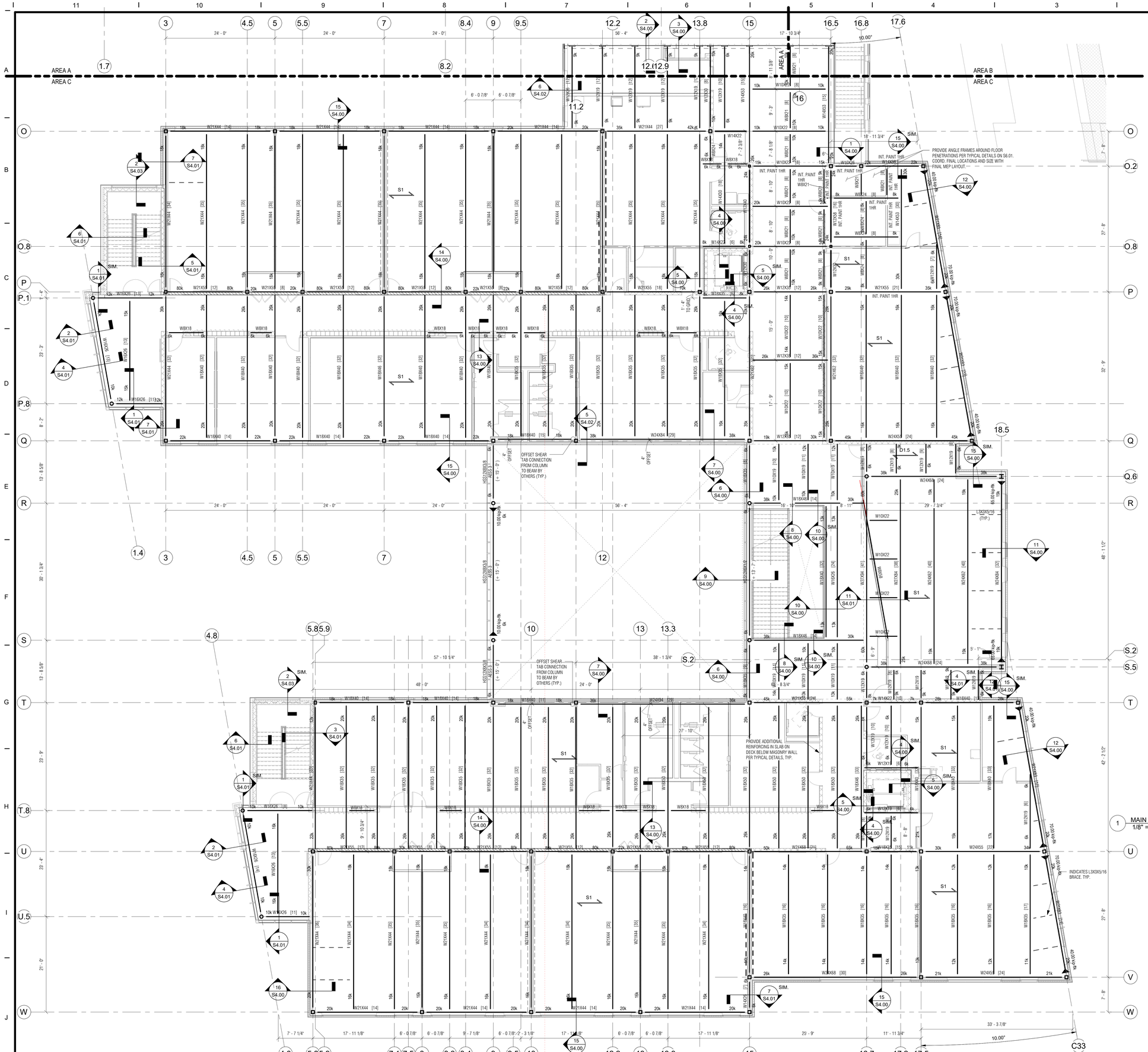

1 MAIN LEVEL FRAMING PLAN - AREA C
1/8" = 1'-0"

FLOOR FRAMING NOTES

S1 — FLOOR CONSTRUCTION: 3" NORMAL WEIGHT CONCRETE ON 2"-18ga LOK GALV. COMPOSITE FLOOR DECK (3" TOTAL THICKNESS)REINFORCED WITH 6x6-W2.9xW2.9 WELDED WIRE FABRIC (CHAIRED).

D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE 'B' METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.

2. TOP OF SLAB ELEVATION: MAIN LEVEL (+ 14'-0") UNLESS NOTED OTHERWISE
UPPER LEVEL (+ 28'-0") UNLESS NOTED OTHERWISE

3. TOP OF STEEL ELEVATION (-5") FROM TOP OF SLAB, UNLESS NOTED OTHERWISE

4. (XX) INDICATES NUMBER OF 3/4"Ø x4" SHEAR STUDS WELDED TO THE TOP FLANGE OF STEEL BEAMS.

5. PROVIDE POURSTOP AT ALL EDGE OF SLAB CONDITIONS UNLESS OTHERWISE SHOWN ON DRAWINGS.

6. " ◄ " INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.00

7. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.

8. ALL SLOPED 'K'- SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED 'LH'- SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.

9. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCH'L DRAWINGS.

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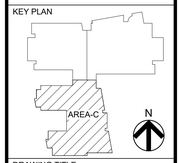
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

MAIN LEVEL FRAMING PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

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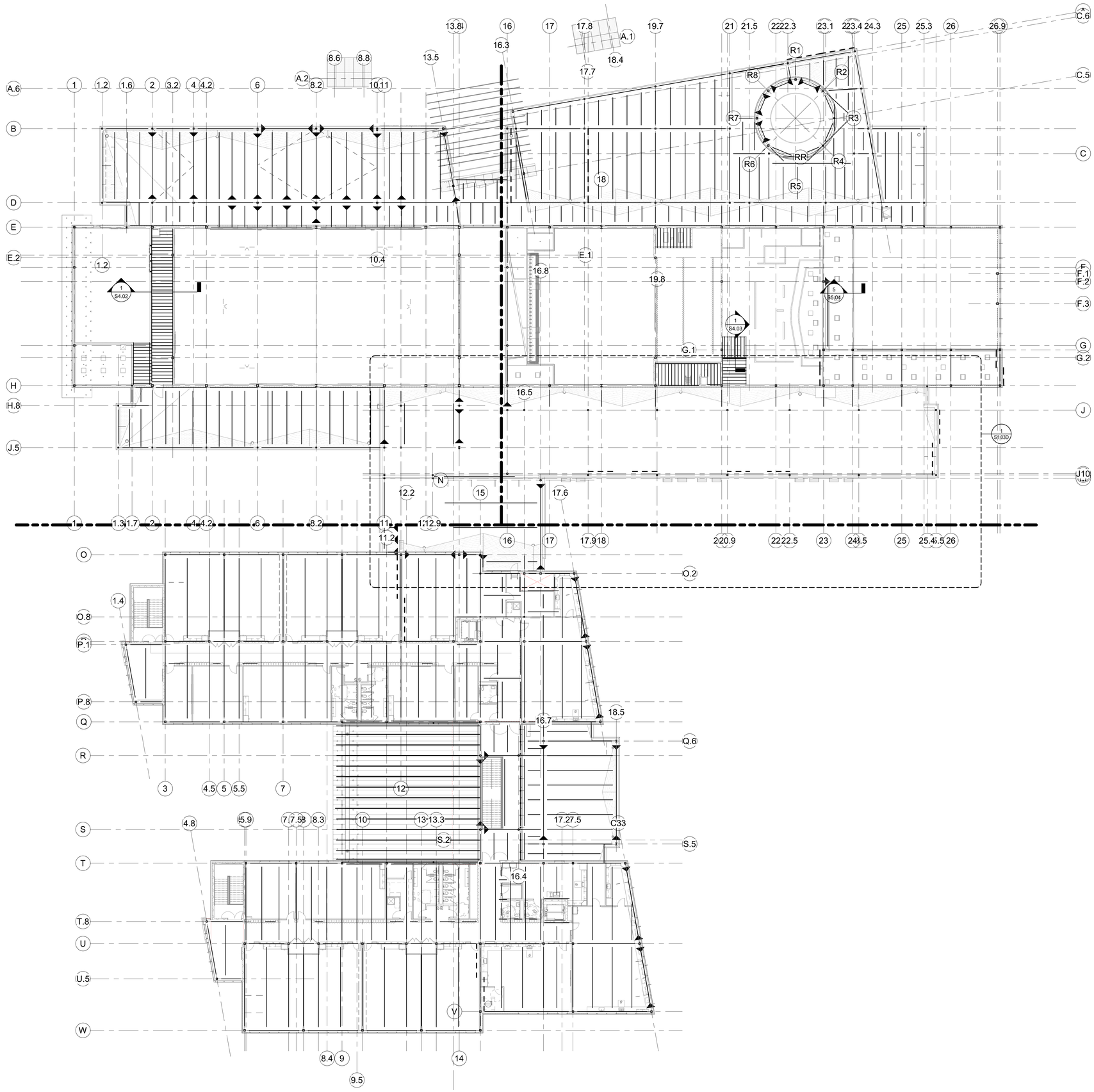

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

AREA-A · AREA-B · AREA-C · N

DRAWING TITLE

OVERALL UPPER LEVEL FRAMING PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
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4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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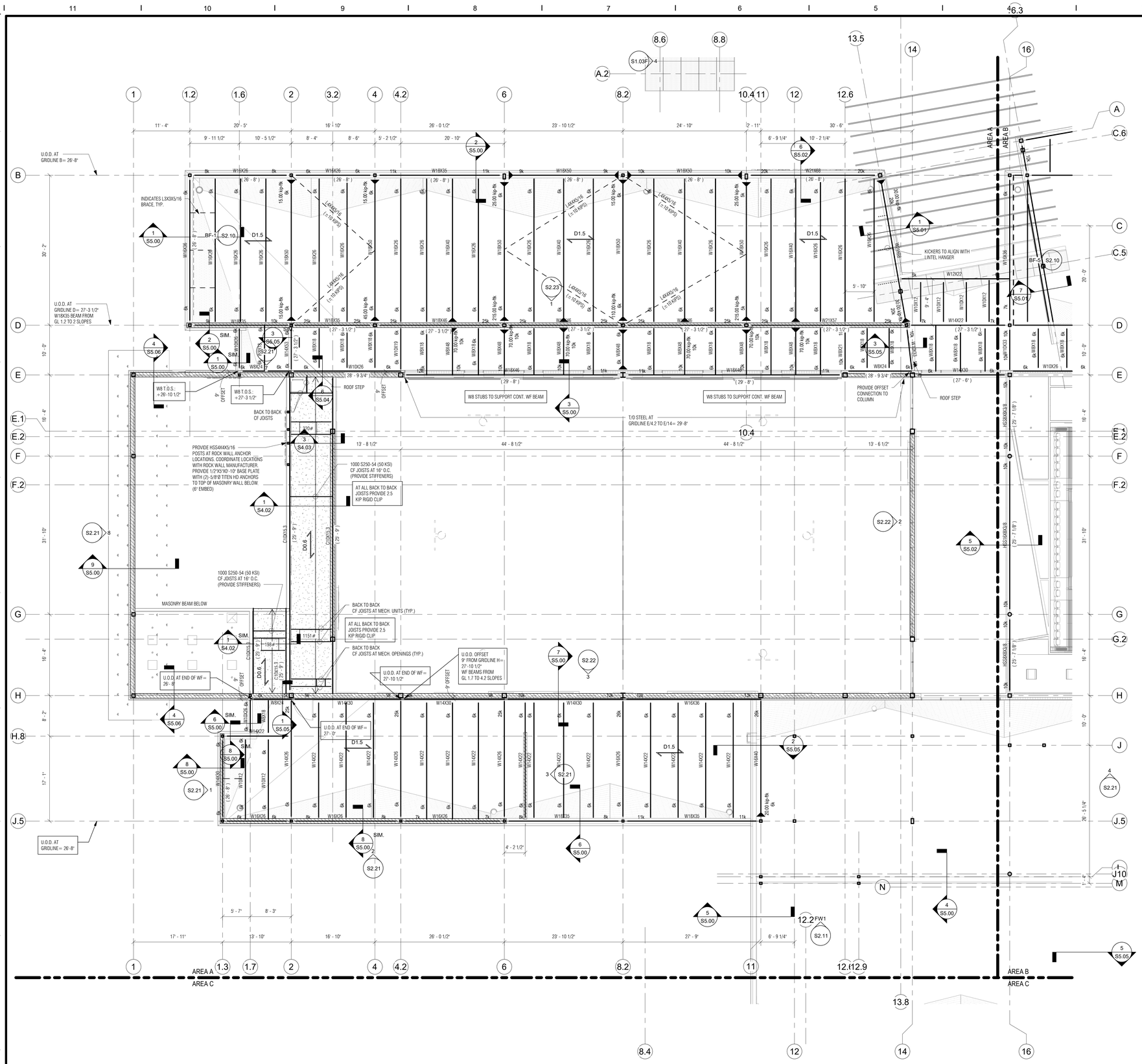

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D0.6 — INDICATES: 3" NORMAL WEIGHT CONCRETE SLAB ON 9/16" - 26GA. UFS FORM DECK REINFORCED WITH 6X6-W2.0XW2.0 WELDED WIRE FABRIC
3. ° —◄ INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.01
4. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
5. REFER TO DRAWING S6.01 FOR ALL ROOF FRAMES AT OPENINGS. COORDINATE ALL OPENING LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
6. REFER TO MECHANICAL AND ARCHITECTURAL DRAWINGS FOR ALL OPENING, DRAINS AND EQUIPMENT. PROVIDE FRAMES PER TYPICAL DETAILS
7. REFER TO DRAWING S2.02 FOR TRUSS ELEVATIONS AND DETAILS.
8. ALL SLOPED "K"-SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED "LH"-SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.
9. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCHL DRAWINGS.

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

LOW ROOF FRAMING PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
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4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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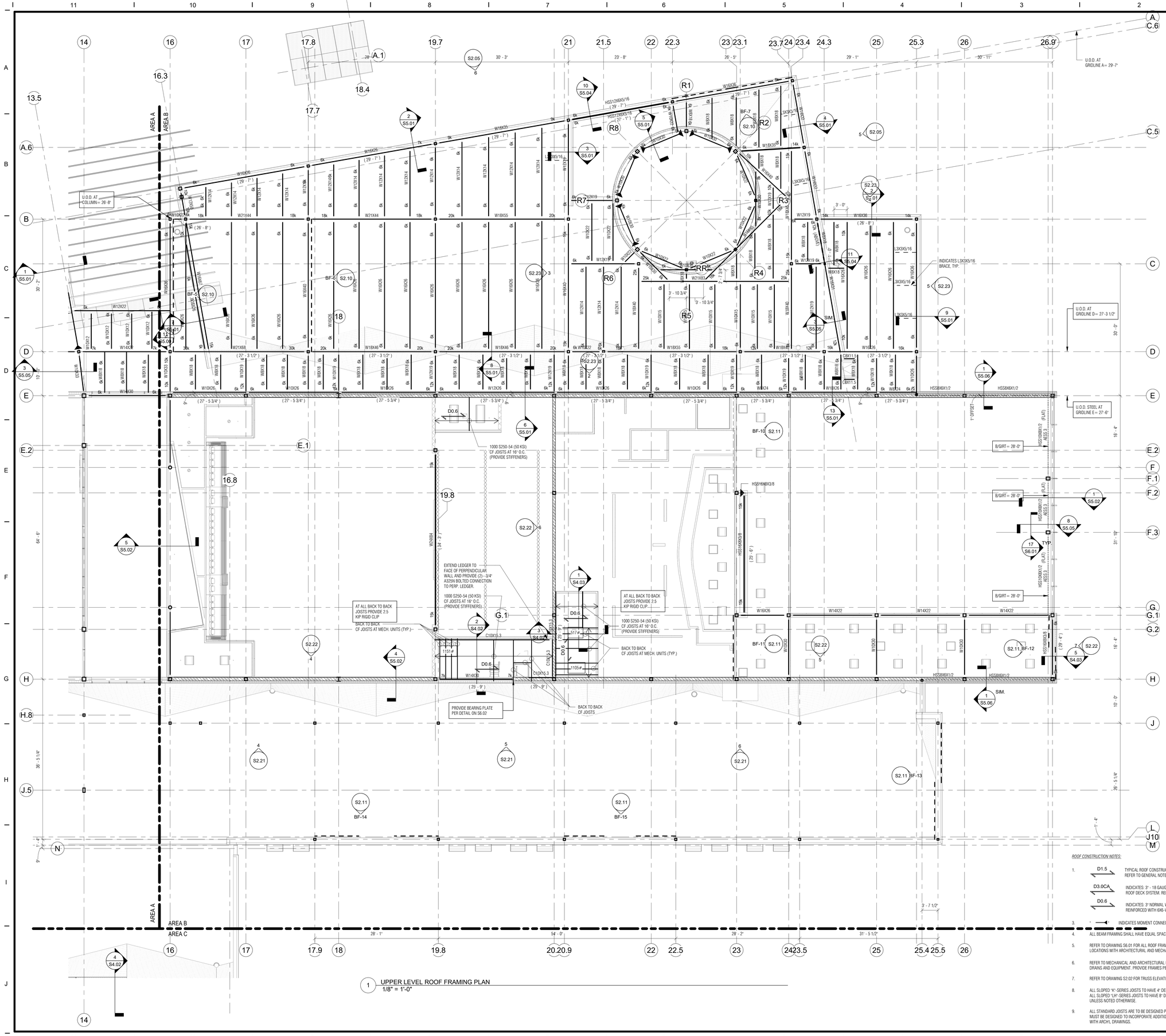
AREA A
AREA B
AREA C
U.O.D. AT COLUMN = 26'-8"
U.O.D. AT GRIDLINE A = 29'-7"
U.O.D. AT GRIDLINE D = 27'-3 1/2"
U.O.D. STEEL AT GRIDLINE E = 27'-6"
INDICATES L3X3X5/16 BRACE, TYP.
1" OFFSET
B/GIRT = 28'-0"
SIM.
TYP.
1000 S250-54 (50 KSI) CF JOISTS AT 16" O.C. (PROVIDE STIFFENERS)
EXTEND LEDGER TO FACE OF PERPENDICULAR WALL AND PROVIDE (2) -3/4" A325N BOLTED CONNECTION TO PERP. LEDGER.
AT ALL BACK TO BACK JOISTS PROVIDE 2.5 KIP RIGID CLIP
BACK TO BACK CF JOISTS AT MECH. UNITS (TYP.)
PROVIDE BEARING PLATE PER DETAIL ON S6.02
BACK TO BACK CF JOISTS
HSS16NBX3/8
HSS8X6X1/2
HSS10X6X1/2 (FLAT)
HSS7X5X1/2 (FLAT)
W16X26
W14X22
W10X30
W10X49
W12X19
W16X36
W21X44
W18X35
W21X68
W18X46
W18X55
W18X40
W21X83
W24X84
W14X30
W14X24
W10X26
W8X18
W10X19
W10X15
W12X26
W12X14
W12X22
W10X12
W14X26
W10X17
W10X33
W14X30
W16X45
W16X40
W16X31
W16X36
W16X26
W16X50
W16X67
W16X57
W16X89
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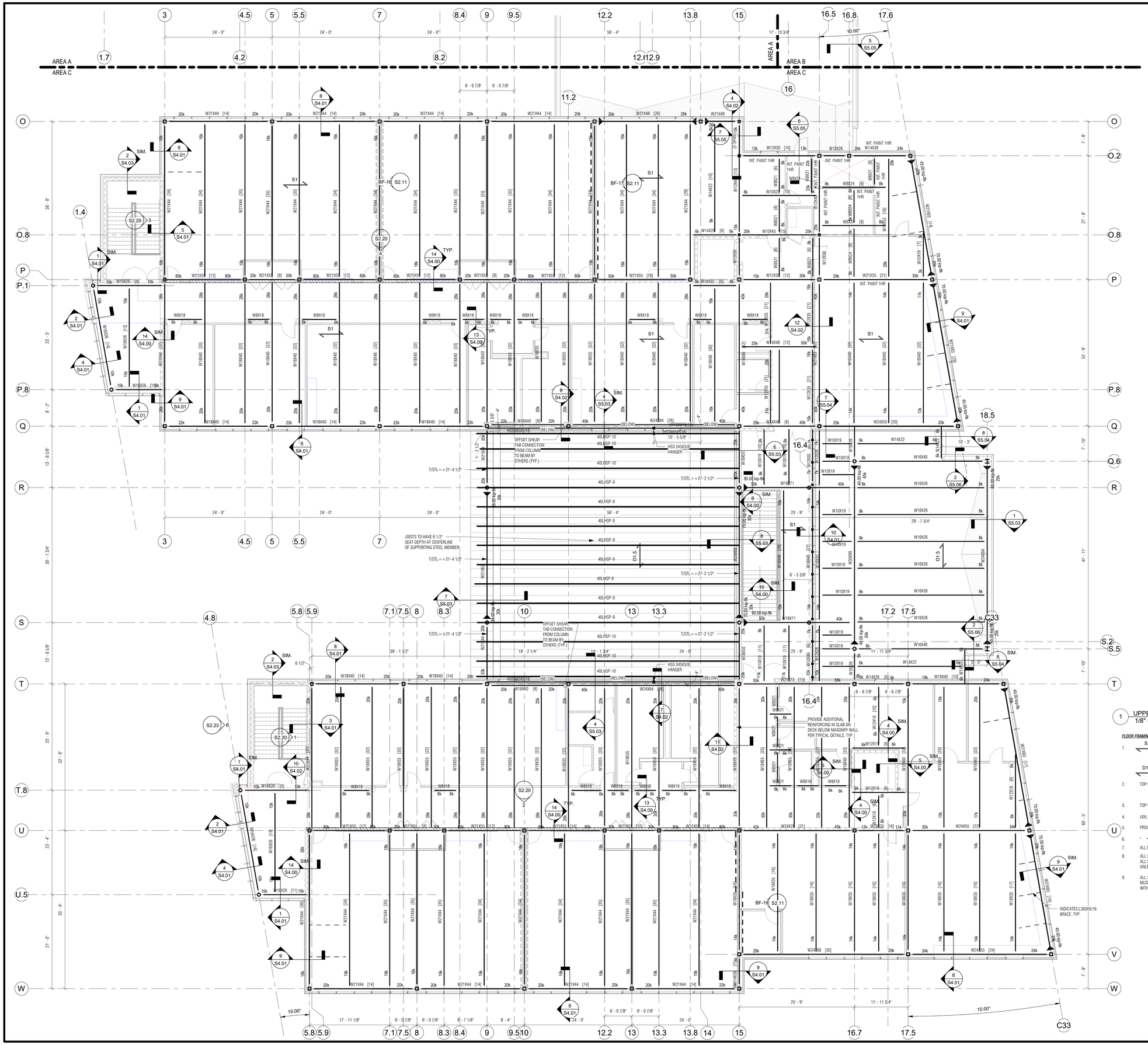
W18X65
W18X86
W18X119



1 UPPER LEVEL FRAMING PLAN
1/8" = 1'-0"

FLOOR FRAMING NOTES

1. S1 — FLOOR CONSTRUCTION: 3" NORMAL WEIGHT CONCRETE ON 2"-18ga LOK GALV. COMPOSITE FLOOR DECK (5" TOTAL THICKNESS)REINFORCED WITH 6x6-W2.9xW2.9 WELDED WIRE FABRIC (CHAIRED).
   D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2" 'X20GA. GALVANIZED TYPE 'B' METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
2. TOP OF SLAB ELEVATION: MAIN LEVEL (+ 14'-0") UNLESS NOTED OTHERWISE
   UPPER LEVEL (+28'-0") UNLESS NOTED OTHERWISE
3. TOP OF STEEL ELEVATION (-5") FROM TOP OF SLAB, UNLESS NOTED OTHERWISE
4. (XX) INDICATES NUMBER OF 3/4"Ø x4" SHEAR STUDS WELDED TO THE TOP FLANGE OF STEEL BEAMS.
5. PROVIDE POURSTOP AT ALL EDGE OF SLAB CONDITIONS UNLESS OTHERWISE SHOWN ON DRAWINGS.
6. " — " INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.00
7. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
8. ALL SLOPED "K"-SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED "LH"-SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.
9. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCH'L DRAWINGS.

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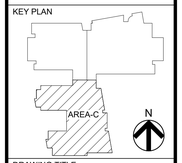
PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

UPPER LEVEL FRAMING PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
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2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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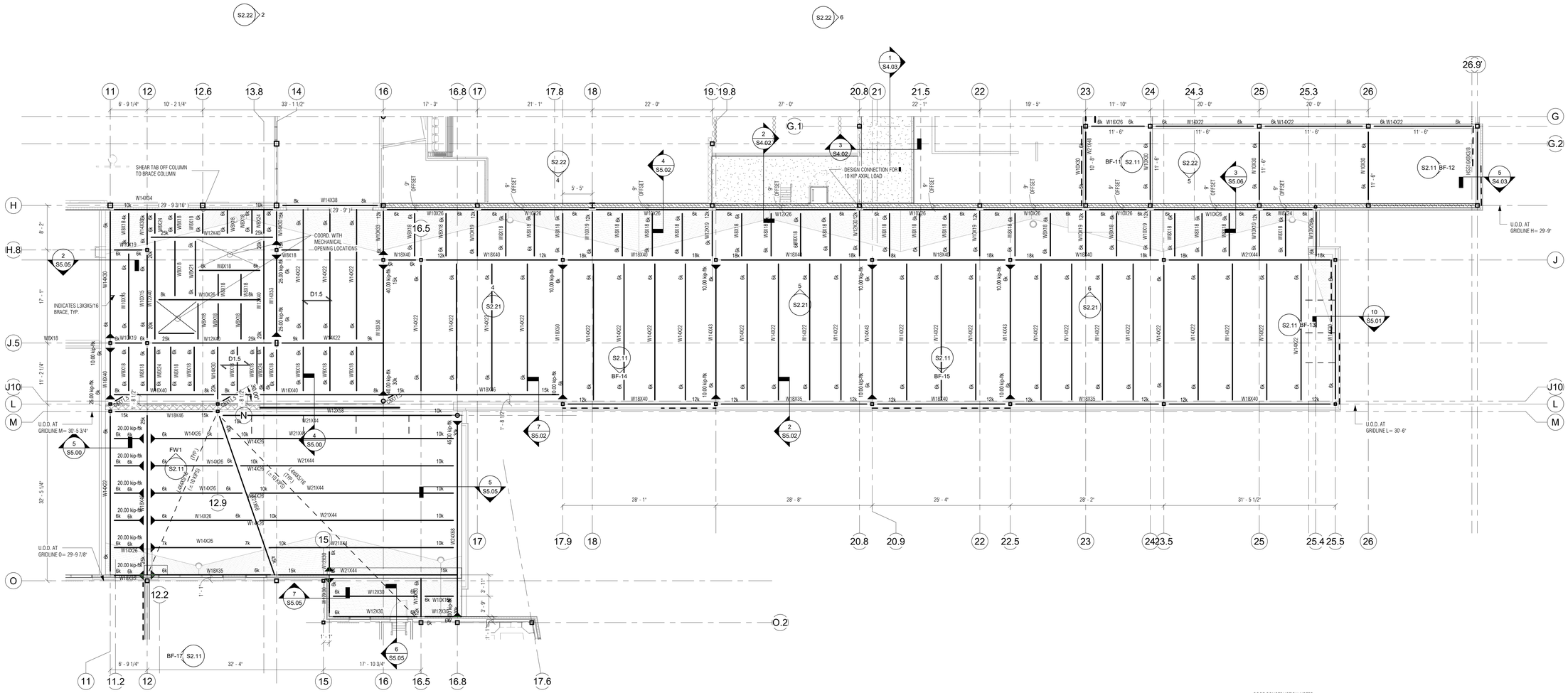

1 AREA B HIGH ROOF
1/8" = 1'-0"

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D0.6 — INDICATES: 3" NORMAL WEIGHT CONCRETE SLAB ON 9/16" - 26GA. UFS FORM DECK REINFORCED WITH 6X6-W2.0XW2.0 WELDED WIRE FABRIC
3. " — INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.01
4. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
5. REFER TO DRAWING S6.01 FOR ALL ROOF FRAMES AT OPENINGS. COORDINATE ALL OPENING LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
6. REFER TO MECHANICAL AND ARCHITECTURAL DRAWINGS FOR ALL OPENING, DRAINS AND EQUIPMENT. PROVIDE FRAMES PER TYPICAL DETAILS
7. REFER TO DRAWING S2.02 FOR TRUSS ELEVATIONS AND DETAILS.
8. ALL SLOPED "K"-SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED "LH"-SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.
9. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCHL DRAWINGS.

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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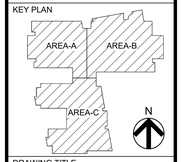

DRAWING TITLE

HIGH ROOF FRAMING PLAN - AREA B

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OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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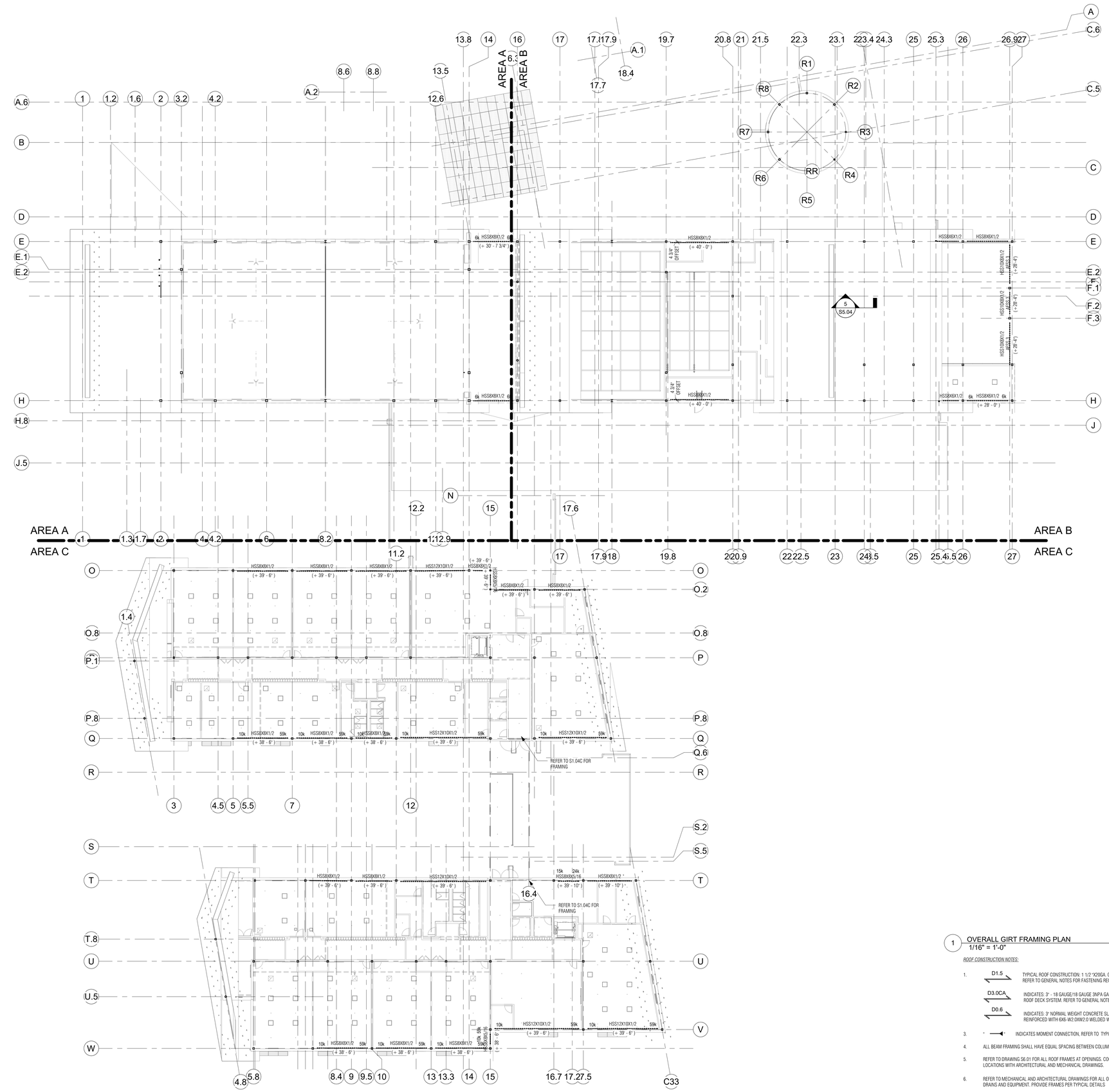

1 OVERALL GIRT FRAMING PLAN
1/16" = 1'-0"

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D0.6 — INDICATES: 3" NORMAL WEIGHT CONCRETE SLAB ON 9/16" - 26GA. UFS FORM DECK REINFORCED WITH 6X6-W2.0XW2.0 WELDED WIRE FABRIC
3. " —◄" INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.01
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6. REFER TO MECHANICAL AND ARCHITECTURAL DRAWINGS FOR ALL OPENING, DRAINS AND EQUIPMENT. PROVIDE FRAMES PER TYPICAL DETAILS
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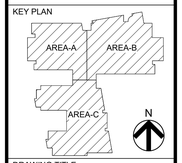
STATE OF CONNECTICUT — MICHAEL J SHEEHAN — NO. 0033406 — LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

OVERALL GIRT FRAMING PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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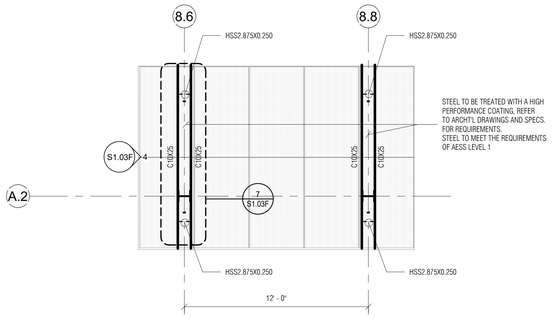
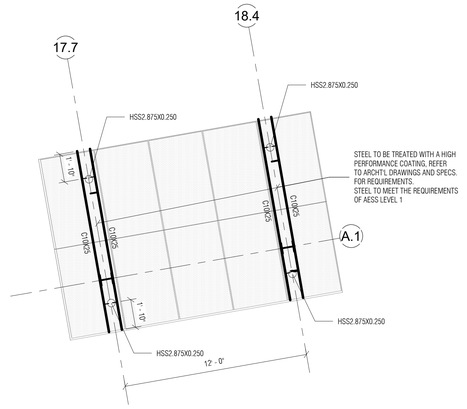
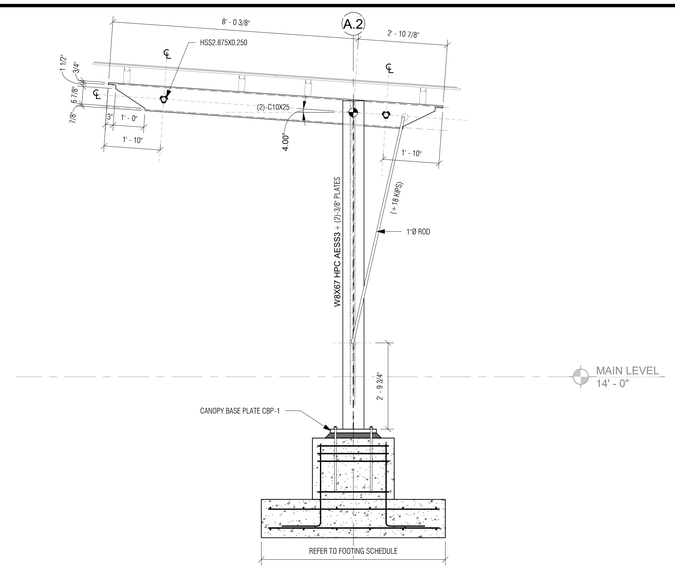


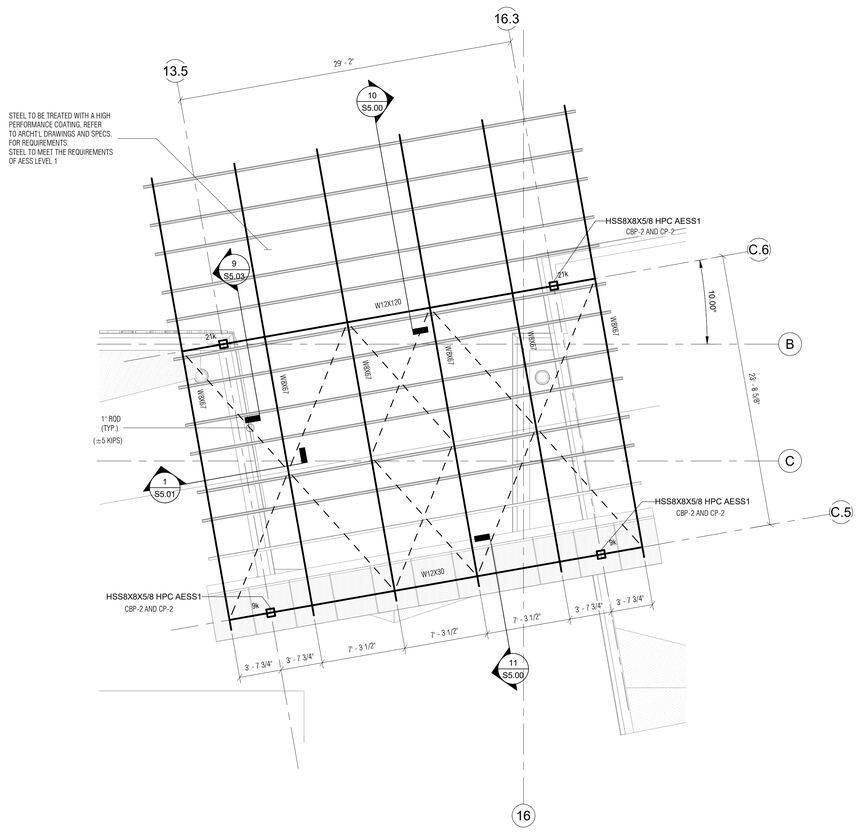
1 CANOPY ROOF FRAMING PLAN
1/4" = 1'-0"



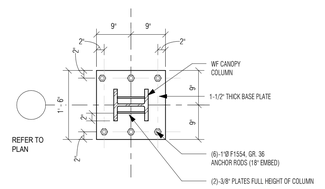
2 CANOPY ROOF FRAMING PLAN
1/4" = 1'-0"



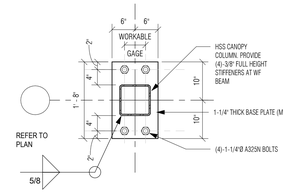
4 TYPICAL SMALL CANOPY ELEVATION
1/2" = 1'-0"



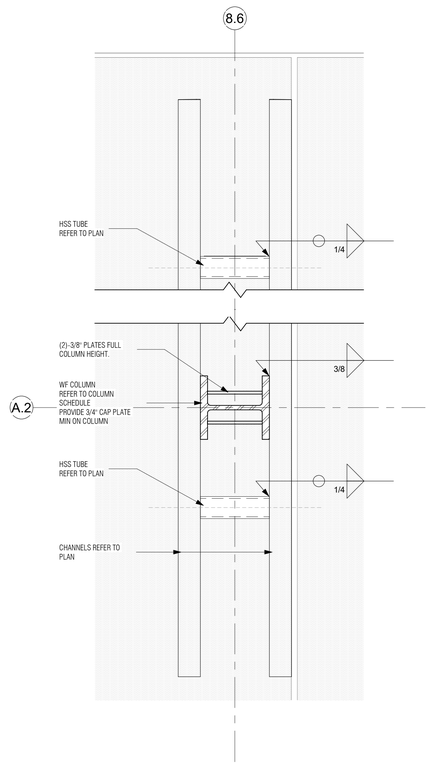
3 UPPER LEVEL ROOF FRAMING PLAN
3/16" = 1'-0"



CANOPY BASE PLATE CBP-1



CANOPY BASE PLATE CBP-2
AND CAP PLATE CP-2



7 UPPER LEVEL AREA A CANOPY - Callout 1
1 1/2" = 1'-0"

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KEY PLAN



DRAWING TITLE

CANOPY FRAMING PLAN

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OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

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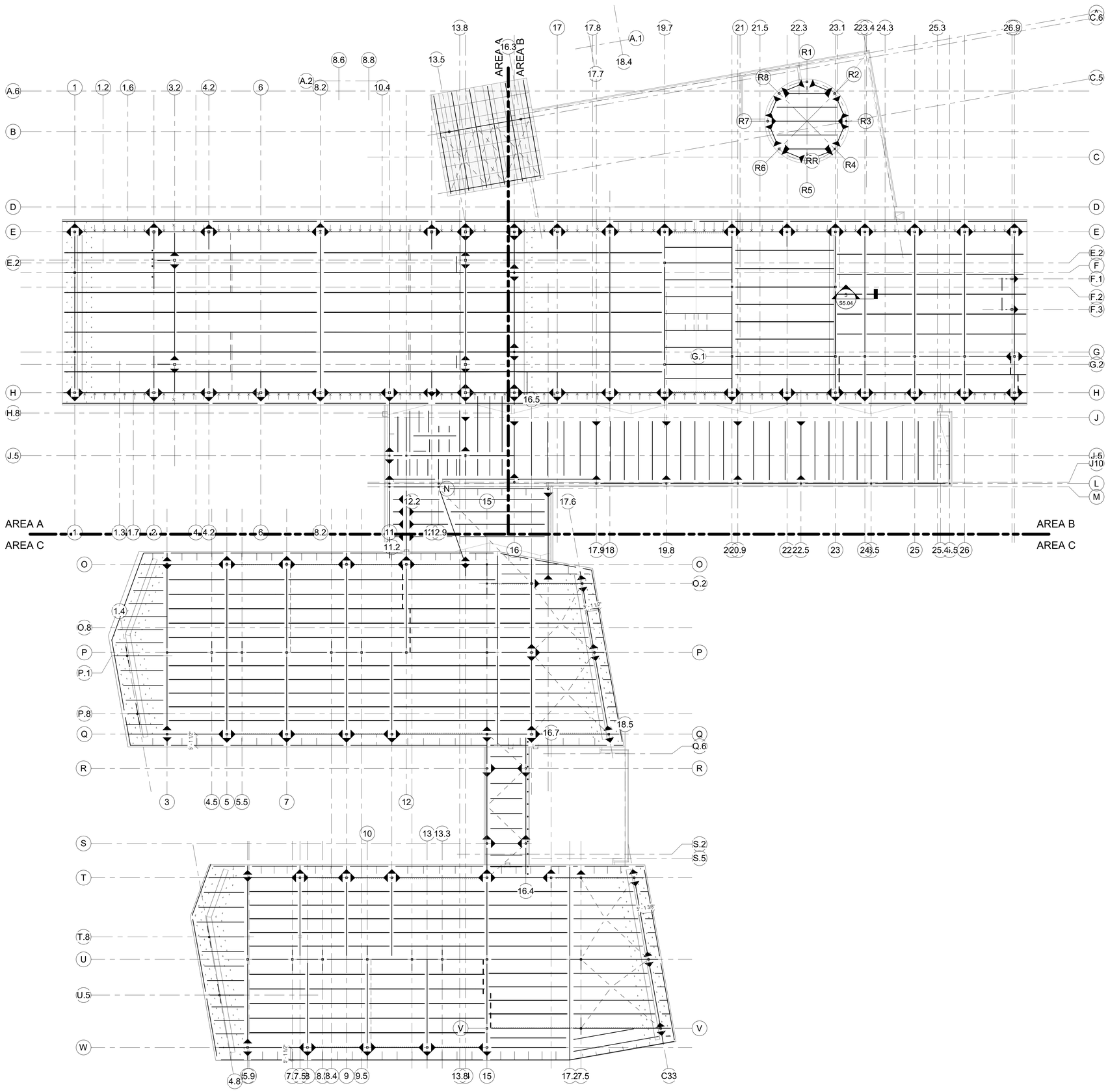

1 ROOF FRAMING PLAN - OVERALL
1/16" = 1'-0"

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STATE OF CONNECTICUT
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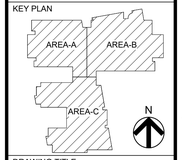

DRAWING TITLE

ROOF FRAMING PLAN - OVERALL

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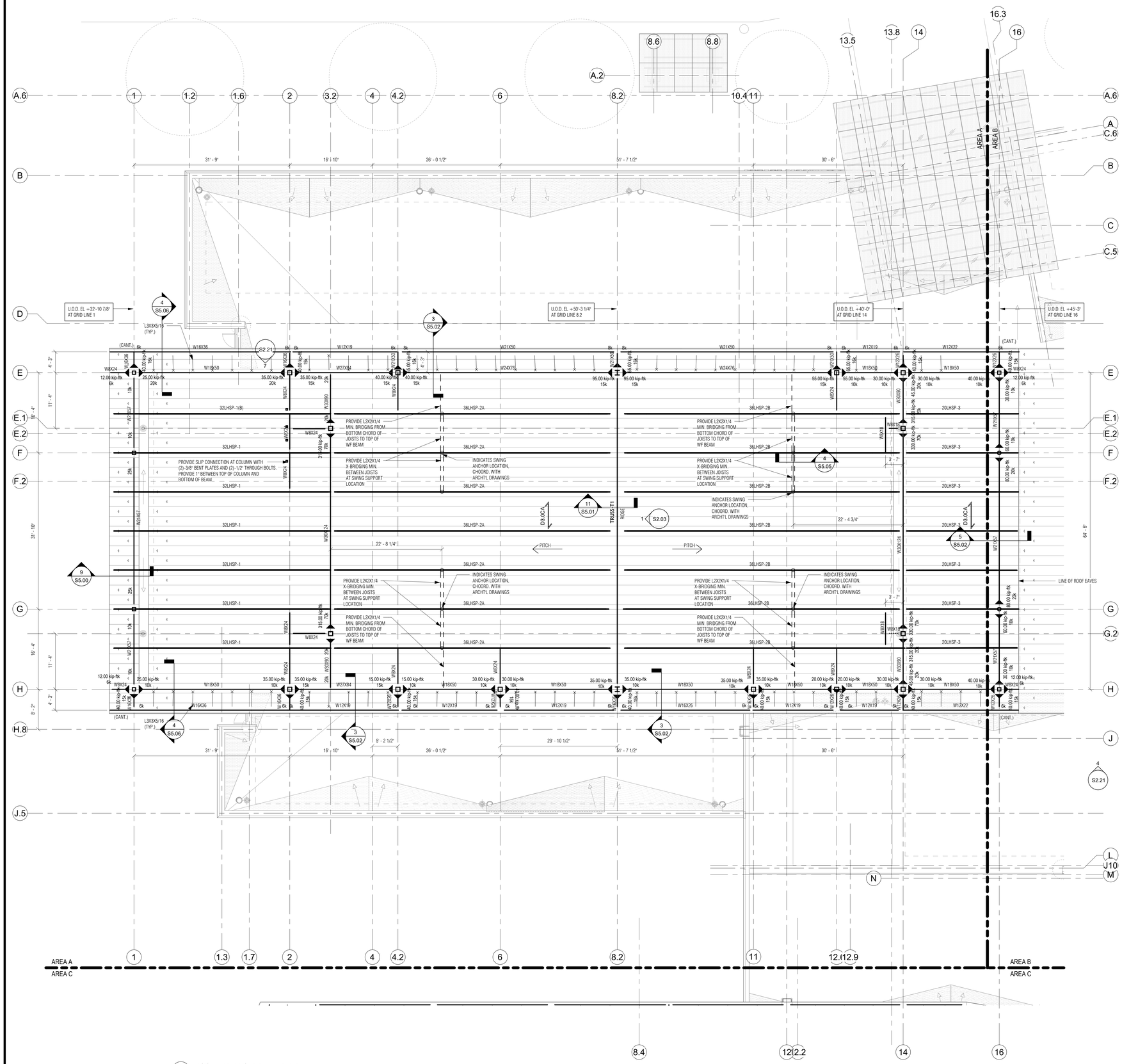

1 ROOF FRAMING PLAN - AREA A
1/8" = 1'-0"

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
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KEY PLAN



DRAWING TITLE

ROOF FRAMING PLAN - AREA A

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SCALE	1/8" = 1'-0"
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DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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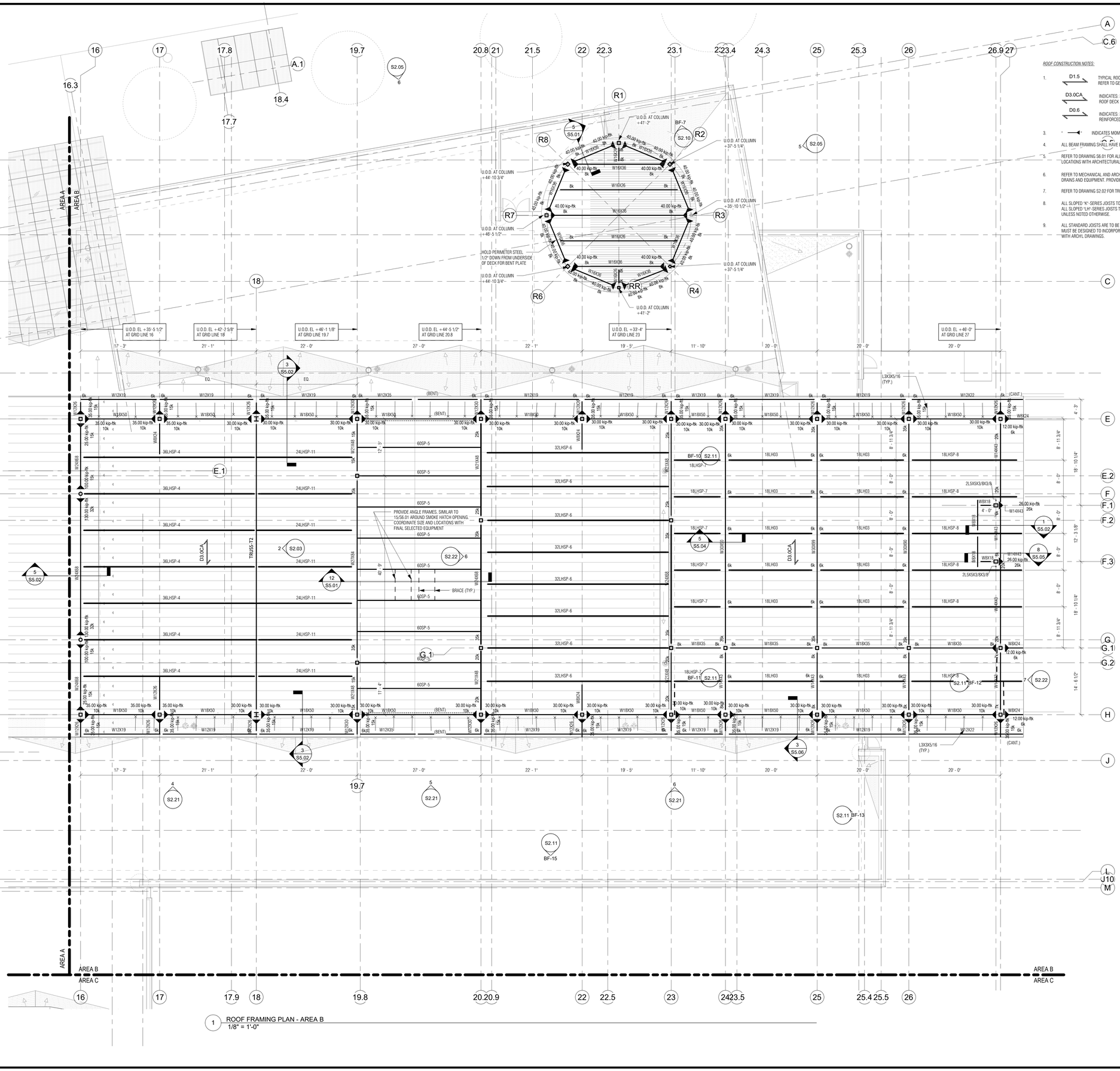

1 ROOF FRAMING PLAN - AREA B
1/8" = 1'-0"

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE 'B' METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
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PROFESSIONAL SEAL

STATE OF CONNECTICUT — MICHAEL J. SHEA — NO. 0035406 — LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF FRAMING PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S1.04B

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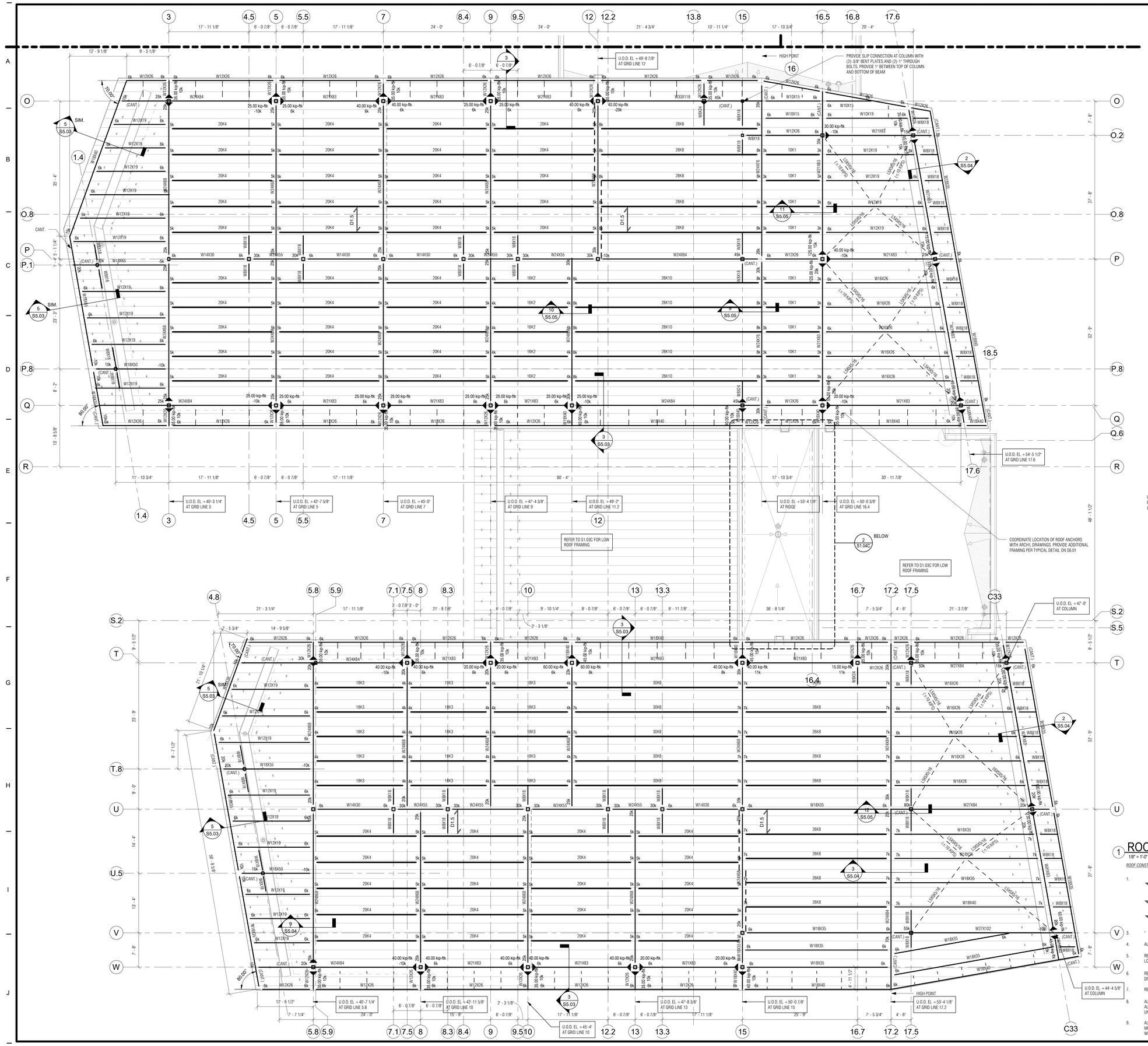

1 ROOF FRAMING PLAN - AREA C

1/8" = 1'-0"

ROOF CONSTRUCTION NOTES:

1. D1.5 — TYPICAL ROOF CONSTRUCTION: 1 1/2 "X20GA. GALVANIZED TYPE "B" METAL ROOF DECK, REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D3.0CA — INDICATES: 3" - 18 GAUGE/18 GAUGE 3NPA GALVANIZED CELLULAR ACOUSTIC ROOF DECK SYSTEM. REFER TO GENERAL NOTES FOR FASTENING REQUIREMENTS.
   D0.6 — INDICATES: 3" NORMAL WEIGHT CONCRETE SLAB ON 9/16" - 26GA. UFS FORM DECK REINFORCED WITH 6X6-W2.0XW2.0 WELDED WIRE FABRIC
2. INDICATES MOMENT CONNECTION, REFER TO TYPICAL DETAILS ON DRAWING S6.01
3. ALL BEAM FRAMING SHALL HAVE EQUAL SPACING BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
4. REFER TO DRAWING S6.01 FOR ALL ROOF FRAMES AT OPENINGS. COORDINATE ALL OPENING LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
5. REFER TO MECHANICAL AND ARCHITECTURAL DRAWINGS FOR ALL OPENING, DRAINS AND EQUIPMENT. PROVIDE FRAMES PER TYPICAL DETAILS
6. REFER TO DRAWING S2.02 FOR TRUSS ELEVATIONS AND DETAILS.
7. ALL SLOPED "K"-SERIES JOISTS TO HAVE 4" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. ALL SLOPED "LH"-SERIES JOISTS TO HAVE 8" DEEP JOIST SEAT AT CENTERLINE OF SUPPORTING MEMBER. UNLESS NOTED OTHERWISE.
8. ALL STANDARD JOISTS ARE TO BE DESIGNED PER STANDARD JOIST LOAD TABLES. HOWEVER, SLOPED JOISTS MUST BE DESIGNED TO INCORPORATE ADDITIONAL AXIAL LOAD CAUSED BY JOIST SLOPE. COORDINATE SLOPE WITH ARCH'L DRAWINGS.

2 LOW ROOF PARTIAL FRAMING PLAN - AREA C

1/8" = 1'-0"

U.O.D. = +41'-0"

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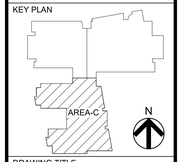
KEY PLAN



DRAWING TITLE

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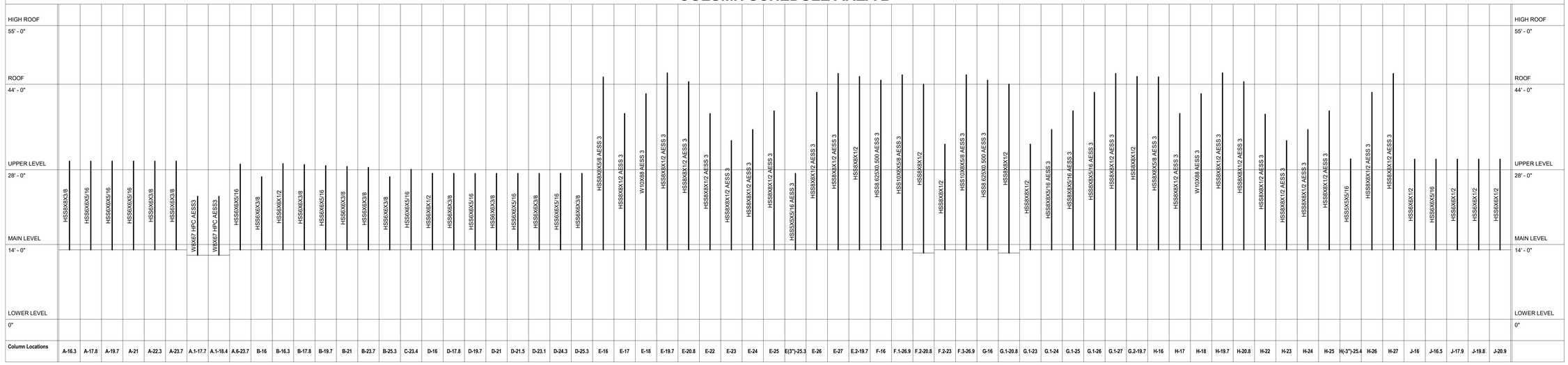
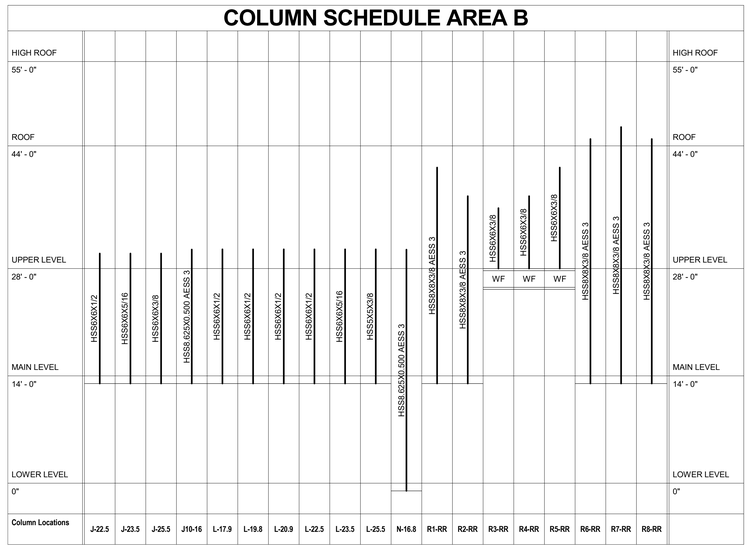
COLUMN SCHEDULE AREA A

| | | |

COLUMN SCHEDULE AREA B



COLUMN SCHEDULE AREA B



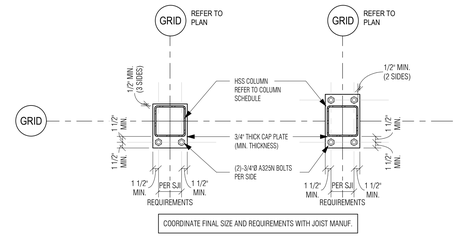
COLUMN PIER SCHEDULE AREA B			
GRID	T/CONC	PIER	BASE PLATE
A-16.3	13' - 0"	P1	BP-10
A-17.8	13' - 0"	P1	BP-9
A-19.7	13' - 0"	P1	BP-9
A-21	13' - 0"	P1	BP-10
A-22.3	13' - 0"	P3	BP-10
A-23.7	13' - 0"	P3	BP-10
A.1-17.7	12' - 0"	P4	CBP-1
A.1-18.4	12' - 0"	P4	CBP-1
A.6-23.7	13' - 0"	P1	BP-9
B-16	13' - 0"	P4	BP-15
B-16.3	13' - 0"	P1	BP-10
B-17.8	13' - 0"	P1	BP-5
B-19.7	13' - 0"	P1	BP-2
B-21	13' - 0"	P1	BP-2
B-23.7	13' - 0"	P1	BP-10
B-25.3	13' - 0"	P1	BP-10
C-23.4	13' - 0"	P1	BP-2
C.6-16.3	29' - 4"	N/A	CBP-2
D-16	13' - 0"	N/A	BP-5
D-17.8	13' - 0"	P1	BP-5
D-19.7	13' - 0"	P1	BP-2
D-21	13' - 0"	P1	BP-2
D-21.5	13' - 0"	N/A	BP-2
D-23.1	13' - 0"	P1	BP-2
D-24.3	13' - 0"	P1	BP-2
D-25.3	13' - 0"	P1	BP-10
E(3")-25.3	13' - 0"	P1	BP-10
E-16	13' - 0"	P1	BP-1
E-17	13' - 0"	P1	BP-1
E-18	13' - 0"	P1	BP-3
E-19.7	13' - 0"	P1	BP-1
E-20.8	13' - 0"	P1	BP-1
E-22	13' - 0"	P1	BP-1
E-23	13' - 0"	P1	BP-1
E-24	13' - 0"	P1	BP-1
E-25	13' - 0"	P1	BP-1
E-26	13' - 0"	P1	BP-9
E-27	13' - 0"	P1	BP-10
E.2-19.7	13' - 0"	N/A	BP-1
F-16	13' - 0"	P1	BP-1
F.1-26.9	13' - 0"	P2	BP-1

COLUMN PIER SCHEDULE AREA B			
GRID	T/CONC	PIER	BASE PLATE
F.2-20.8	12' - 5"	N/A	BP-1
F.2-23	13' - 0"	N/A	BP-1
F.3-26.9	13' - 0"	P2	BP-1
G-16	13' - 0"	N/A	BP-1
G.1-20.8	12' - 5"	N/A	BP-1
G.1-23	13' - 0"	N/A	BP-1
G.1-24	13' - 0"	N/A	BP-1
G.1-25	13' - 0"	N/A	BP-1
G.1-26	13' - 0"	N/A	BP-1
G.1-27	13' - 0"	P4	BP-9(C)
G.2-19.7	13' - 0"	N/A	BP-1
H(-3")-25.4	13' - 0"	P1	BP-10
H-16	13' - 0"	N/A	BP-1
H-17	13' - 0"	N/A	BP-1
H-18	13' - 0"	N/A	BP-3
H-19.7	13' - 0"	N/A	BP-1
H-20.8	13' - 0"	N/A	BP-1
H-22	13' - 0"	P1	BP-1
H-23	13' - 0"	N/A	BP-1
H-24	13' - 0"	P1	BP-1
H-25	13' - 0"	P1	BP-1
H-26	13' - 0"	P1	BP-9
H-27	13' - 0"	P4	BP-14
J10-16	13' - 0"	P3	BP-1
J-16	13' - 0"	P3	BP-5
J-16.5	13' - 0"	P1	BP-2
J-17.9	13' - 0"	P1	BP-5
J-19.8	13' - 0"	P1	BP-5
J-20.9	13' - 0"	P1	BP-5
J-22.5	13' - 0"	P1	BP-5
J-23.5	13' - 0"	P1	BP-2
J-25.5	13' - 0"	P3	BP-10
L-17.9	13' - 0"	P1	BP-9
L-19.8	13' - 0"	P1	BP-9
L-20.9	13' - 0"	P1	BP-9
L-22.5	13' - 0"	P1	BP-9
L-23.5	13' - 0"	P1	BP-9
L-25.5	13' - 0"	P3	BP-10
N-16.8	-1' - 0"	P1	BP-1
R1-RR	13' - 0"	P1	BP-1
R2-RR	13' - 0"	P1	BP-1
R3-RR	28' - 0"	N/A	BP-7
R4-RR	28' - 0"	N/A	BP-7
R5-RR	28' - 0"	N/A	BP-7
R6-RR	13' - 0"	P1	BP-1
R7-RR	13' - 0"	P1	BP-9
R8-RR	13' - 0"	P1	BP-9
Grand total: 88			

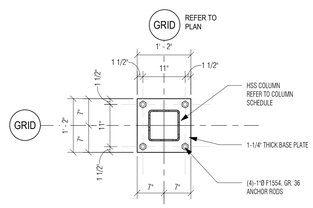
NOTE:
1. IF NO PIER DETAIL DESIGNATION IS GIVEN, COLUMN SITS DIRECTLY ON FOOTING OR STEEL BEAM.
2. REFER TO DRAWING S200 FOR BASE PLATE DETAILS
3. TOP OF CONCRETE IS GIVEN FROM LOWER LEVEL FINISHED FLOOR ELEVATION (0'-0")

COLUMN SCHEDULE NOTES:

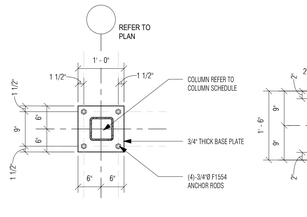
1. LINE AT BOTTOM OF COLUMN INDICATES BOTTOM OF STEEL BASE PLATE. ADD 2" FOR GROUT AND LEVELING NUTS FOR TOP OF CONCRETE ELEVATION SEE COLUMN PIER SCHEDULE. IF NO PIER DETAIL IS GIVEN, COLUMN SITS DIRECTLY ON FOOTING OR STEEL BEAM.
2. APPROXIMATE TOP OF COLUMN ELEVATION. FOR ACTUAL ELEVATION SEE PLANS AND SECTIONS.
3. PROVIDE 1/4" CAP PLATE AT ALL HSS COLUMNS & 3/4" CAP PLATE AT ALL WIDE FLANGE COLUMNS UNLESS OTHERWISE NOTED.
4. ALL ROUND COLUMNS TO MEET AESS LEVEL 3 REQUIREMENTS. REFER TO COLUMN SCHEDULE FOR ADDITIONAL COLUMNS INDICATED AESS. REFER TO SPECIFICATIONS FOR AESS REQUIREMENTS.
5. "INT. PAINT" INDICATES COLUMN TO RECEIVE INTUMESCENT PAINT PROVIDING A 1 HOUR FIRE RATING. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
6. "HPC" INDICATES MEMBER TO RECEIVE HIGH PERFORMANCE COATING. REFER TO ARCH'L DRAWINGS AND SPECS FOR ADDITIONAL REQUIREMENTS.



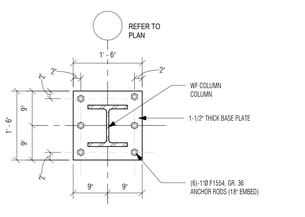
16 TYPICAL CAP PLATE AT JOIST
3/4" = 1'-0"



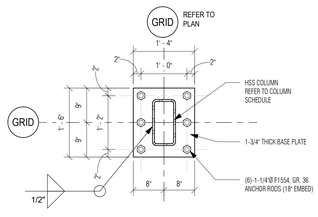
BASE PLATE BP- 1



BASE PLATE BP-2



BASE PLATE BP-3



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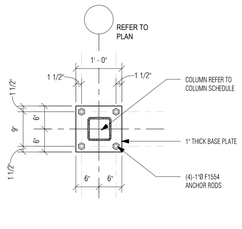
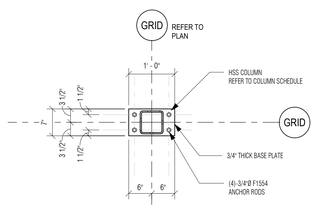
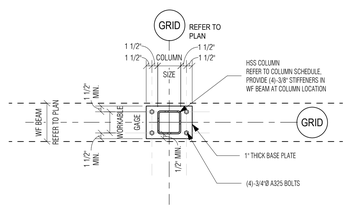


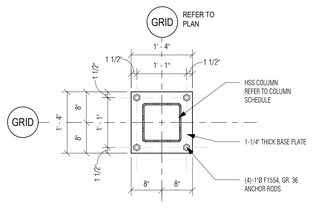
BASE PLATE BP-5



BASE PLATE BP-6



BASE PLATE BP-7 & CP-1



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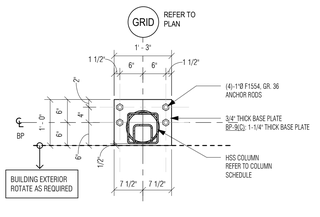
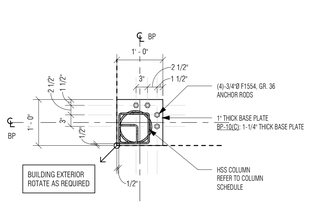


BASE PLATE BP- 9



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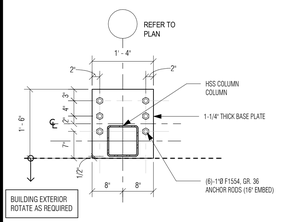
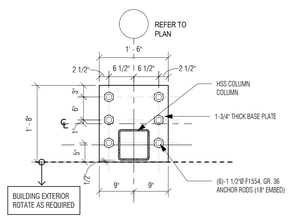


BASE PLATE BP-11



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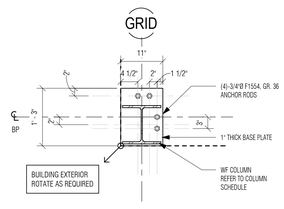

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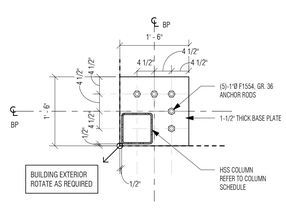

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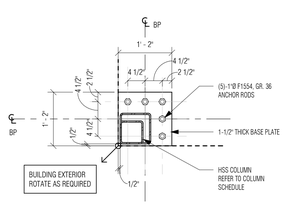

BASE PLATE BP- 15

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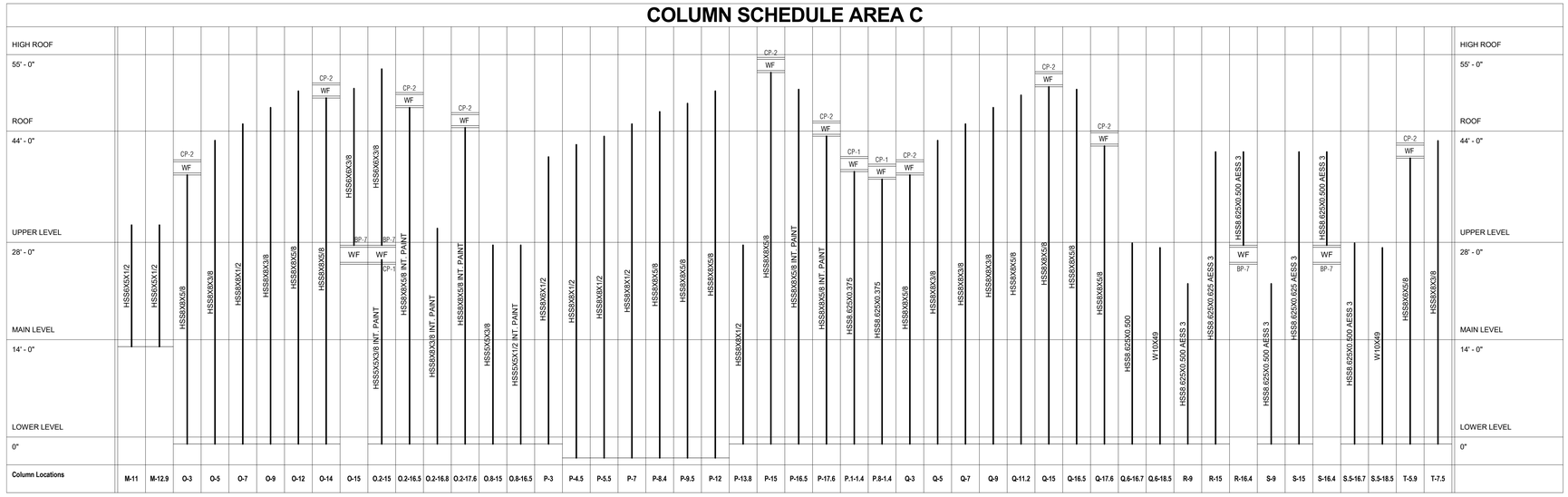
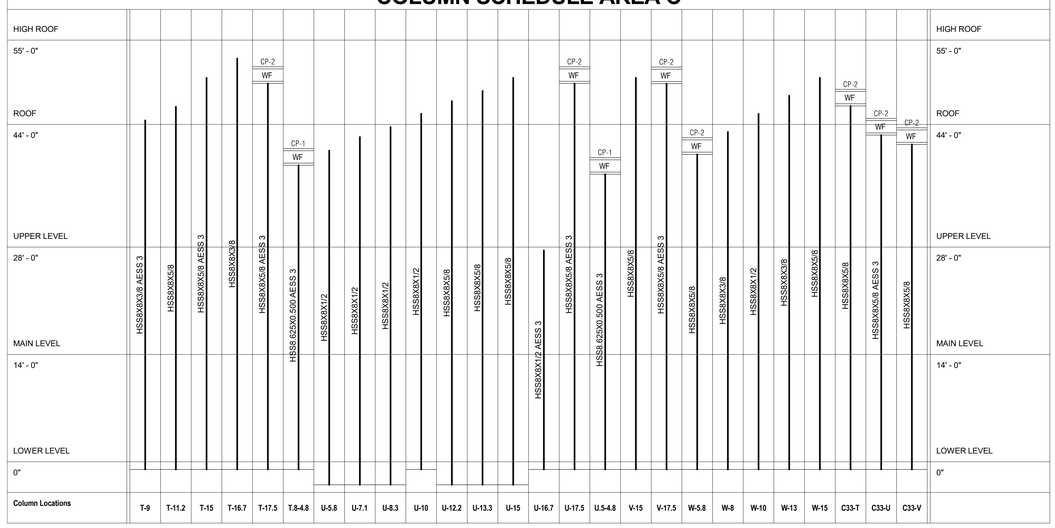
COLUMN SCHEDULE AREA C



COLUMN SCHEDULE AREA C



NOTE:
1. IF NO PIER DETAIL DESIGNATION IS GIVEN. COLUMN SITS DIRECTLY ON FOOTING OR STEEL BEAM.
2. REFER TO DRAWING S200 FOR BASE PLATE DETAILS
3. TOP OF CONCRETE IS GIVEN FROM LOWER LEVEL FINISHED FLOOR ELEVATION (0'-0")

COLUMN SCHEDULE NOTES:

1. LINE AT BOTTOM OF COLUMN INDICATES BOTTOM OF STEEL BASE PLATE. ADD 2" FOR GROUT AND LEVELING NUTS FOR TOP OF CONCRETE ELEVATION SEE COLUMN PIER SCHEDULE. IF NO PIER DETAIL IS GIVEN. COLUMN SITS DIRECTLY ON FOOTING OR STEEL BEAM.
2. APPROXIMATE TOP OF COLUMN ELEVATION. FOR ACTUAL ELEVATION SEE PLANS AND SECTIONS.
3. PROVIDE 1/4" CAP PLATE AT ALL HSS COLUMNS & 3/4" CAP PLATE AT ALL WIDE FLANGE COLUMNS UNLESS OTHERWISE NOTED.
4. ALL ROUND COLUMNS TO MEET AESS LEVEL 3 REQUIREMENTS. REFER TO COLUMN SCHEDULE FOR ADDITIONAL COLUMNS INDICATED AESS. REFER TO SPECIFICATIONS FOR AESS REQUIREMENTS.
5. "INT. PAINT" INDICATES COLUMN TO RECEIVE INTUMESCENT PAINT PROVIDING A 1 HOUR FIRE RATING. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
6. "HPC" INDICATES MEMBER TO RECEIVE HIGH PERFORMANCE COATING. REFER TO ARCH'L DRAWINGS AND SPECS FOR ADDITIONAL REQUIREMENTS.

COLUMN PIER SCHEDULE AREA C

GRID	T/CONC	PIER	BASE PLATE
C33-T	-1' - 0"	P1	BP-10(C)
C33-U	-1' - 0"	P1	BP-9(C)
C33-V	-1' - 0"	P1	BP-10(C)
O-3	-1' - 0"	P1	BP-10(C)
O-5	-1' - 0"	P1	BP-9(C)
O-7	-1' - 0"	P6	BP-11
O-9	-1' - 0"	P1	BP-9(C)
O-12	-1' - 0"	P5	BP-4
O-14	-1' - 0"	N/A	BP-1
O-15	27' - 7"	N/A	BP-7
O.2-15	-1' - 0"	N/A	BP-5
O.2-15	27' - 7"	N/A	BP-7
O.2-16.5	-1' - 0"	P1	BP-1
O.2-16.8	-1' - 0"	P1	BP-10(C)
O.2-17.6	-1' - 0"	P1	BP-10(C)
O.8-15	-1' - 0"	P1	BP-9(C)
O.8-16.5	-1' - 0"	P1	BP-5
P-3	-1' - 0"	P3	BP-1
P-4.5	-3' - 0"	P3	BP-1
P-5.5	-3' - 0"	P3	BP-1
P-7	-3' - 0"	P5	BP-4
P-8.4	-3' - 0"	P3	BP-1
P-9.5	-3' - 0"	P3	BP-1
P-12	-3' - 0"	P5	BP-4
P-13.8	-1' - 0"	P3	BP-9(C)
P-15	-1' - 0"	P3	BP-9(C)
P-16.5	-1' - 0"	P1	BP-1
P-17.6	-1' - 0"	P1	BP-9(C)
P.1-1.4	-1' - 0"	P1	BP-10(C)
P.8-1.4	-1' - 0"	P1	BP-10(C)
Q-3	-1' - 0"	P1	BP-10(C)
Q-5	-1' - 0"	P1	BP-9(C)
Q-7	-1' - 0"	P1	BP-9(C)
Q-9	-1' - 0"	P1	BP-9(C)
Q-11.2	-1' - 0"	N/A	BP-1
Q-15	-1' - 0"	N/A	BP-1
Q-16.5	-1' - 0"	P1	BP-1
Q-17.6	-1' - 0"	P1	BP-10(C)
Q.6-16.7	-1' - 0"	P1	BP-1
Q.6-18.5	-1' - 0"	P1	BP-13
R-9	-1' - 0"	P1	BP-9(C)
R-15	-1' - 0"	N/A	BP-1
R-16.4	27' - 7"	N/A	BP-7
S-9	-1' - 0"	P1	BP-9(C)
S-15	-1' - 0"	N/A	BP-1
S-16.4	27' - 7"	N/A	BP-7
S.5-16.7	-1' - 0"	P1	BP-1
S.5-18.5	-1' - 0"	P1	BP-13
T-5.9	-1' - 0"	P1	BP-10(C)
T-7.5	-1' - 0"	P1	BP-9(C)
T-9	-1' - 0"	P1	BP-9(C)
T-11.2	-1' - 0"	N/A	BP-1
T-15	-1' - 0"	N/A	BP-1
T-16.7	-1' - 0"	P1	BP-1
T-17.5	-1' - 0"	P1	BP-1
T.8-4.8	-1' - 0"	P1	BP-10(C)
U-5.8	-3' - 0"	P3	BP-1
U-7.1	-3' - 0"	P3	BP-1
U-8.3	-3' - 0"	P3	BP-1
U-10	-1' - 0"	P5	BP-4
U-12.2	-3' - 0"	P3	BP-1
U-13.3	-3' - 0"	P3	BP-1
U-15	-3' - 0"	P5	BP-4
U-16.7	-1' - 0"	P1	BP-1
U-17.5	-1' - 0"	P1	BP-1
U.5-4.8	-1' - 0"	P1	BP-10(C)
V-15	-1' - 0"	P6	BP-13
V-17.5	-1' - 0"	P1	BP-9(C)
W-5.8	-1' - 0"	P1	BP-10(C)
W-8	-1' - 0"	P1	BP-9(C)
W-10	-1' - 0"	P6	BP-11
W-13	-1' - 0"	P1	BP-9(C)
W-15	-1' - 0"	P1	BP-10(C)
Grand total: 73			

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

DRAWING TITLE

COLUMN SCHEDULE AREAS C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S2.02

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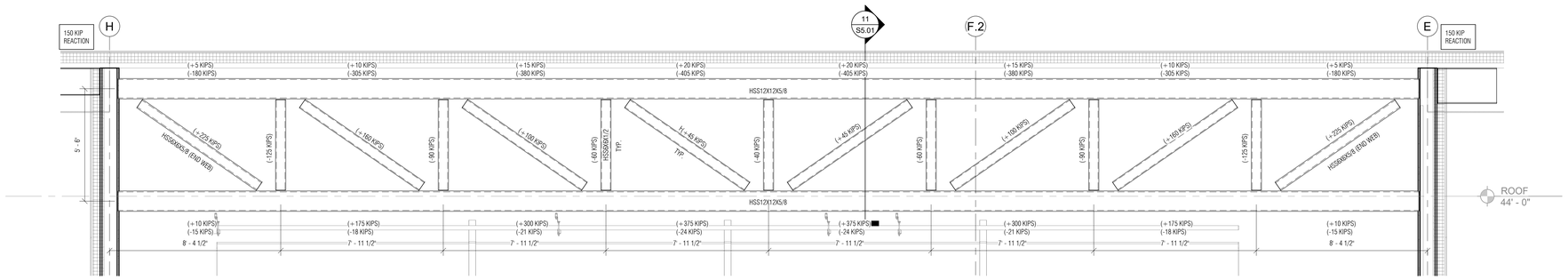
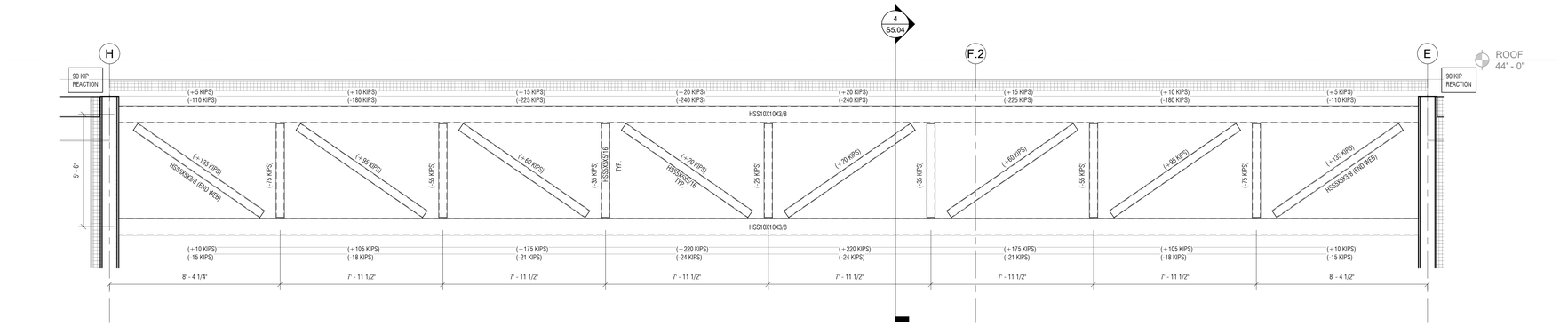


1 TRUSS T-1 ELEVATION
3/8" = 1'-0"



2 TRUSS T-2 ELEVATION
3/8" = 1'-0"

TRUSS ELEVATION NOTES:

1. DO NOT SCALE FRAME ELEVATIONS OR DETAILS. COORDINATE WITH PLANS.
2. TRUSS CONNECTIONS TO BE DESIGNED BY A LICENSED ENGINEER FROM THE STATE OF CONNECTICUT. ALL CALCULATIONS TO BE SIGNED AND SELAED. MEMBER FORCES SHOWN ABOVE ARE FACTORED ALLOWABLE STRESS DESIGN LOADS. NO ADDITIONAL LOAD FACTORS SHOULD BE APPLIED. (-##k) INDICATES COMPRESSION FORCE IN KIPS.
   (+ ##k) INDICATES TENSION FORCES IN KIPS.
3. ALL DOUBLE ANGLES TO HAVE INTERMEDIATE CONNECTION AT MIDSPAN OF MEMBER.
4. TRUSS HAS BEEN DESIGNED WITH ADDITIONAL 250 LB POINT LOAD AT EACH BOTTOM CHORD PANEL POINT TO ACCOUNT FOR BASEBALL HOOP LOADING. GYM EQUIPMENT SHALL BE HUNG WITHIN 6' OF PANEL POINTS UNLESS APPROVED BY MHAI.
5. SPLICES IN CHORDS OF TRUSS MUST BE FULL PENETRATION WELDS. LOCATIONS OF SPLICES MUST BE SUBMITTED FOR REVIEW BY MHAI AS PART OF TRUSS CONNECTION DESIGN DELEGATED DESIGN SUBMITTAL

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KEY PLAN



DRAWING TITLE

TRUSS ELEVATIONS AND DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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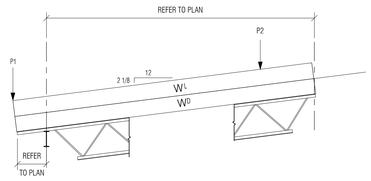


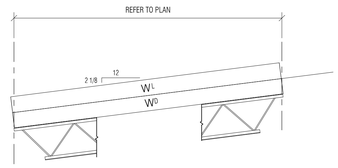
32LHSP-1 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 8'
3. JOIST 32LHSP-1(B) TO BE DESIGNED WITH ADDITIONAL POINT LOAD (P2) FROM ROCK CLIMBING WALL PULLEY SYSTEM. COORDINATE FINAL LOCATION AND WITH PULLEY MANUF.

W_D = 286 LB/FT
W^L = 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

P1: 370 LBS. DL
250 LBS. LL

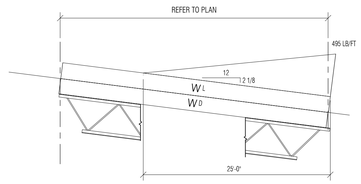
P2: PULLEY SYSTEM LOAD
(32LHSP-1(B) ONLY)



36LHSP-2A JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE A SEAT HEIGHT OF 8'
3. JOIST TO BE DESIGNED WITH 250 LB POINT LOAD AT EVERY PANEL POINT (BASKETBALL HOOPS)
4. JOIST TO BE DESIGNED WITH 500 LB POINT LOAD WHERE NOTED ON PLAN (SWINGS)

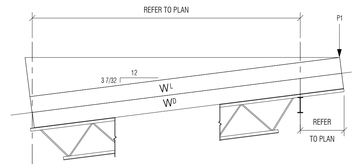
W_D = 286 LB/FT
W^L = 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360



36LHSP-2B JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE A SEAT HEIGHT OF 8'
3. JOIST TO BE DESIGNED WITH 250 LB POINT LOAD AT EVERY PANEL POINT (BASKETBALL HOOPS)
4. JOIST TO BE DESIGNED WITH 500 LB POINT LOAD WHERE NOTED ON PLAN (SWINGS)

W_D = 286 LB/FT
W^L = 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

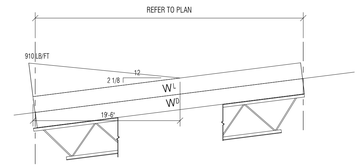


20LHSP-3 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 8'

W_D = 286 LB/FT
W^L = 495 LB/FT - 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

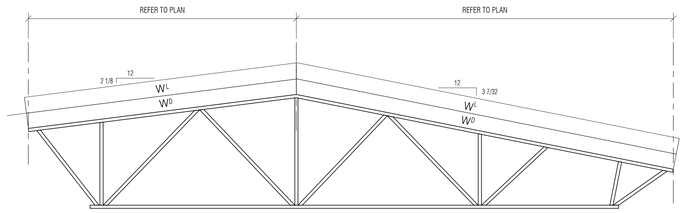
P1: 370 LBS. DL
250 LBS. LL



36LHSP-4 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 8'
3. JOIST BOTTOM CHORD TO BE DESIGNED WITH ADDITIONAL 10 PSF DEAD LOAD (MULTIPLY BY TRIBUTARY WIDTH) FROM PIPE GRID. COORDINATE ATTACHMENT WITH PIPE GRID MANUF. AND PROVIDE BOTTOM CHORD REINFORCEMENT AS REQUIRED

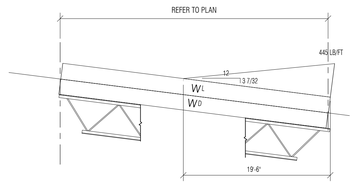
W_D = 286 LB/FT
W^L = 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360



60SP-5 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY
2. JOIST TO HAVE SEAT HEIGHT OF 8'.
3. JOIST BOTTOM CHORD TO BE DESIGNED WITH ADDITIONAL 10 PSF DEAD LOAD (MULTIPLY BY TRIBUTARY WIDTH) FROM PIPE GRID. COORDINATE ATTACHMENT WITH PIPE GRID MANUF. AND PROVIDE BOTTOM CHORD REINFORCEMENT AS REQUIRED
4. JOIST TO BE DESIGNED FOR ADDITIONAL POINT LOAD FROM SMOKE HATCH.

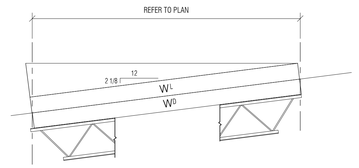
W_D = 245 LB/FT
W^L = 210 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360



32LHSP-6 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 8'

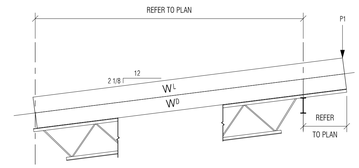
W_D = 260 LB/FT
W^L = 225 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360



18LHSP-7 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE A SEAT HEIGHT OF 8'

W_D = 300 LB/FT
W^L = 510 LB/FT - 355 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

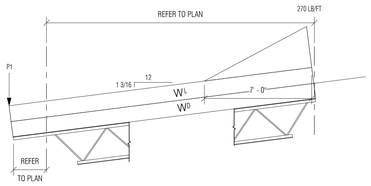


18LHSP-8 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 8'

W_D = 300 LB/FT
W^L = 255 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

P1: 450 LBS. DL
260 LBS. LL

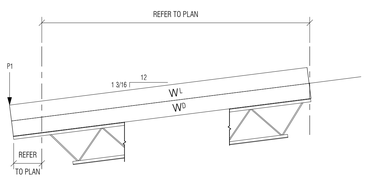


40LHSP-9 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 6-1/2"

W_D = 145 LB/FT
W^L = 130 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

P1: 190 LBS. DL
130 LBS. LL

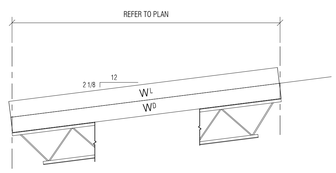


40LHSP-10 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE SEAT HEIGHT OF 6-1/2"

W_D = 145 LB/FT
W^L = 270 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

P1: 190 LBS. DL
270 LBS. LL



24LHSP-11 JOIST DIAGRAM

1. JOIST MANUFACTURER COORDINATE MECH'L DUCT OPENINGS THROUGH JOIST -IF ANY.
2. JOIST TO HAVE A SEAT HEIGHT OF 8'
3. JOIST BOTTOM CHORD TO BE DESIGNED WITH ADDITIONAL 10 PSF DEAD LOAD (MULTIPLY BY TRIBUTARY WIDTH) FROM PIPE GRID. COORDINATE ATTACHMENT WITH PIPE GRID MANUF. AND PROVIDE BOTTOM CHORD REINFORCEMENT AS REQUIRED

W_D = 286 LB/FT
W^L = 245 LB/FT
$\triangle_L$ = L/360
$\triangle_{TL}$ = L/360

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

TRUSS ELEVATIONS AND DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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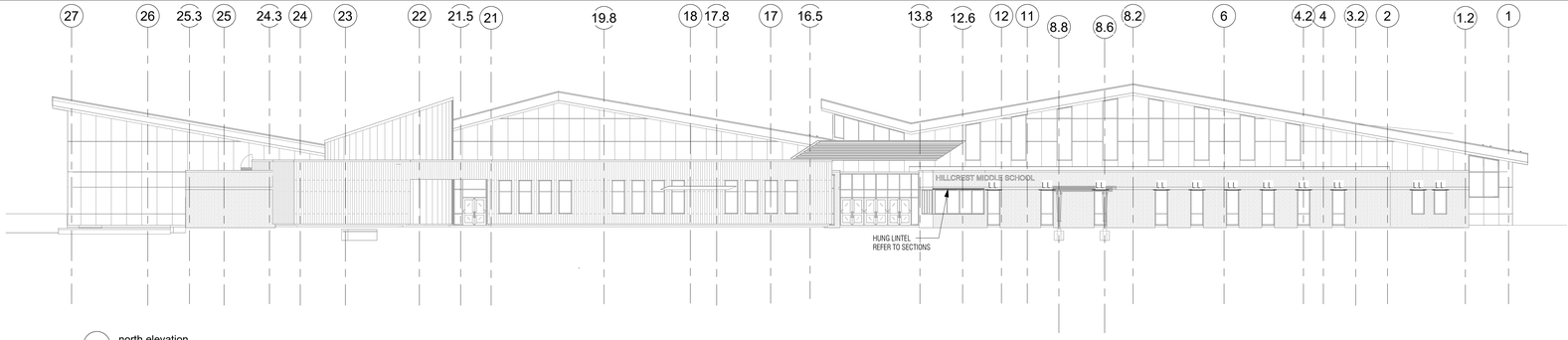
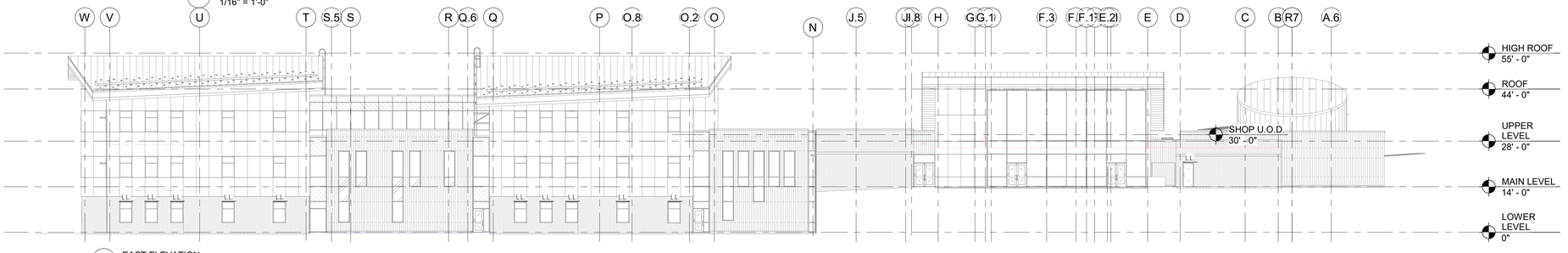


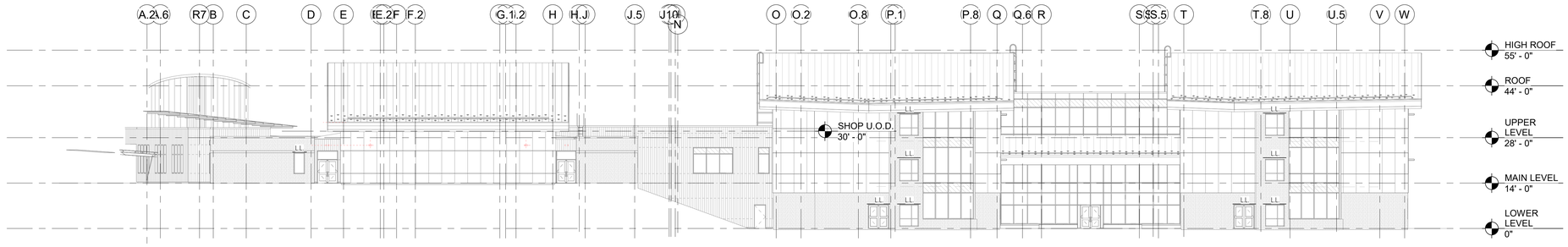
1 north elevation
1/16" = 1'-0"



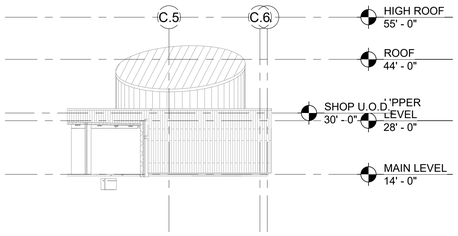
2 EAST ELEVATION
1/16" = 1'-0"



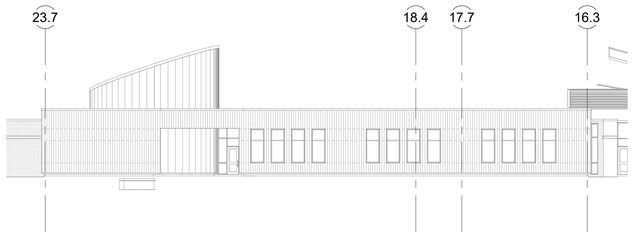
3 SOUTH ELEVATION
1/16" = 1'-0"



4 WEST ELEVATION
1/16" = 1'-0"



5 EAST ELEVATION
1/16" = 1'-0"



6 NORTH ELEVATION
1/16" = 1'-0"

EXTERIOR ELEVATION NOTES

1. "L.L." INDICATES LOOSE LINTEL. REFER TO TYPICAL DETAIL ON S6.01. COORDINATE ADDITIONAL LOOSE LINTEL LOCATIONS WITH ARCHITECTURAL AND MEP DRAWINGS.

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KEY PLAN



DRAWING TITLE

ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	08/15/2025
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APPROVED BY	PS

ISSUE DATES

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3	03/16/2026	50% CD
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5	05/19/2026	100% CD

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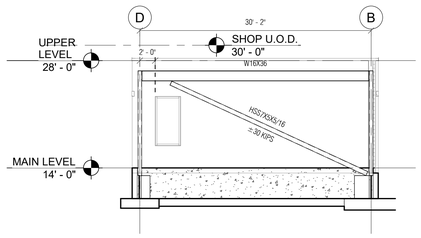
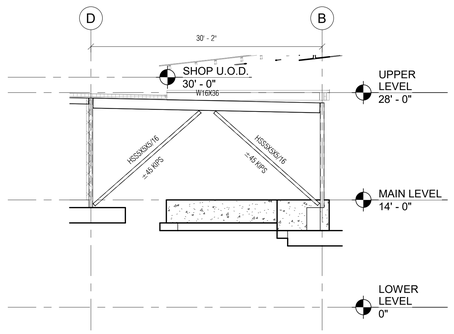
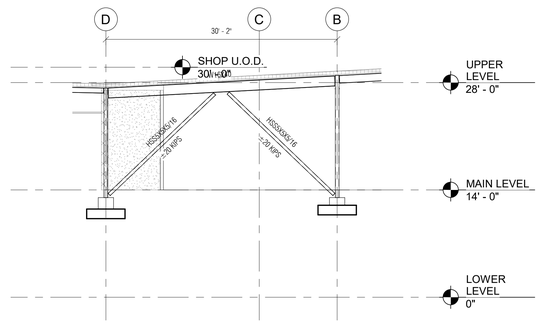


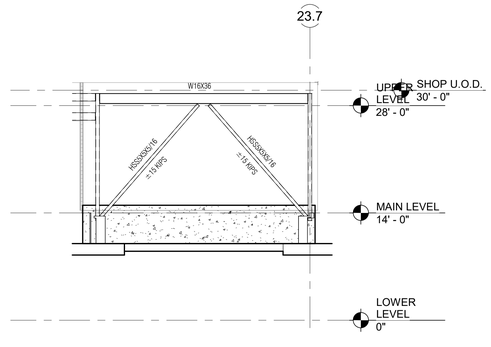
BF-1 / S2.10 BRACE FRAME ELEVATION AT GRID 1.2
SCALE: 1/8" = 1'-0"



BF-5 / S2.10 BRACE FRAME ELEVATION AT GRID 16.2
SCALE: 1/8" = 1'-0"



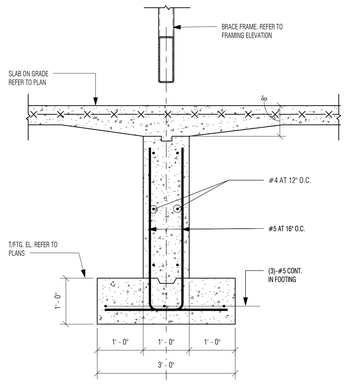
BF-6 / S2.10 BRACE FRAME ELEVATION AT GRID 17.8
SCALE: 1/8" = 1'-0"



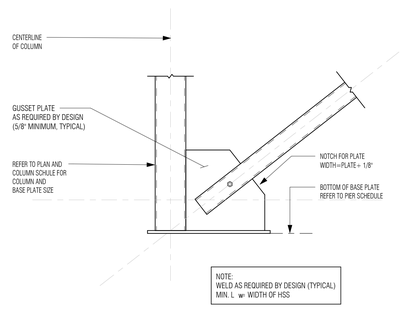
BF-7 / S2.10 BRACE FRAME ELEVATION AT GRID A
SCALE: 1/8" = 1'-0"

BRACE FRAME NOTES:

1. DO NOT SCALE FRAME ELEVATIONS OR DETAILS. COORDINATE WITH PLANS.
2. DO NOT INCREASE ALLOWABLE STRESSES FOR CONNECTION DESIGN.
3. MEMBER LOADS NOTED, (i.e. 6.7K), (K=Kips), ARE REVERSIBLE MEMBER AXIAL LOADS TO BE USED TO DESIGN CONNECTIONS AT BOTH ENDS OF EACH MEMBER. APPLY FULL LOAD AT EACH END, AND COMBINE WITH GRAVITY LOADS AS APPLICABLE.
4. BOLTED CONNECTIONS ON BRACING FRAMES SHALL USE STANDARD HOLES AND SLIP-CRITICAL BOLTS.
5. SEISMIC BRACING CONNECTIONS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF CONNECTICUT.

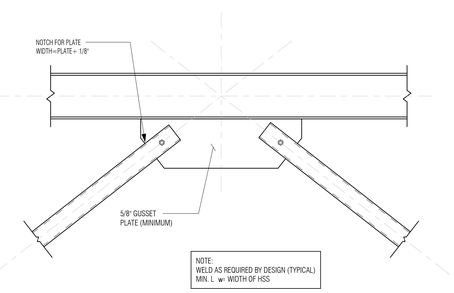


7 BRACE FRAME FOUNDATION DETAIL

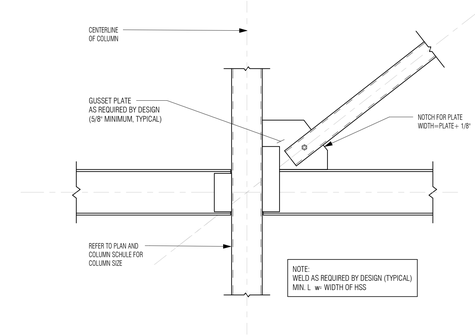


BEAM / COLUMN / BRACE BASE CONNECTION DETAIL

8 BEAM / COLUMN / BRACE BASE CONNECTION DETAIL



9 BEAM / BRACING CONNECTION DETAIL



BEAM / COLUMN / BRACE CONNECTION DETAIL

10 BEAM / COLUMN / BRACE CONNECTION DETAIL

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TRUMBULL HILLCREST MIDDLE SCHOOL

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KEY PLAN



DRAWING TITLE

BRACE FRAME ELEVATIONS AND DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
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DRAWN BY	Author
APPROVED BY	Approver

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S2.10

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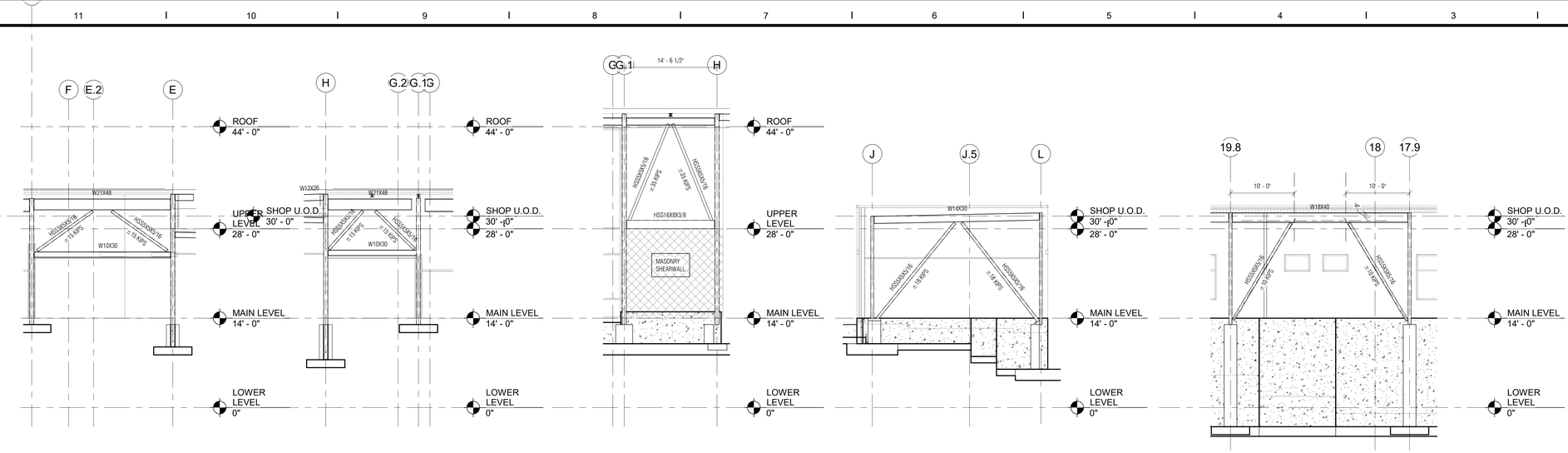


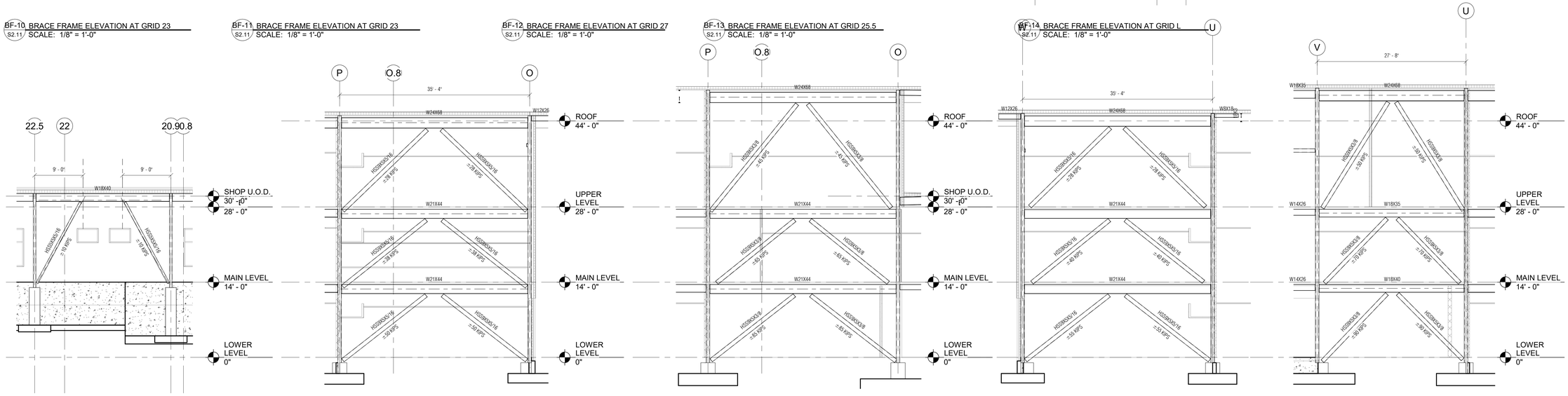
BF-10 BRACE FRAME ELEVATION AT GRID 23
S2.11 SCALE: 1/8" = 1'-0"

BF-11 BRACE FRAME ELEVATION AT GRID 23
S2.11 SCALE: 1/8" = 1'-0"

BF-12 BRACE FRAME ELEVATION AT GRID 27
S2.11 SCALE: 1/8" = 1'-0"

BF-13 BRACE FRAME ELEVATION AT GRID 25.5
S2.11 SCALE: 1/8" = 1'-0"

BF-14 BRACE FRAME ELEVATION AT GRID L
S2.11 SCALE: 1/8" = 1'-0"



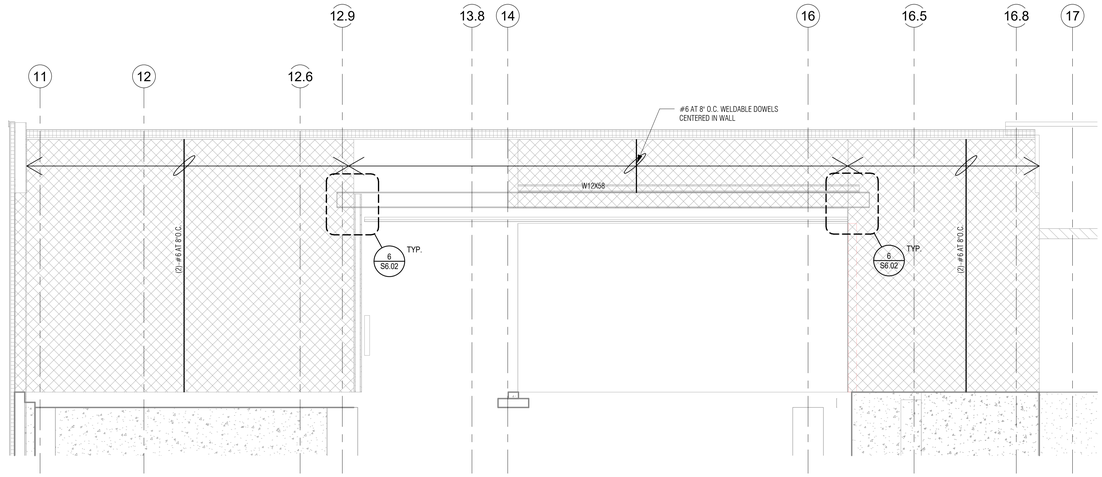
BF-15 BRACE FRAME ELEVATION AT GRID L
S2.11 SCALE: 1/8" = 1'-0"

BF-16 BRACE FRAME ELEVATION AT GRID 7
S2.11 SCALE: 1/8" = 1'-0"

BF-17 BRACE FRAME ELEVATION AT GRID 12
S2.11 SCALE: 1/8" = 1'-0"

BF-18 BRACE FRAME ELEVATION AT GRID 10
S2.11 SCALE: 1/8" = 1'-0"

BF-19 BRACE FRAME ELEVATION AT GRID 15
S2.11 SCALE: 1/8" = 1'-0"



FW1 FIRE WALL ELEVATION
S2.11 SCALE: 1/4" = 1'-0"

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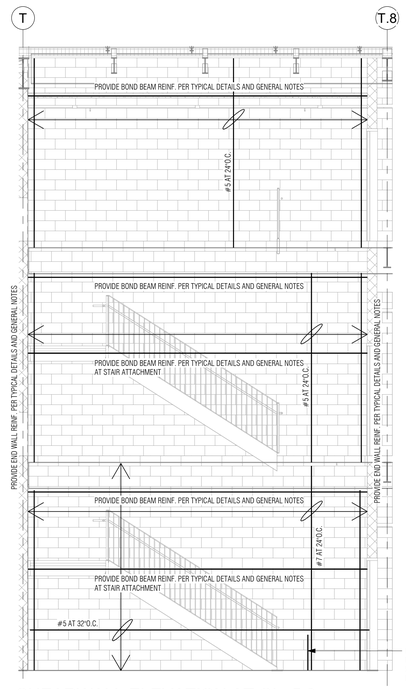
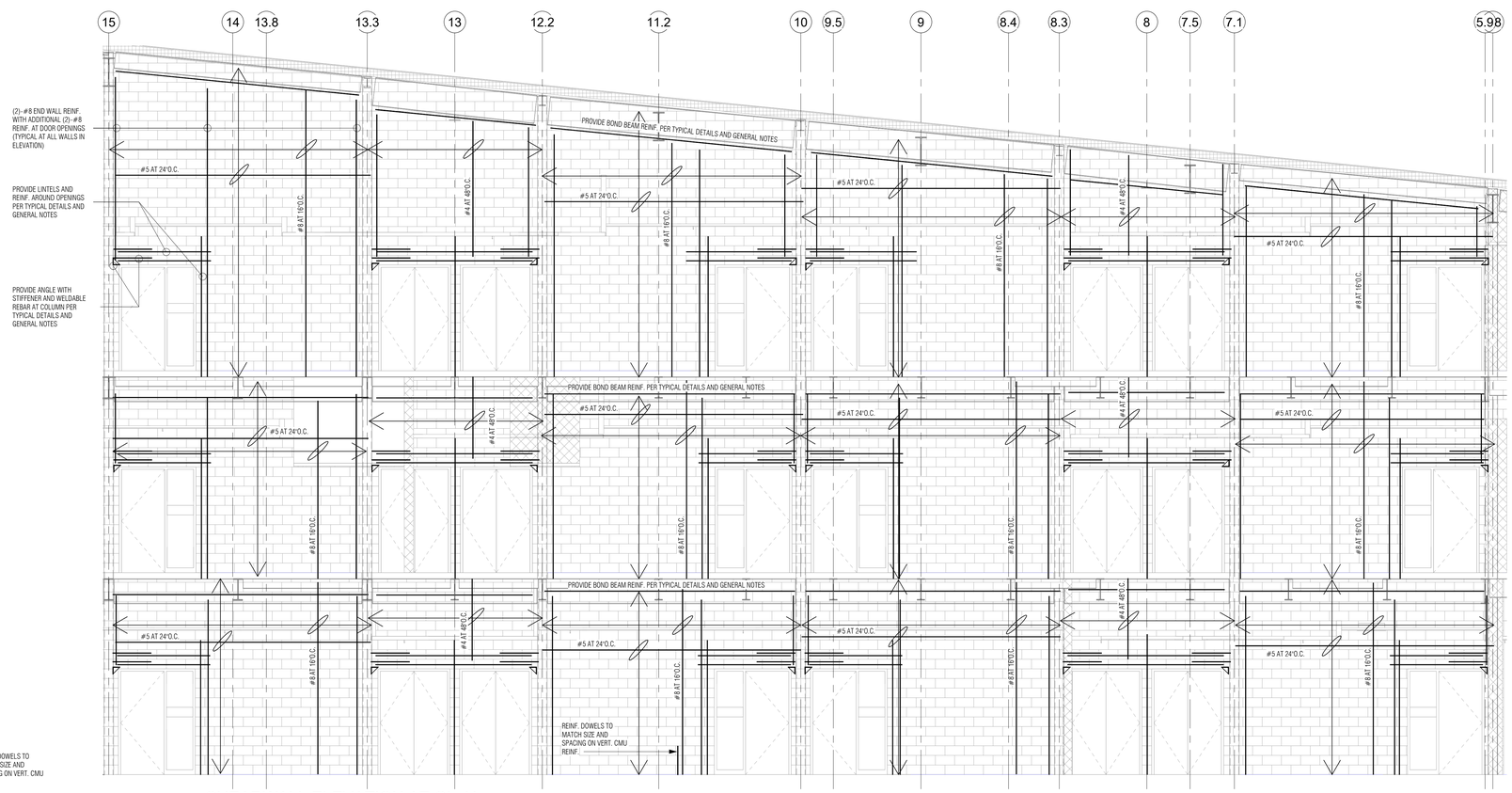
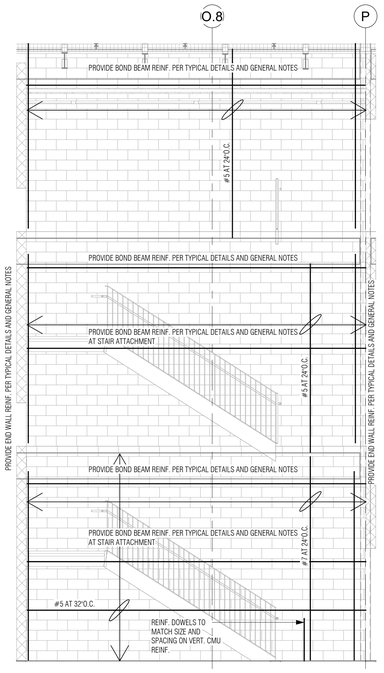


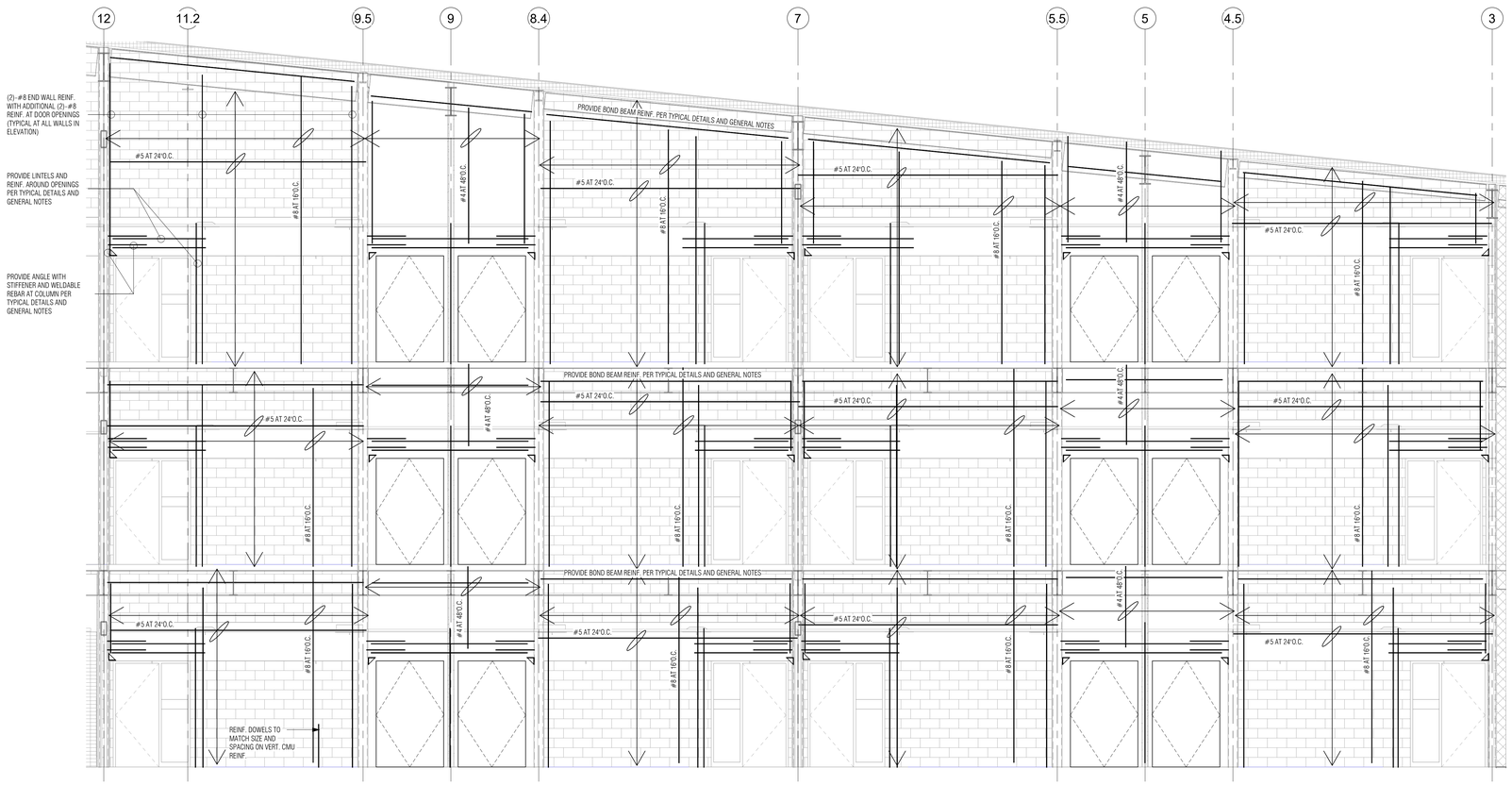
1 SHEARWALL ELEVATION AT GL: 5.9
1/4" = 1'-0"



2 SHEARWALL ELEVATION AT GL: U
1/4" = 1'-0"



3 SHEARWALL ELEVATION AT GL: 3
1/4" = 1'-0"



4 SHEARWALL ELEVATION AT GL: P
1/4" = 1'-0"

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KEY PLAN



DRAWING TITLE

MASONRY SHEAR WALL ELEVATIONS

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OFFICE PROJ. NO.	250501
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APPROVED BY	Approver

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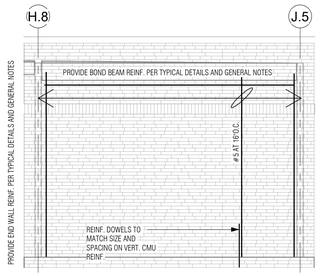
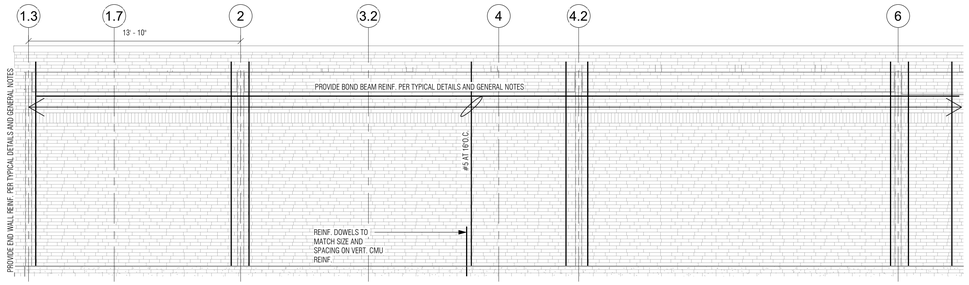
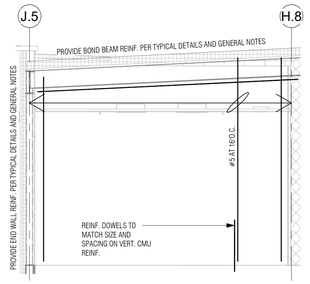


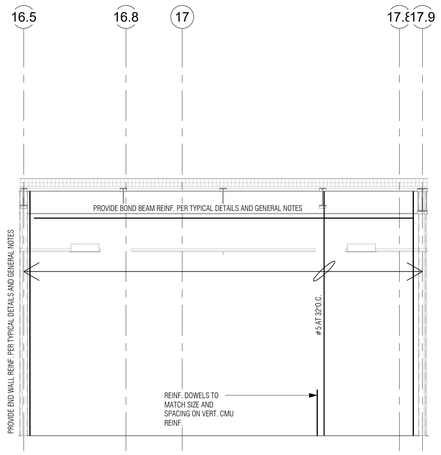
1 SHEARWALL ELEVATION AT GL: 1.3
1/4" = 1'-0"



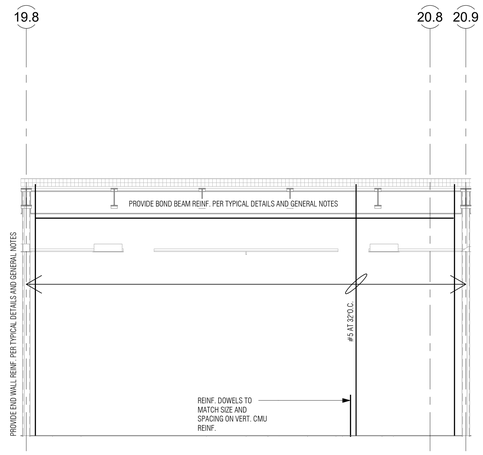
2 SHEARWALL ELEVATION AT GL: J.5
1/4" = 1'-0"



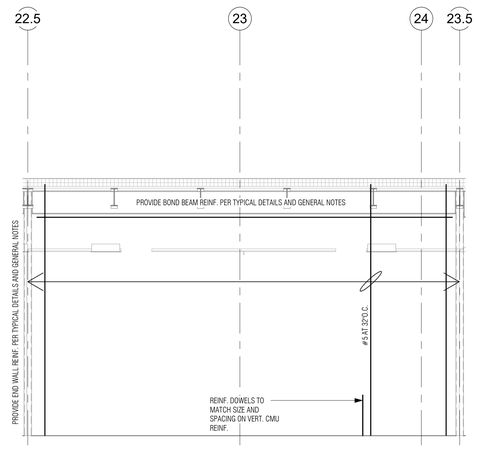
3 SHEARWALL ELEVATION AT GL: 6.1
1/4" = 1'-0"



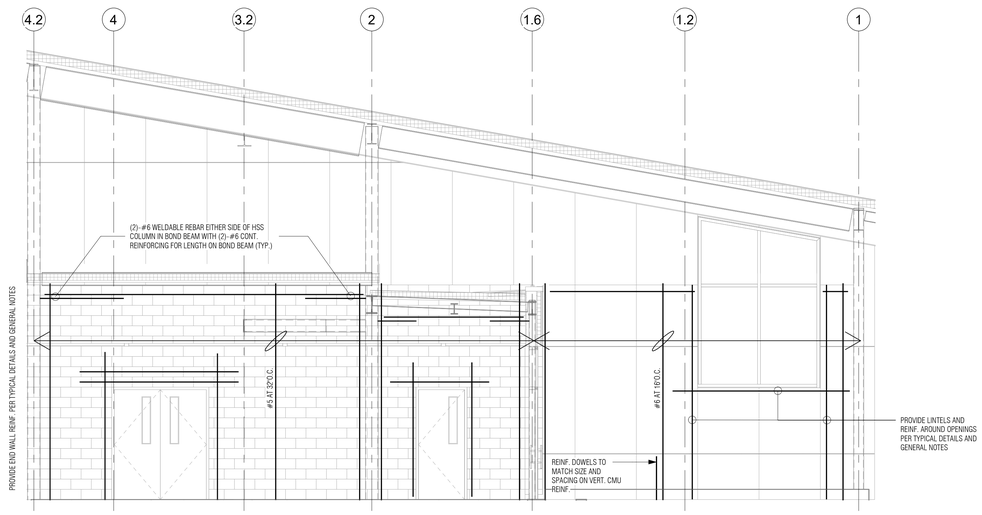
4 SHEARWALL ELEVATION AT GL: J(1)
1/4" = 1'-0"



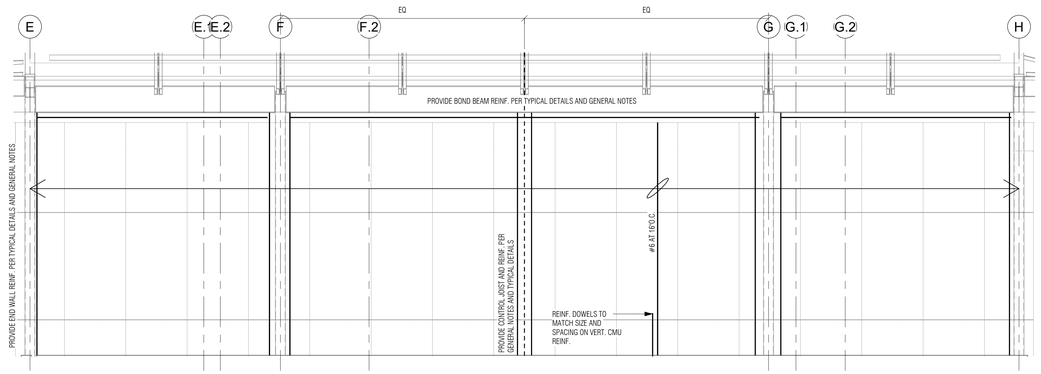
5 SHEARWALL ELEVATION AT GL: J(2)
1/4" = 1'-0"



6 SHEARWALL ELEVATION AT GL: J(3)
1/4" = 1'-0"



7 SHEARWALL ELEVATION AT GL: E(1)
1/4" = 1'-0"



8 SHEARWALL ELEVATION AT GL: 1
1/4" = 1'-0"

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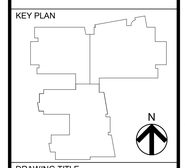

DRAWING TITLE

MASONRY SHEAR WALL ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	Author
APPROVED BY	Approver

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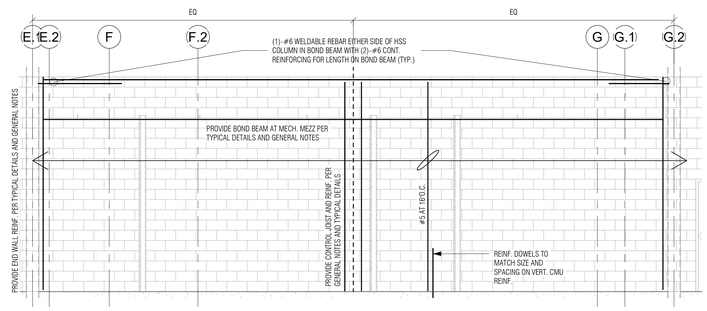
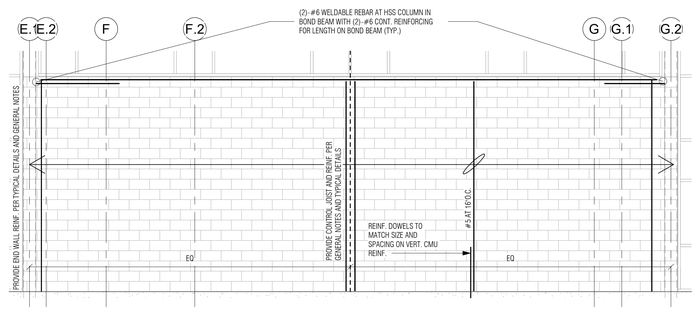
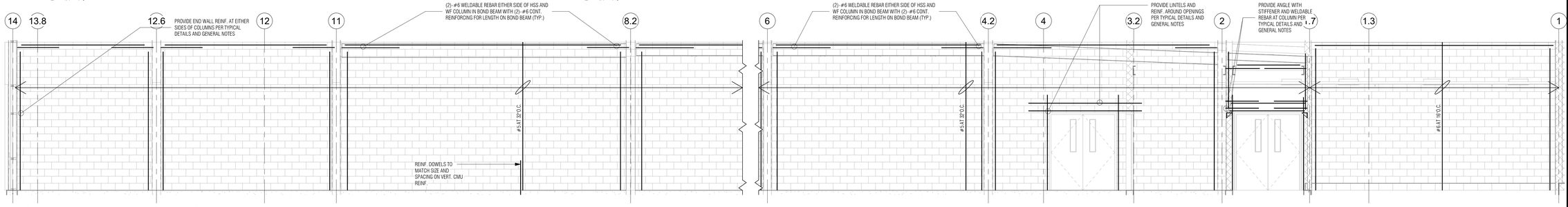


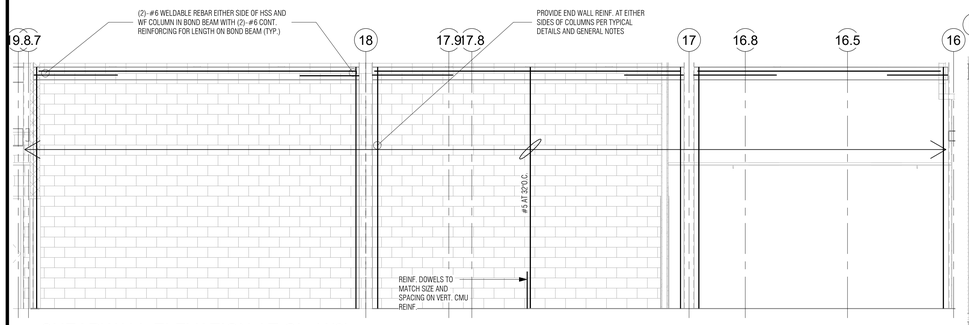
1 SHEARWALL ELEVATION AT GL: 3.2
1/4" = 1'-0"



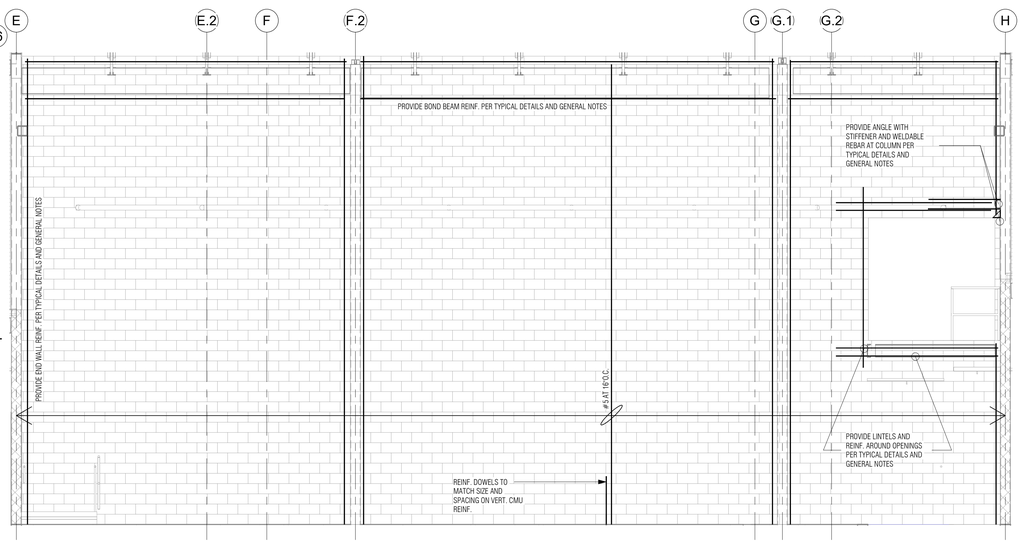
2 SHEARWALL ELEVATION AT GL: 14
1/4" = 1'-0"



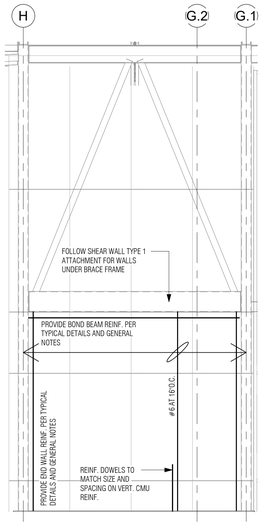
3 SHEARWALL ELEVATION AT GL: H(1)
1/4" = 1'-0"



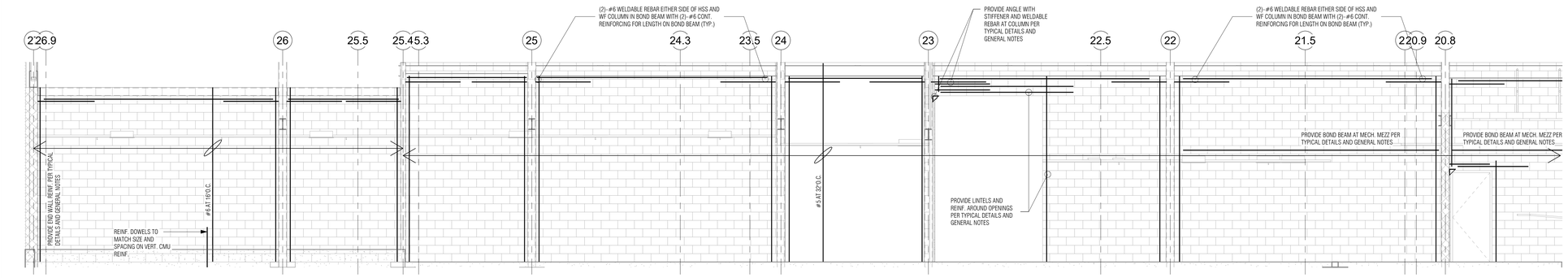
4 SHEARWALL ELEVATION AT GL: H(2)
1/4" = 1'-0"



6 SHEARWALL ELEVATION AT GL: 20.8
1/4" = 1'-0"



7 SHEARWALL ELEVATION AT GL: 27
1/4" = 1'-0"



5 SHEARWALL ELEVATION AT GL: H(3)
1/4" = 1'-0"

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KEY PLAN



DRAWING TITLE

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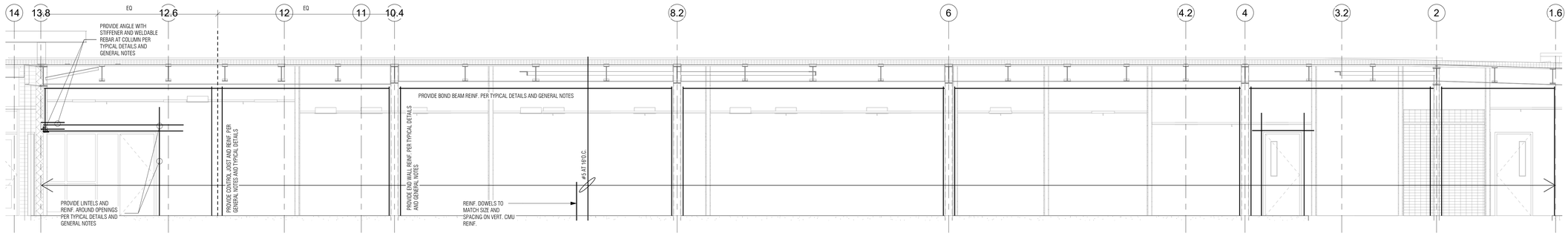
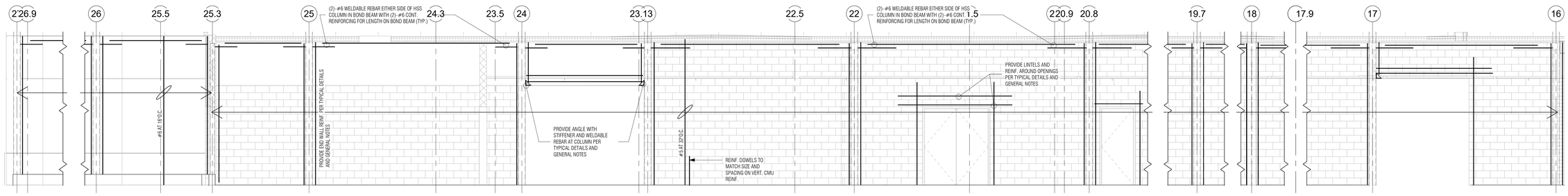


1 SHEARWALL ELEVATION AT GL: D
1/4" = 1'-0"



2 SHEARWALL ELEVATION AT GL: E
1/4" = 1'-0"

3 SHEARWALL ELEVATION AT GL: 21
1/4" = 1'-0"

4 SHEARWALL ELEVATION AT GL: B
1/4" = 1'-0"

5 SHEARWALL ELEVATION AT GL: 25.3
1/4" = 1'-0"

6 TYPICAL MASONRY WALL AT STAIR
1/4" = 1'-0"

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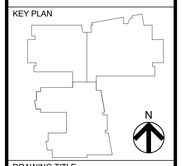

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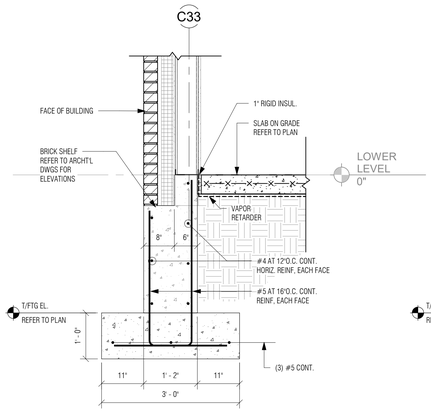
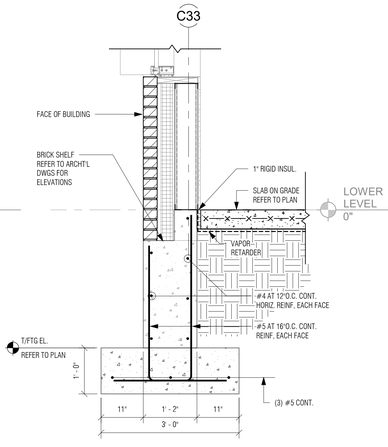
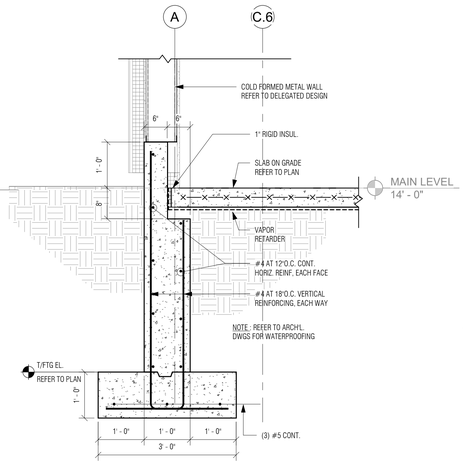


1 SECTION
3/4" = 1'-0"



1A SECTION
3/4" = 1'-0"



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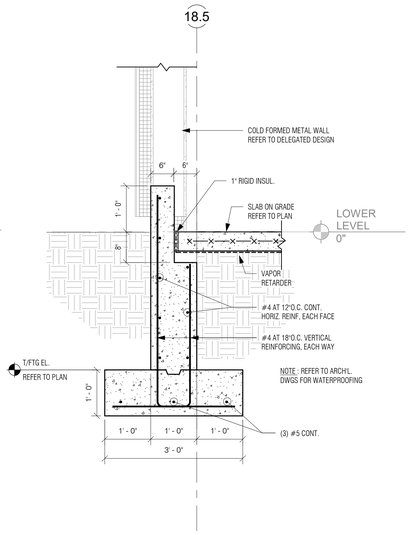
3/4" = 1'-0"



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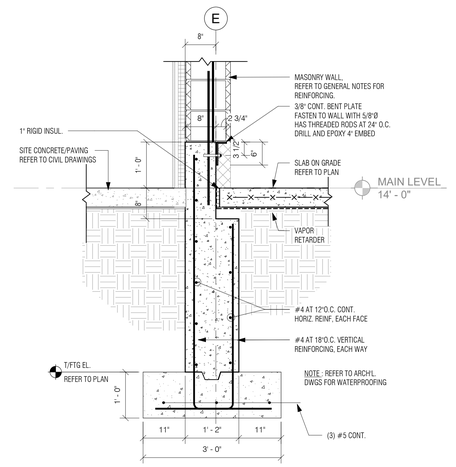
3/4" = 1'-0"



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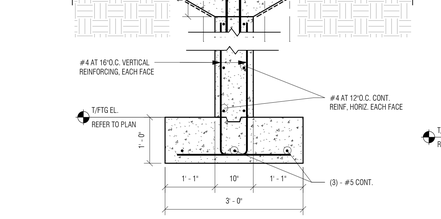
3/4" = 1'-0"



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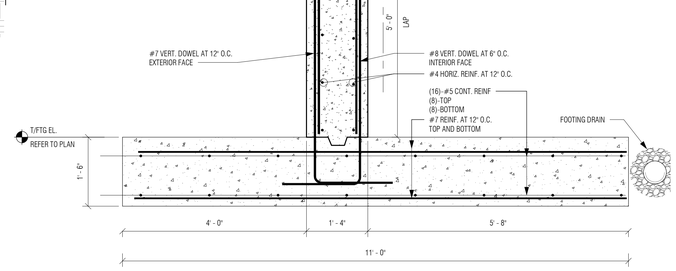

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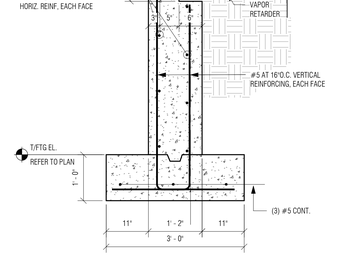
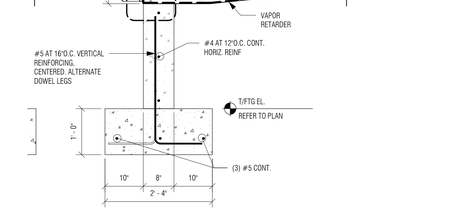
3/4" = 1'-0"



6 SECTION
3/4" = 1'-0"



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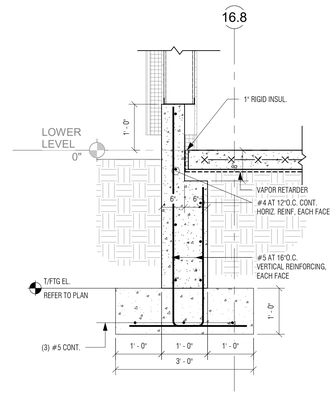
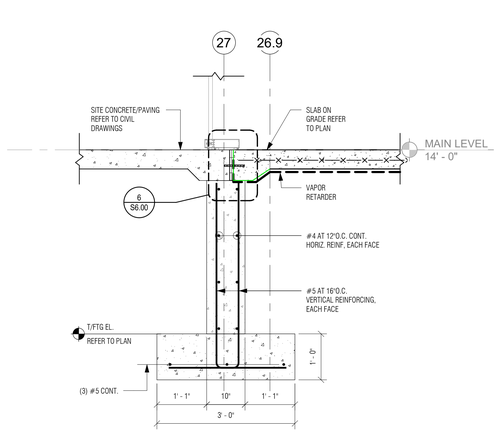
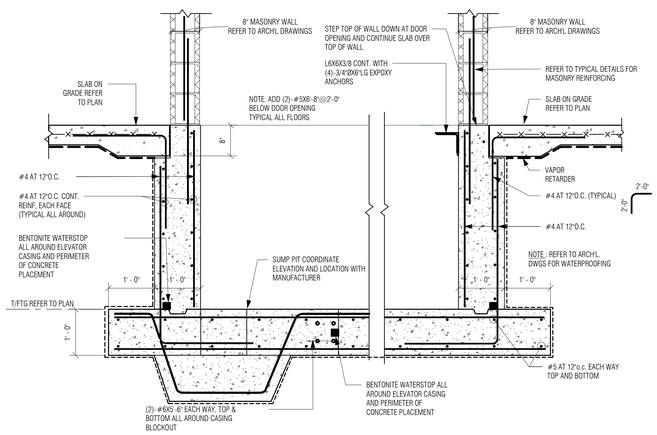
3/4" = 1'-0"



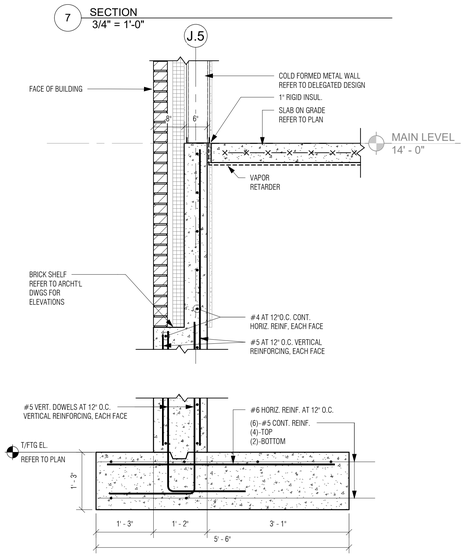
8 SECTION
3/4" = 1'-0"



9 SECTION
3/4" = 1'-0"



10 TYPICAL ELEVATOR PIT
3/4" = 1'-0"



11 SECTION
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203-481-8600 mha-eng.com

PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FOUNDATION SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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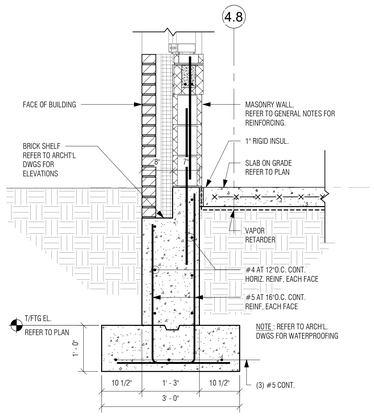
5/18/2026 3:34:29 PM Autodesk Docs://Trumbull Hillcrest Middle School/25-80-Trumbull Hillcrest MS-STR_RC26.rvt



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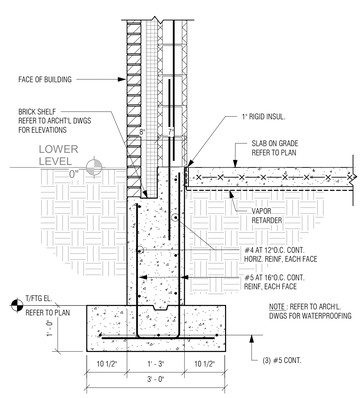

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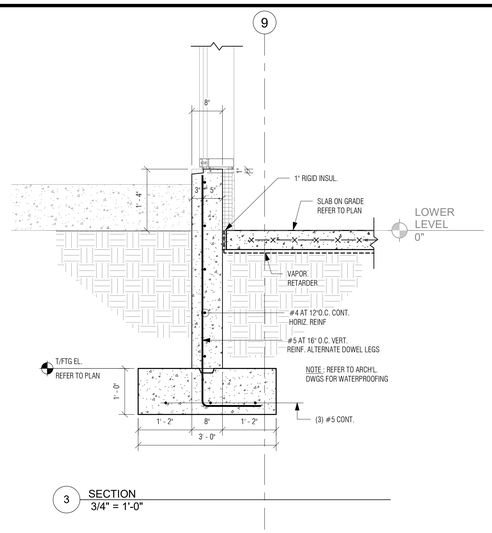

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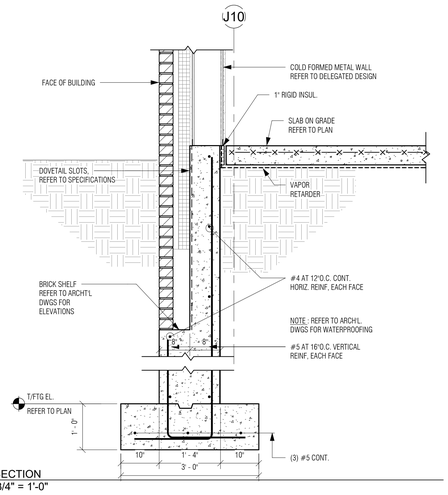

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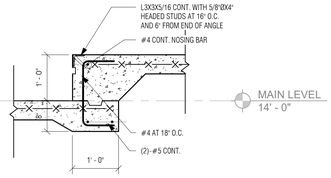
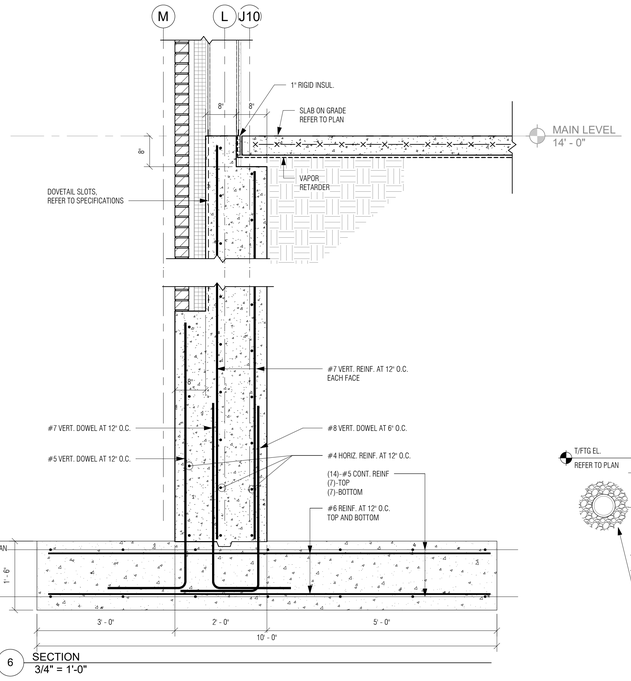
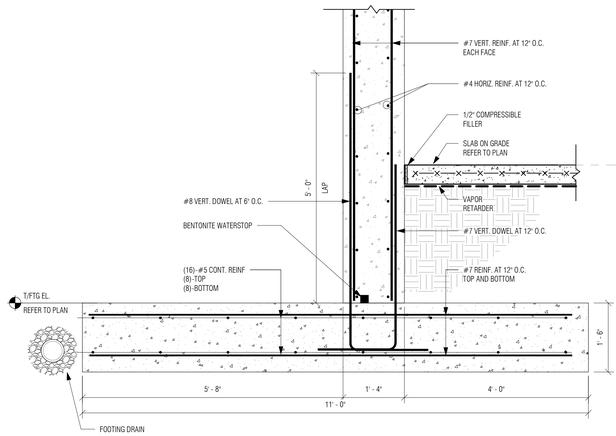


5 SECTION
3/4" = 1'-0"



6 SECTION
3/4" = 1'-0"



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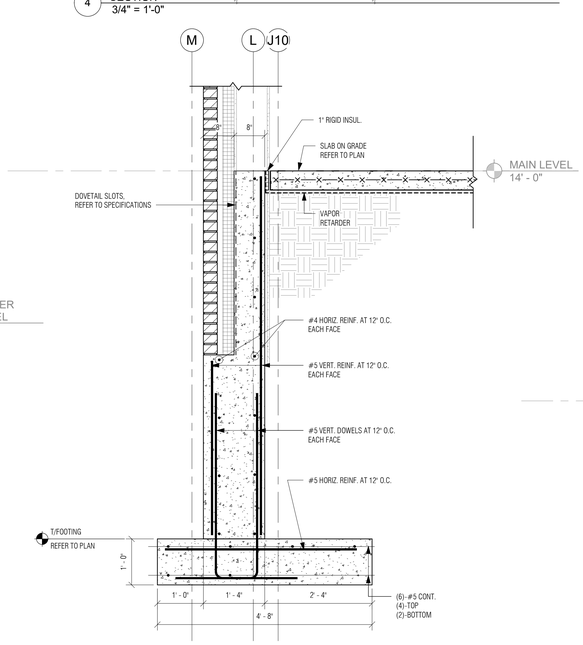
3/4" = 1'-0"



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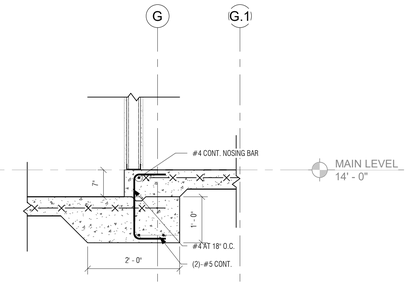
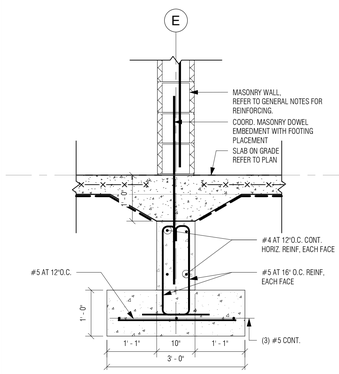


14 SECTION
3/4" = 1'-0"



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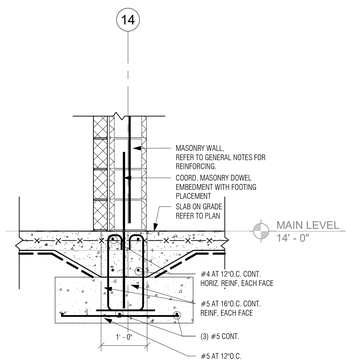

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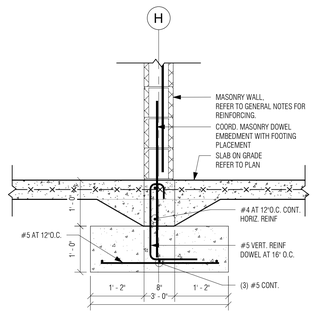
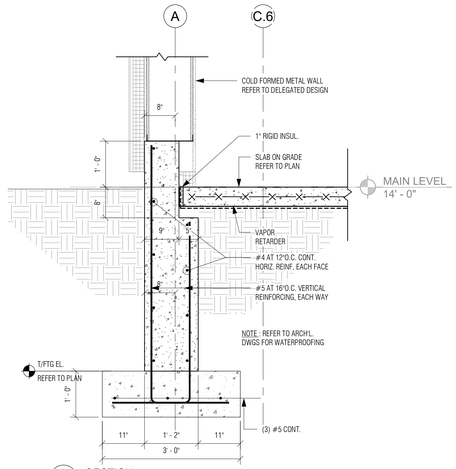
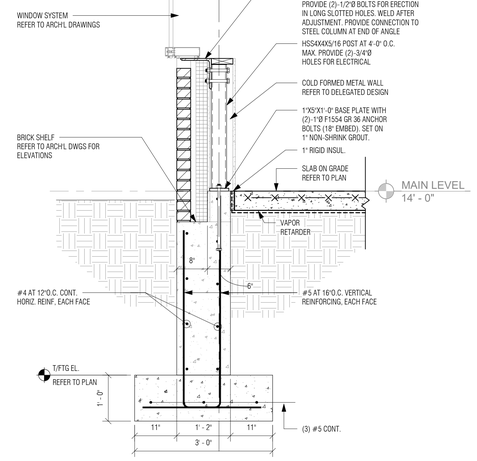
3/4" = 1'-0"



11 SECTION
3/4" = 1'-0"



12 SECTION
3/4" = 1'-0"



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PROFESSIONAL SEAL

STATE OF CONNECTICUT
KENNETH J. SHEEHAN
No. 0023406
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

N

DRAWING TITLE

FOUNDATION SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
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ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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3	03/16/2026	50% CD
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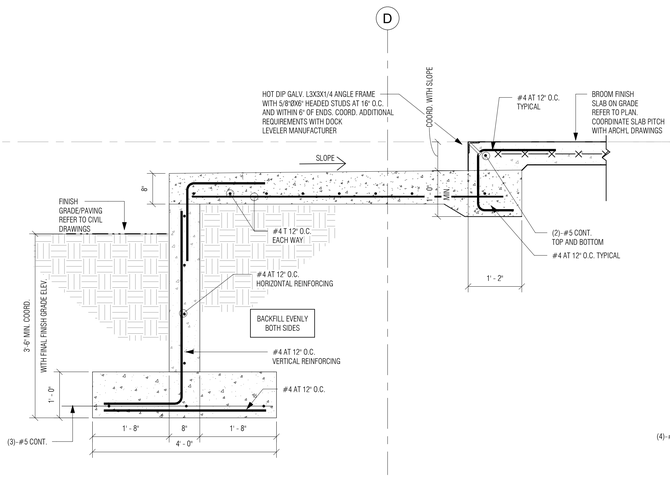
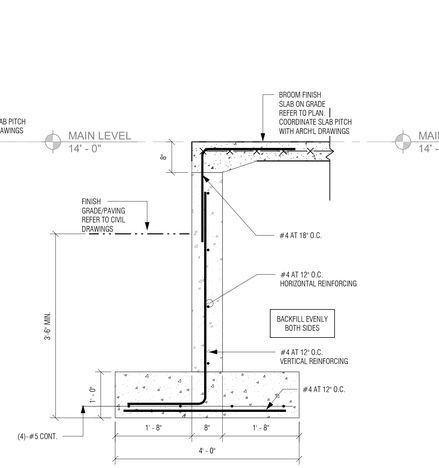


1 SECTION
3/4" = 1'-0"



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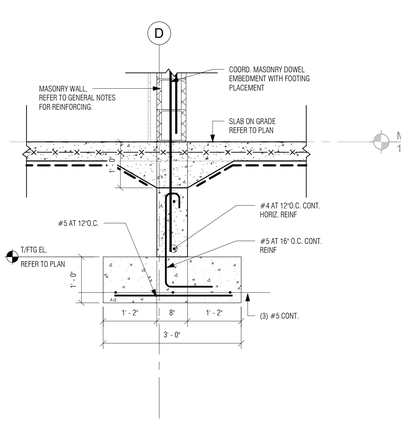

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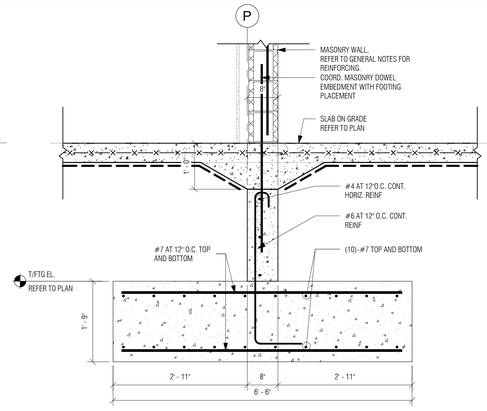
3/4" = 1'-0"



4 SECTION
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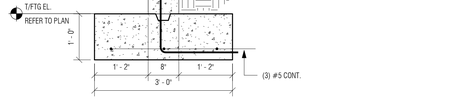

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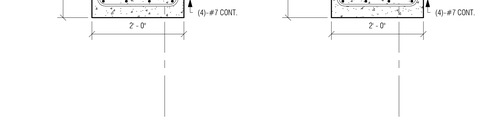
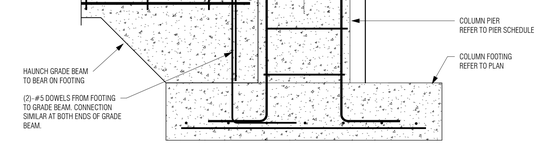


6 SECTION
3/4" = 1'-0"



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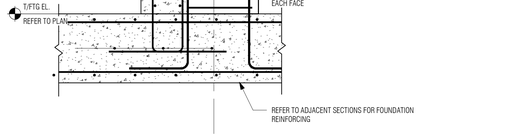

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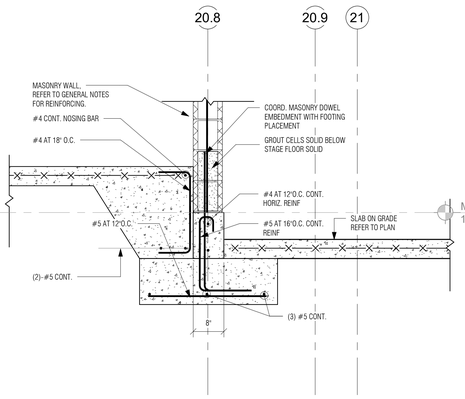

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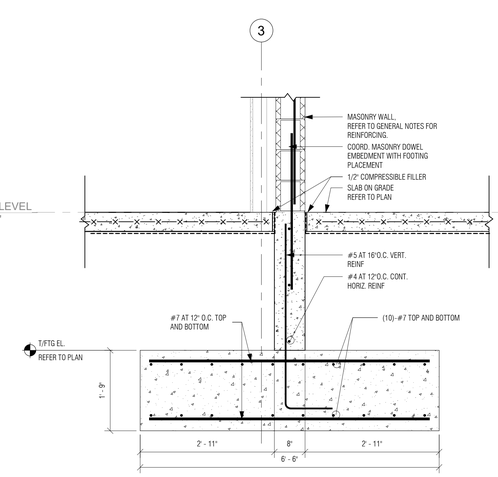

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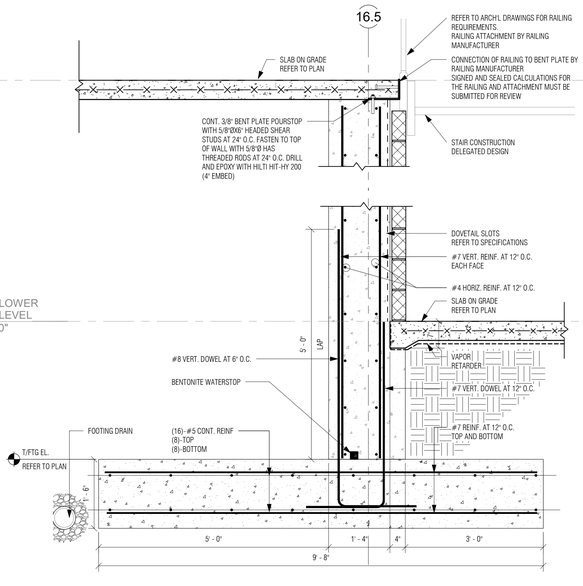

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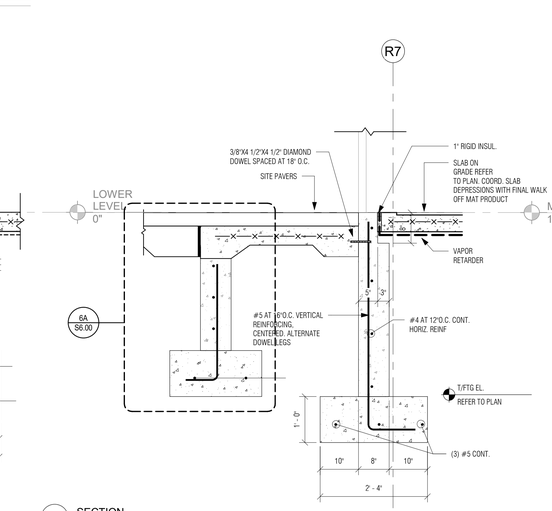

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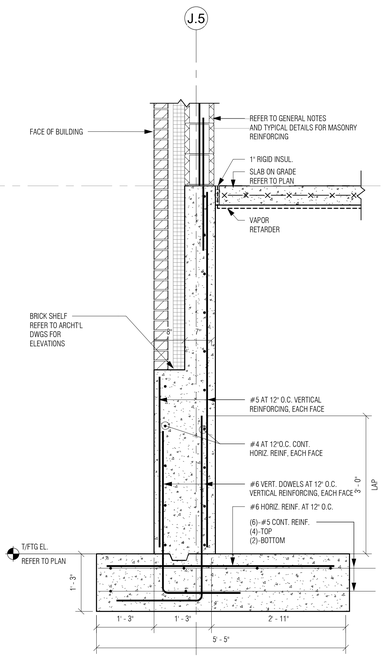

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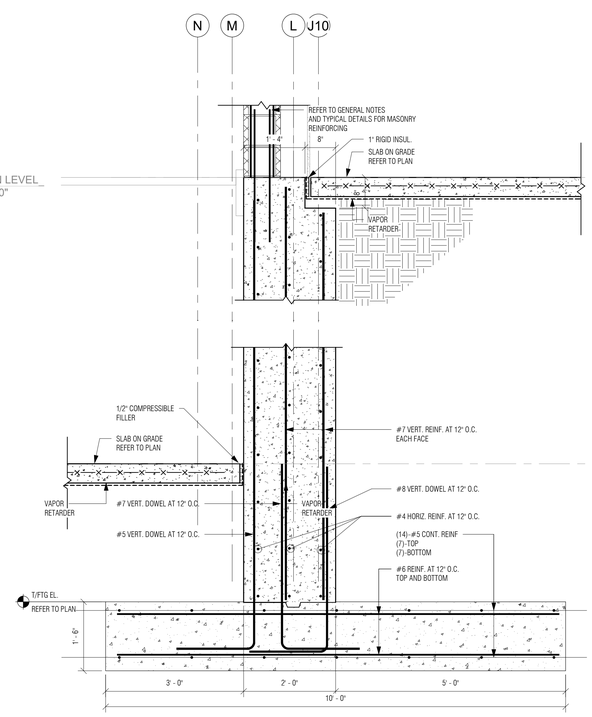

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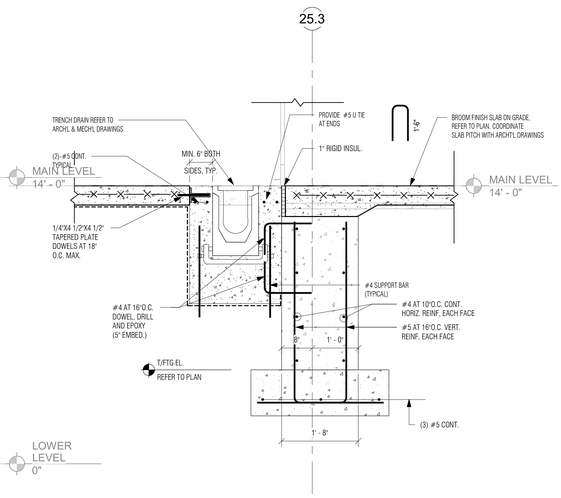

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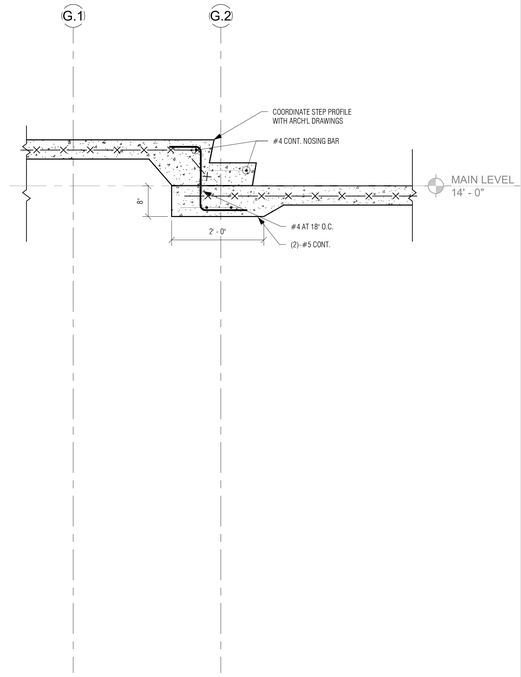

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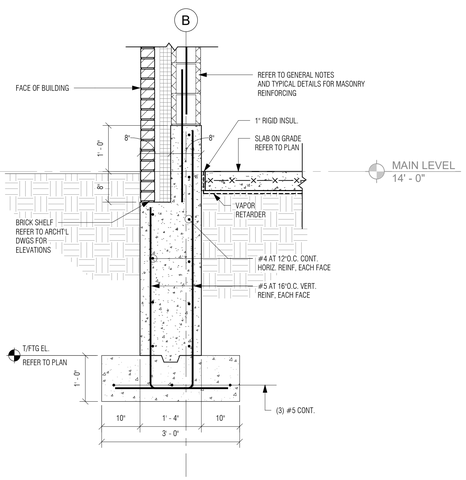
3/4" = 1'-0"



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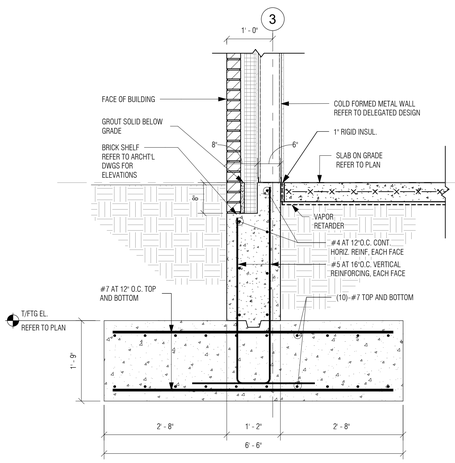
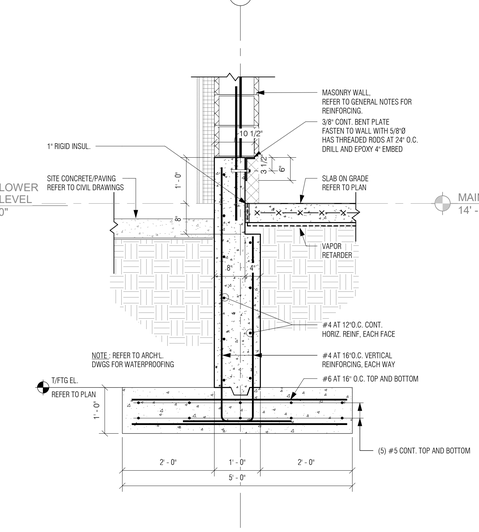
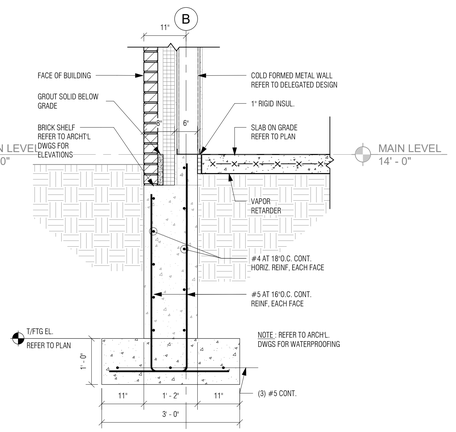


6 SECTION
3/4" = 1'-0"



7 SECTION
3/4" = 1'-0"



8 SECTION
3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FOUNDATION SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S3.03

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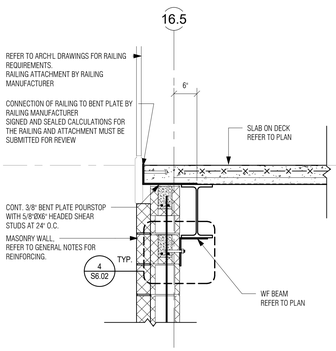
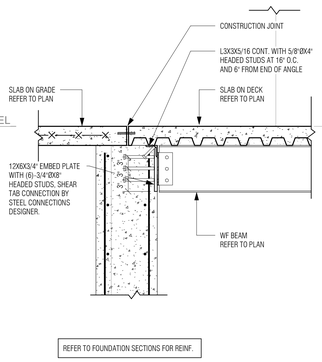
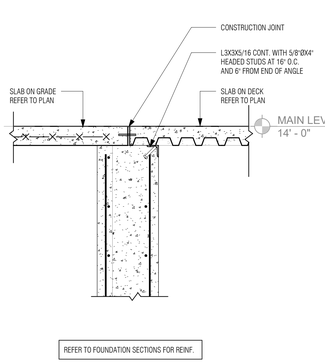


1 SECTION
3/4" = 1'-0"



AT BEAM

2 SECTION
3/4" = 1'-0"



BETWEEN BEAM

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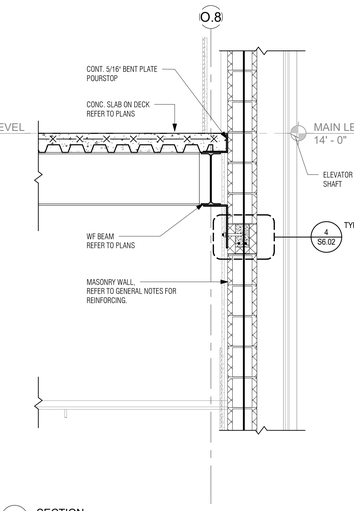
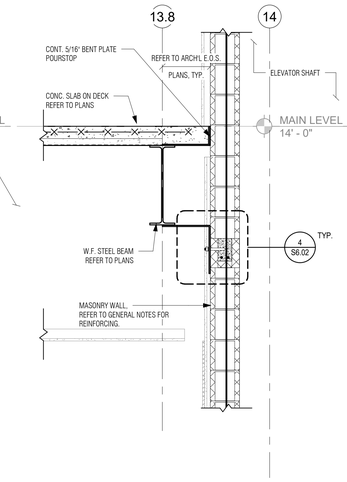
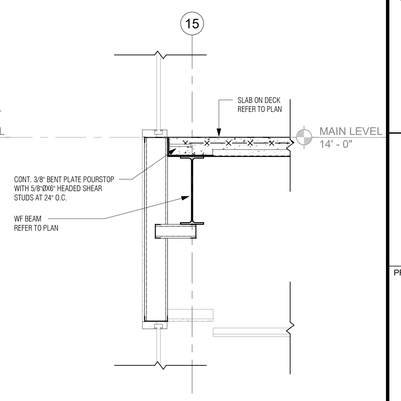
3/4" = 1'-0"



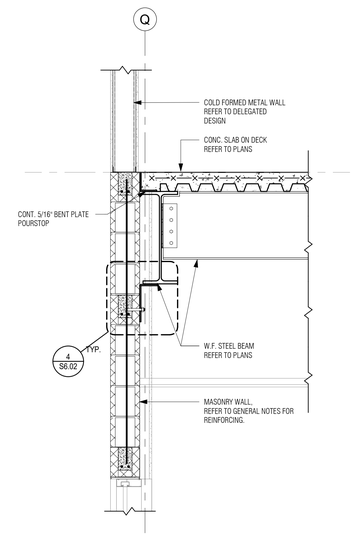
4 SECTION
3/4" = 1'-0"



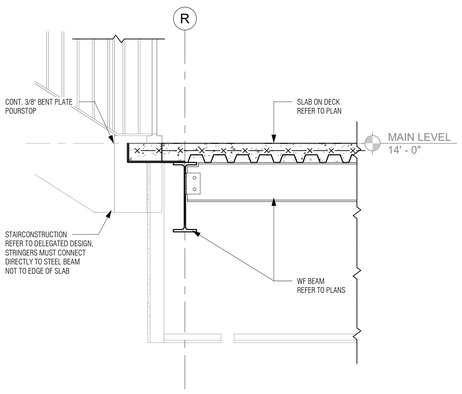
5 SECTION
3/4" = 1'-0"



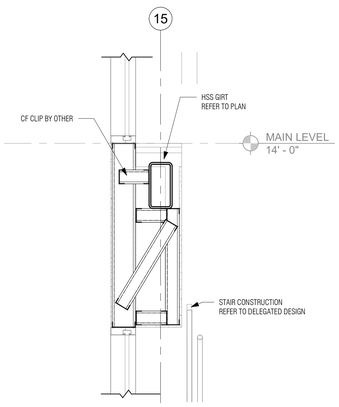
6 SECTION
3/4" = 1'-0"



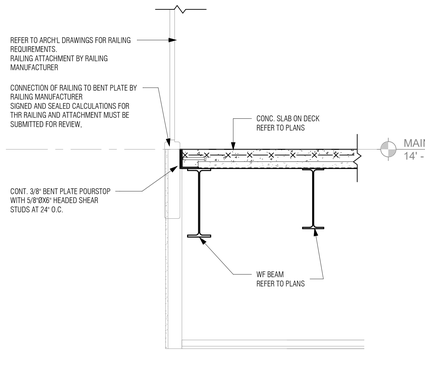
7 SECTION
3/4" = 1'-0"



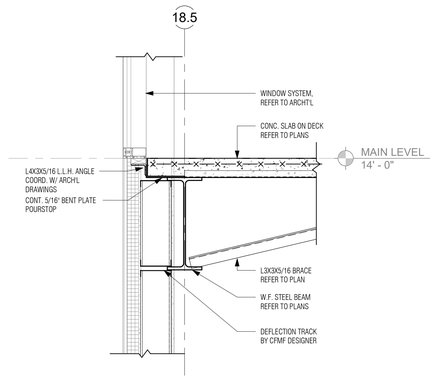
8 SECTION
3/4" = 1'-0"



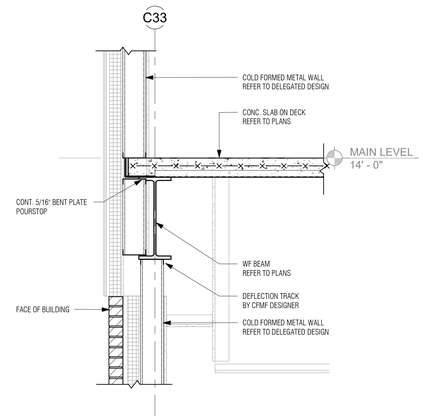
9 SECTION
3/4" = 1'-0"



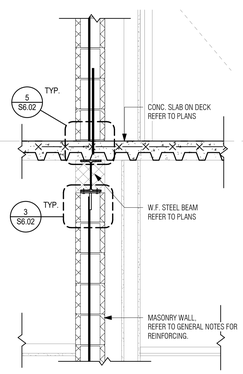
10 SECTION
3/4" = 1'-0"



11 SECTION
3/4" = 1'-0"



12 SECTION
3/4" = 1'-0"



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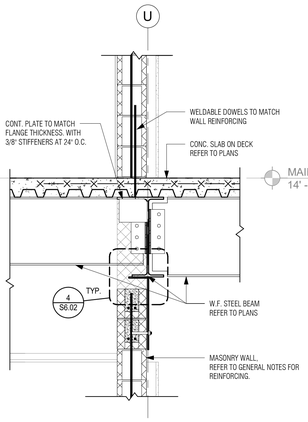
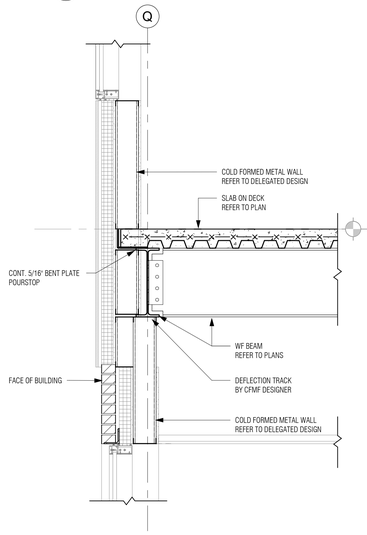


14 SECTION
3/4" = 1'-0"



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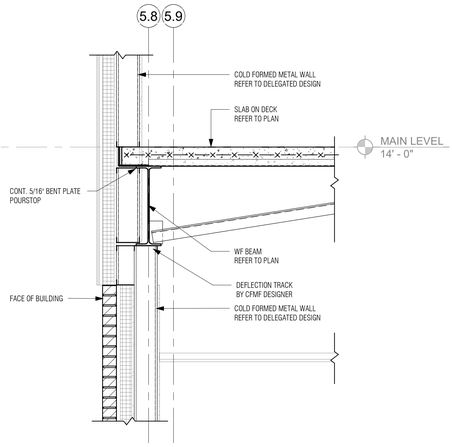
3/4" = 1'-0"



16 SECTION
3/4" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FLOOR SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
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DRAWN BY	AC
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ISSUE DATES

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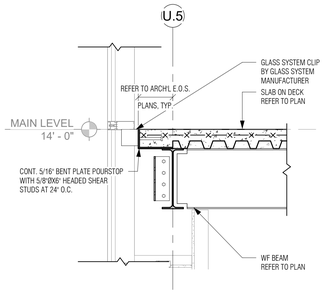
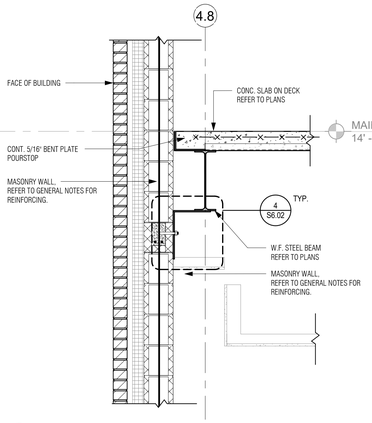


1 SECTION 3/4" = 1'-0"



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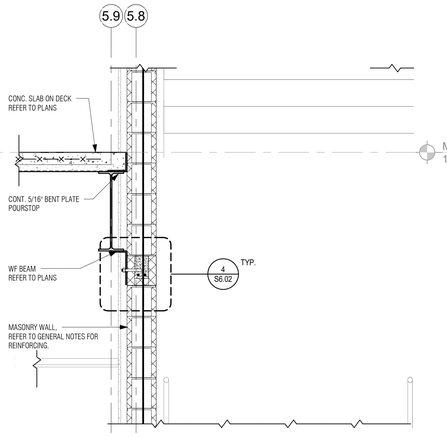
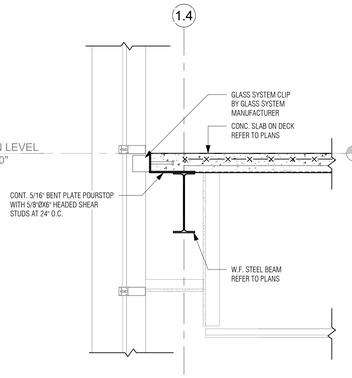
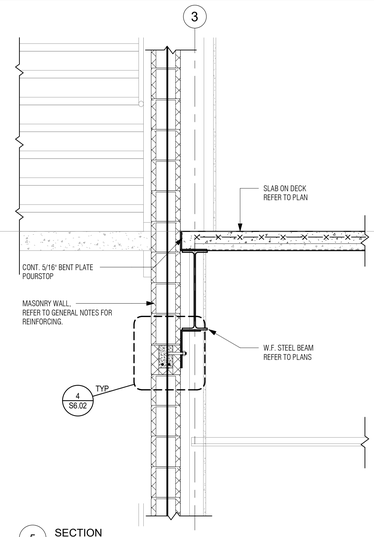


3 SECTION 3/4" = 1'-0"



4 SECTION 3/4" = 1'-0"



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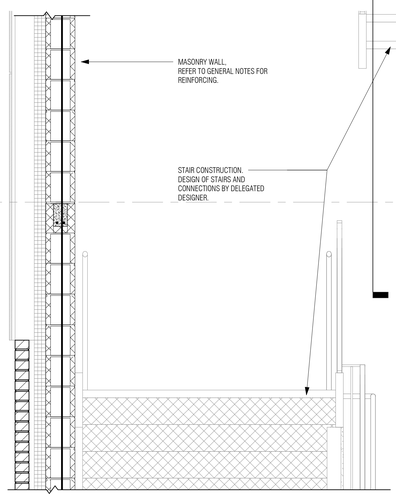
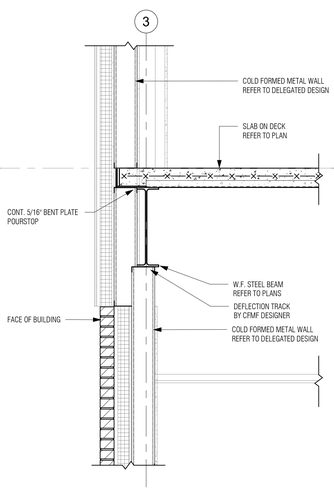
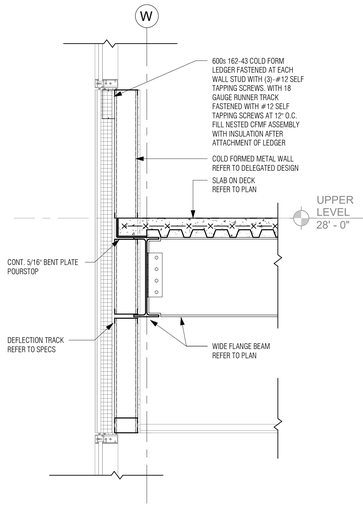


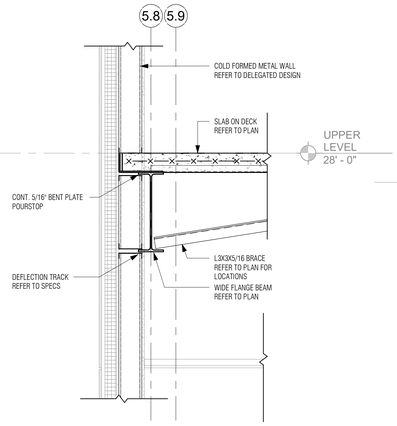
6 SECTION 3/4" = 1'-0"



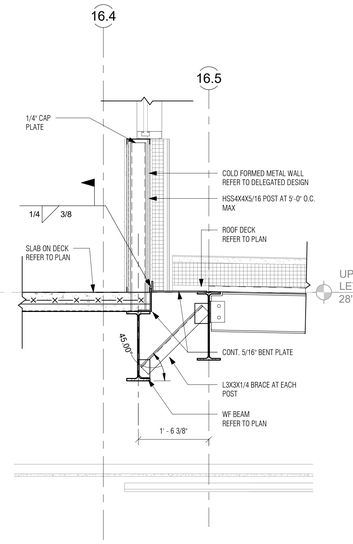
7 SECTION 3/4" = 1'-0"



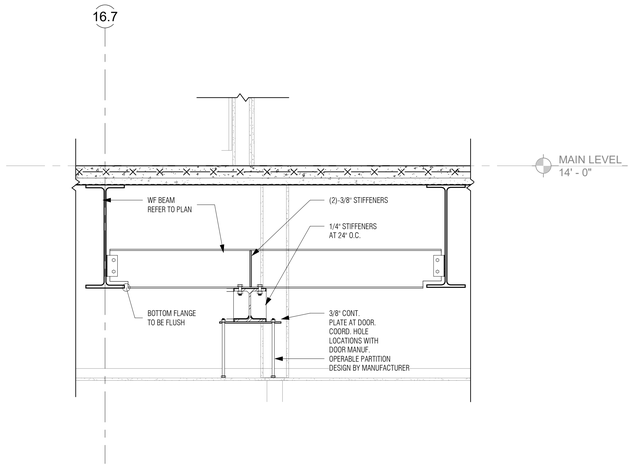
8 SECTION 3/4" = 1'-0"



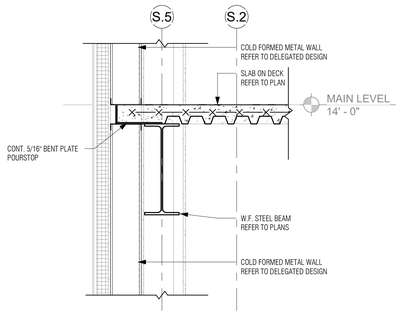
9 SECTION 3/4" = 1'-0"



10 SECTION 3/4" = 1'-0"



11 SECTION 3/4" = 1'-0"



12 SECTION 3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

FLOOR SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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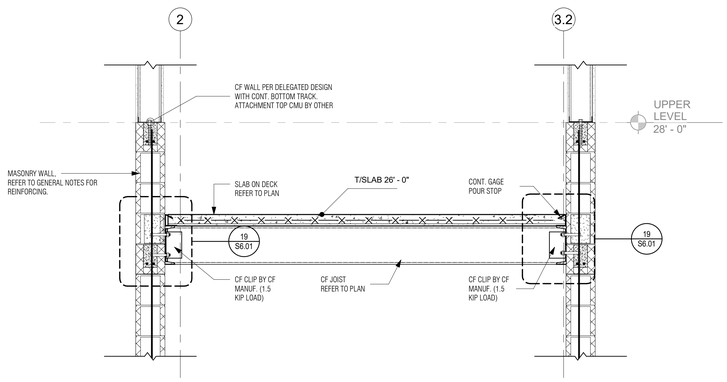
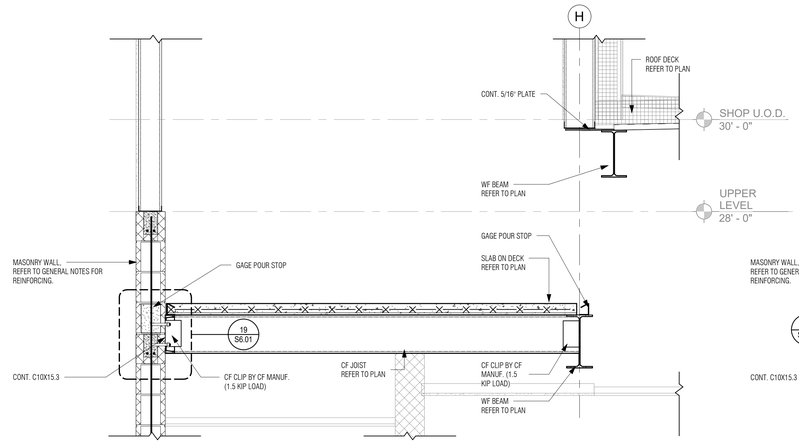


1 SECTION
3/4" = 1'-0"



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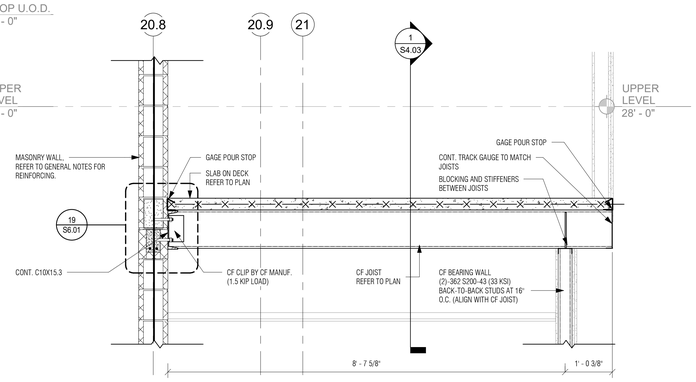
3/4" = 1'-0"

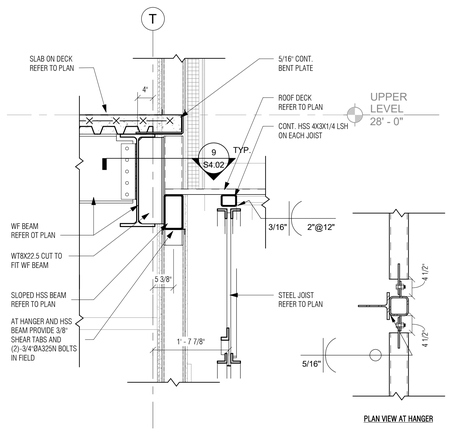


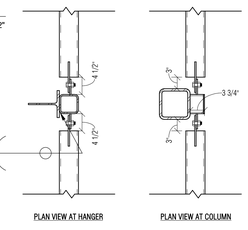
3 SECTION
3/4" = 1'-0"

4 SECTION
3/4" = 1'-0"

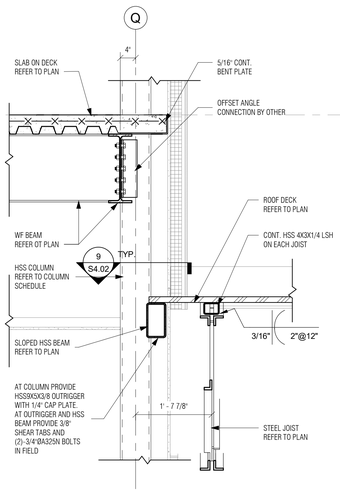
5 SECTION
3/4" = 1'-0"

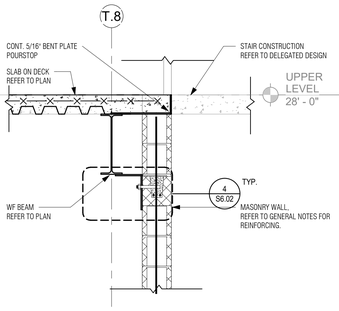
6 SECTION
3/4" = 1'-0"

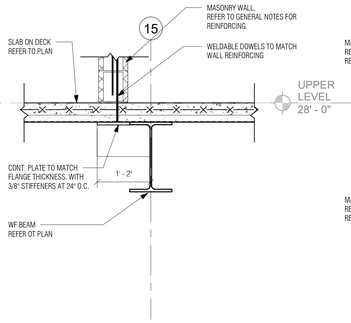


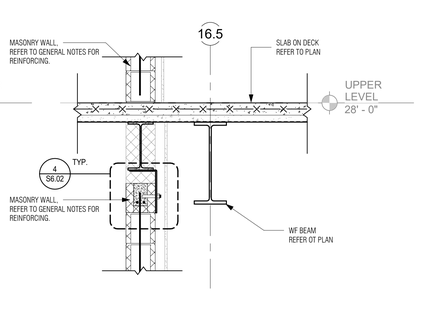


9 PLAN DETAIL
3/4" = 1'-0"









7 SECTION
3/4" = 1'-0"

8 SECTION
3/4" = 1'-0"

10 SECTION
3/4" = 1'-0"

11 SECTION
3/4" = 1'-0"

12 SECTION
3/4" = 1'-0"

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KEY PLAN



DRAWING TITLE

FLOOR SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
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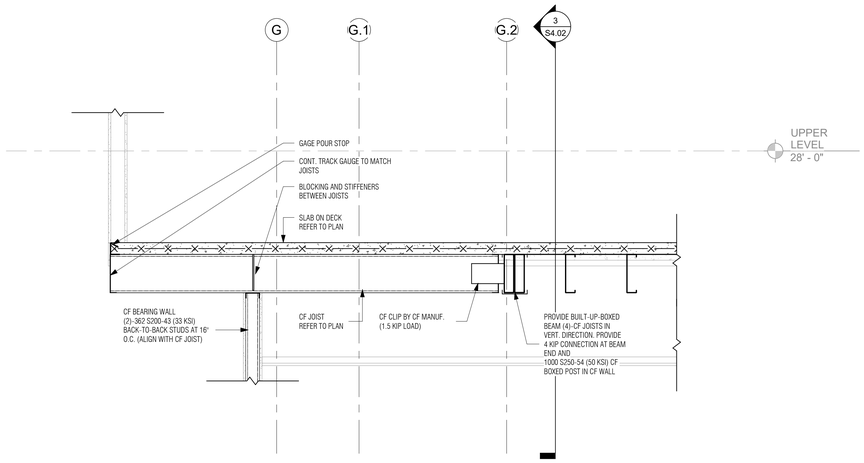
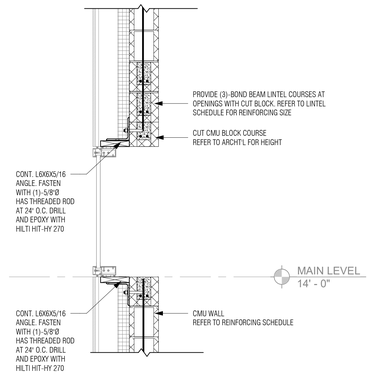
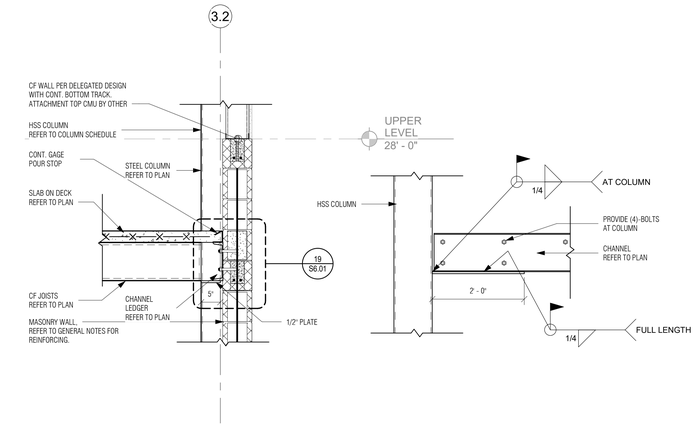


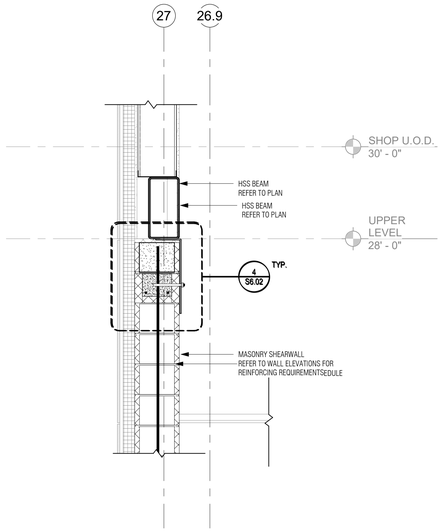
1 SECTION
3/4" = 1'-0"



2 SECTION
3/4" = 1'-0"



3 SECTION
3/4" = 1'-0"



5 SECTION
3/4" = 1'-0"

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Branford, Connecticut 06405
203-481-8600 mha-eng.com

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

DRAWING TITLE

FLOOR SECTIONS

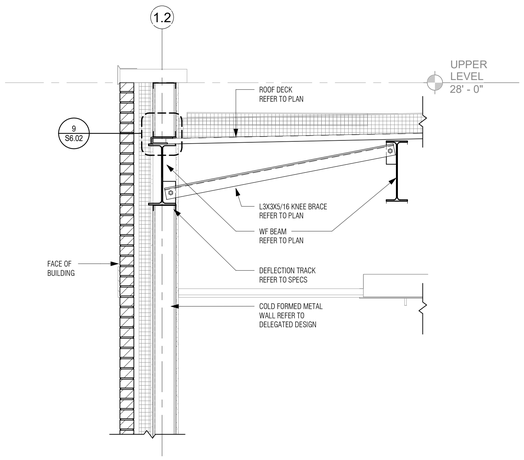
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

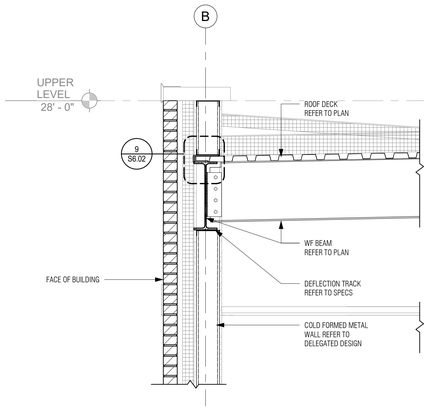
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S4.03

5/18/2026 3:35:14 PM Autodesk Docs://Trumbull Hillcrest Middle School/25-80-Trumbull Hillcrest MS-STR_RC26.rvt



1 SECTION
3/4" = 1'-0"



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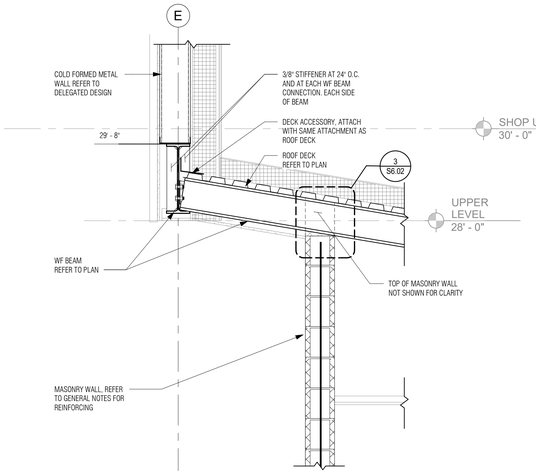
3/4" = 1'-0"



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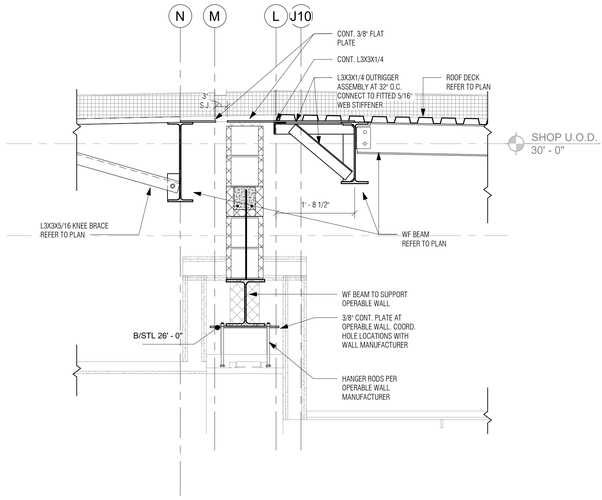
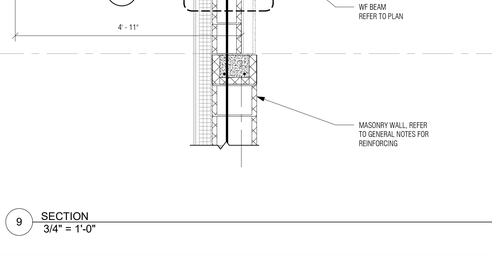
3/4" = 1'-0"



4 SECTION
3/4" = 1'-0"



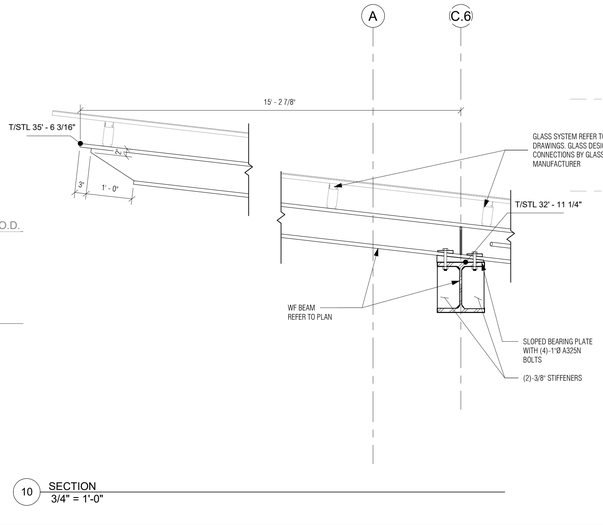
5 SECTION
3/4" = 1'-0"

6 SECTION
3/4" = 1'-0"

7 SECTION
3/4" = 1'-0"

8 SECTION
3/4" = 1'-0"

9 SECTION
3/4" = 1'-0"



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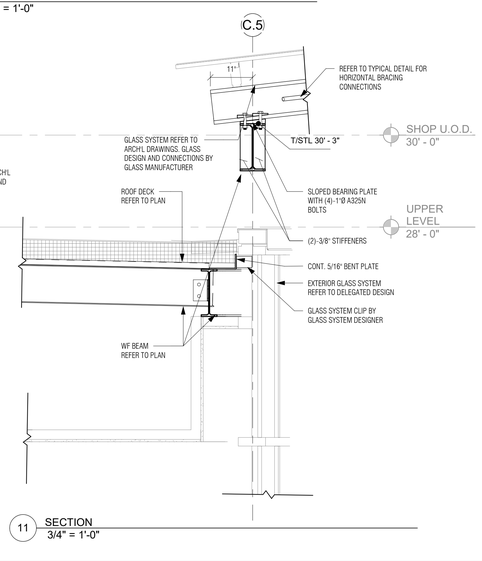

11 SECTION
3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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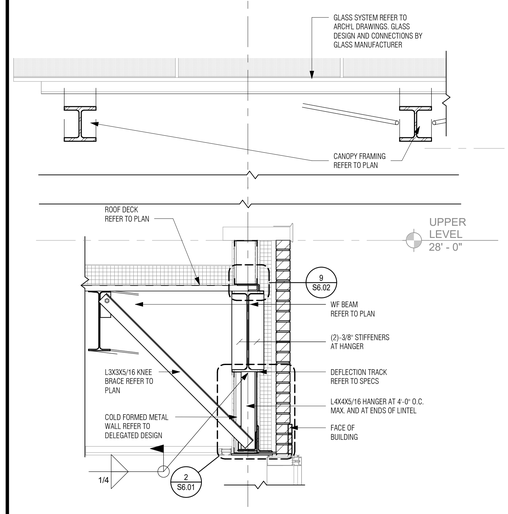
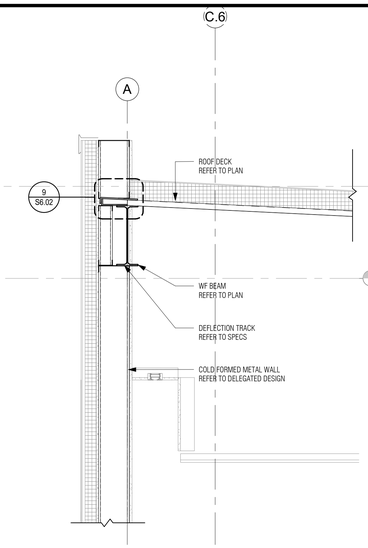
S5.00

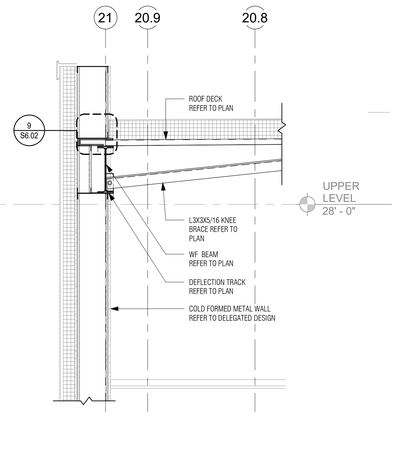
5/19/2026 3:55:20 PM Autodesk Docs://Trumbull Hillcrest Middle School/25-60-Trumbull Hillcrest MS-STR_RC26.rvt



1 SECTION
3/4" = 1'-0"



2 SECTION
3/4" = 1'-0"



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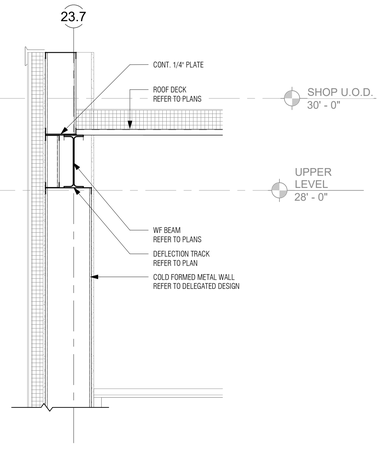
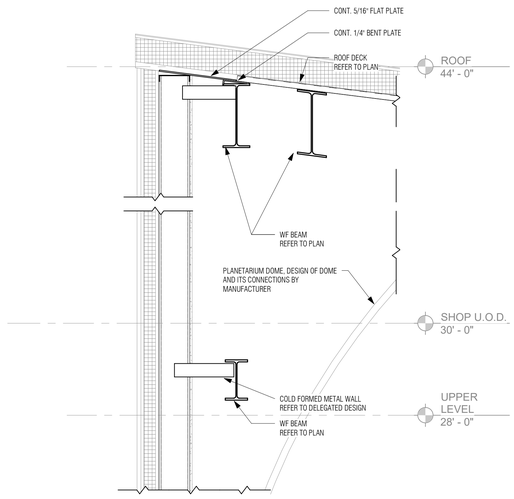
3/4" = 1'-0"



4 SECTION
3/4" = 1'-0"



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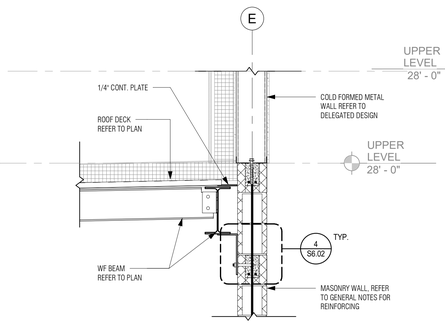
3/4" = 1'-0"



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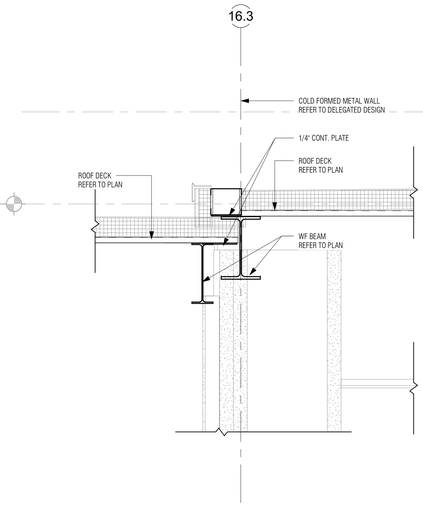
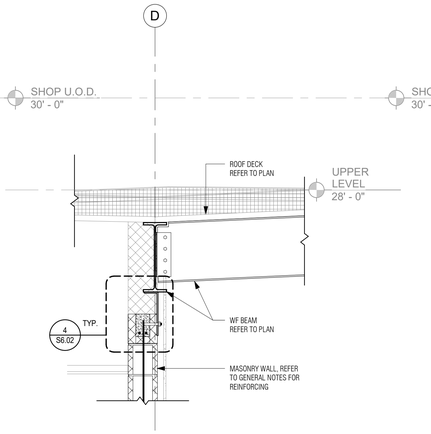
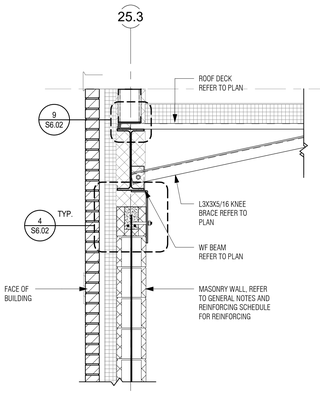
3/4" = 1'-0"



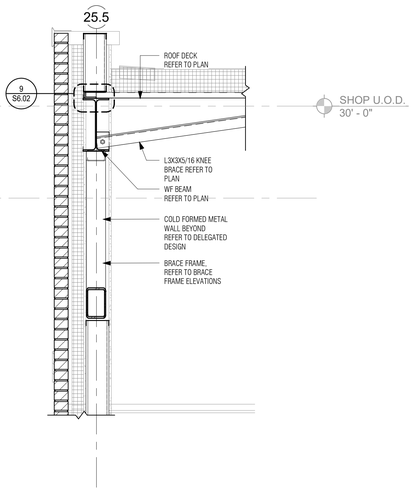
7 SECTION
3/4" = 1'-0"



8 SECTION
3/4" = 1'-0"



9 SECTION
3/4" = 1'-0"



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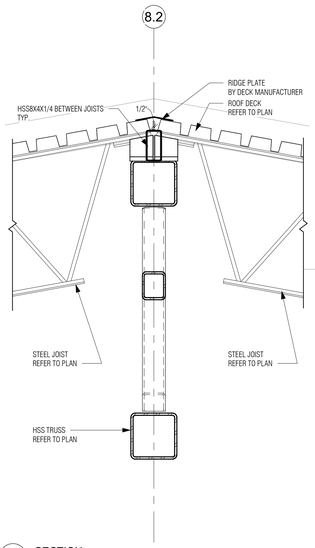
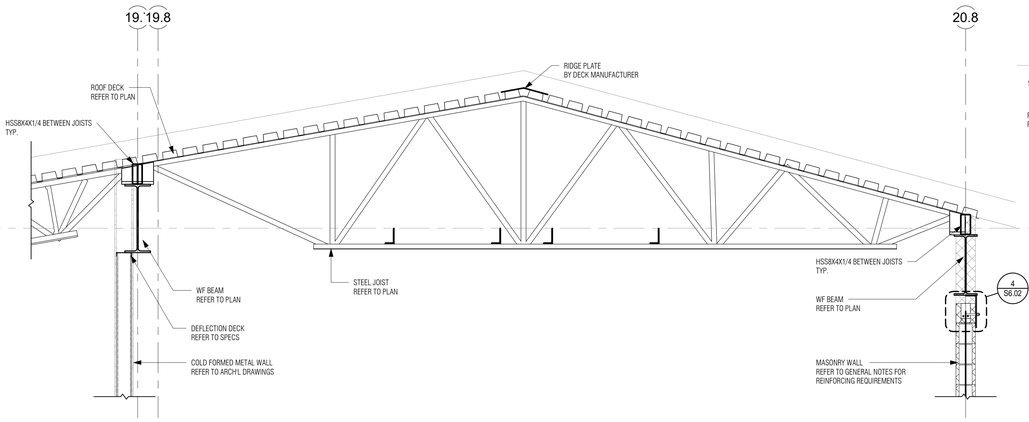
3/4" = 1'-0"



11 SECTION
3/4" = 1'-0"



12 SECTION
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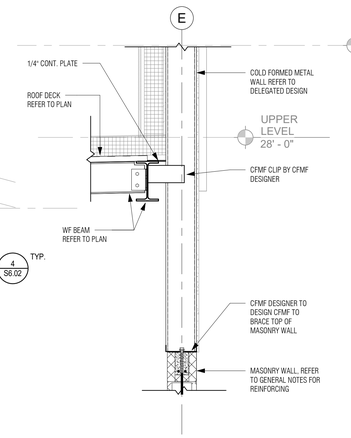

13 SECTION
3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE
SHOP U.O.D.
30' - 0"
ROOF SECTIONS

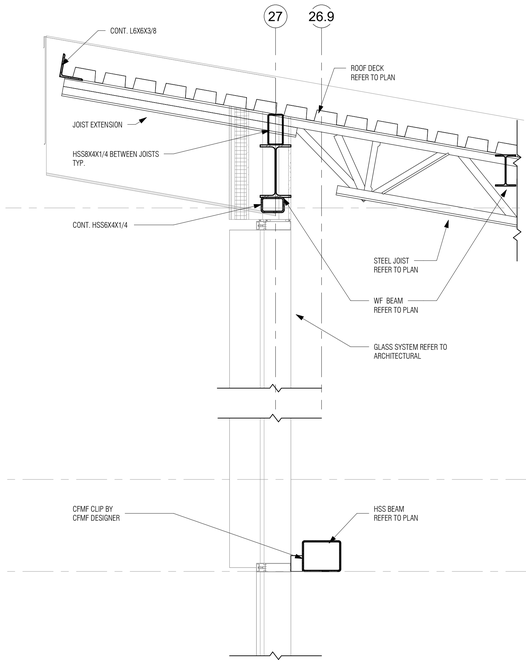
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2025	100% CD

S5.01

5/18/2026 3:35:27 PM Autodesk Docs://Trumbull Hillcrest Middle School/25-80-Trumbull Hillcrest MS-S1R_RC26.rvt



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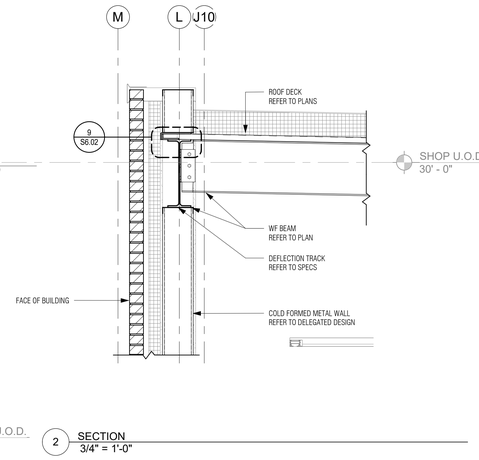
3/4" = 1'-0"



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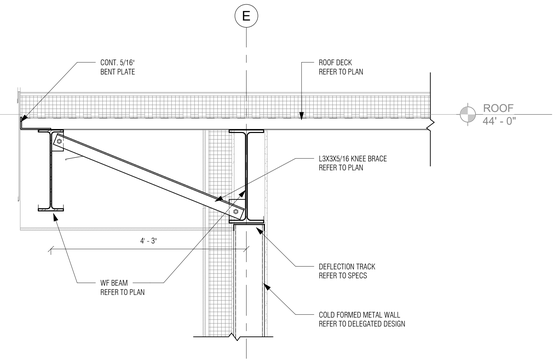
3/4" = 1'-0"



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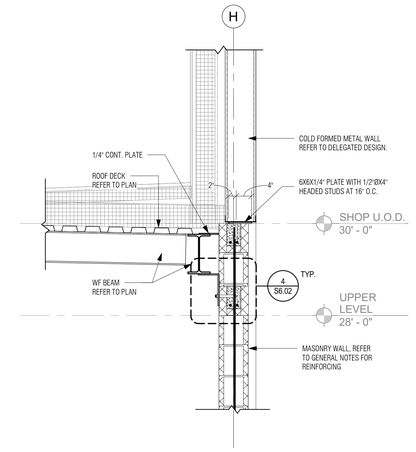
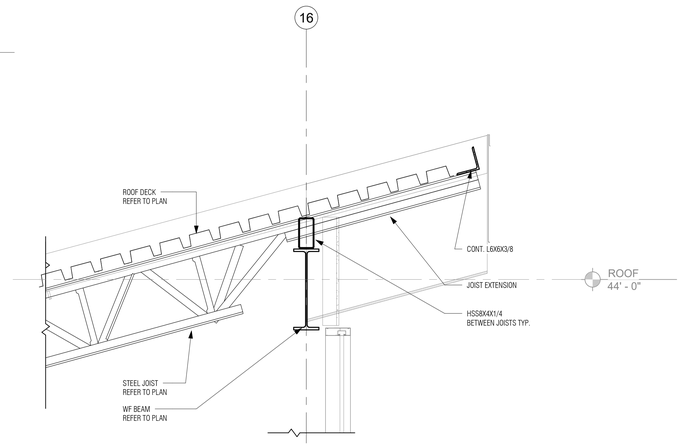
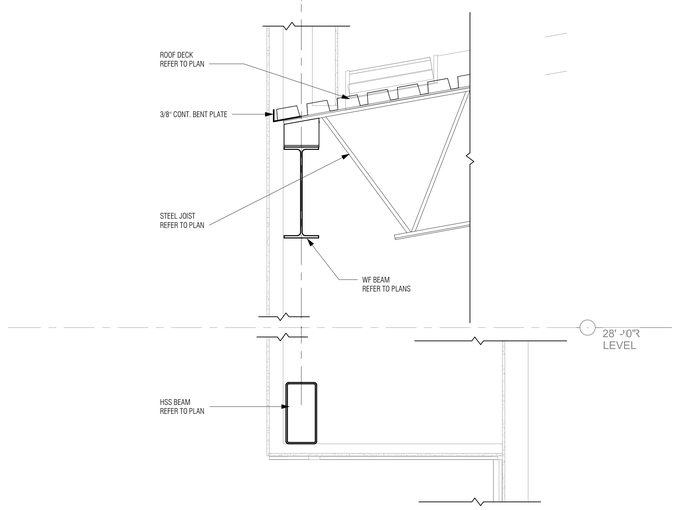
3/4" = 1'-0"

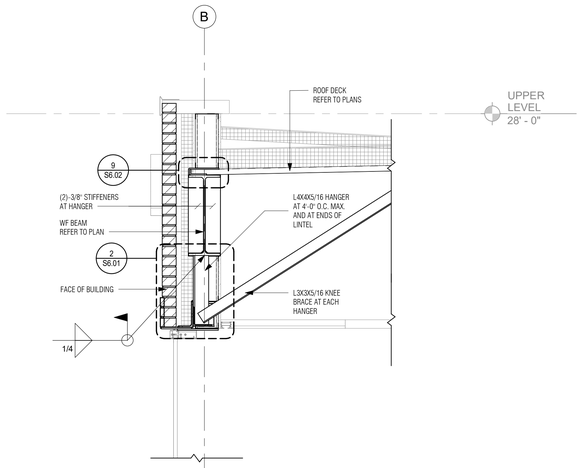


4 SECTION
3/4" = 1'-0"

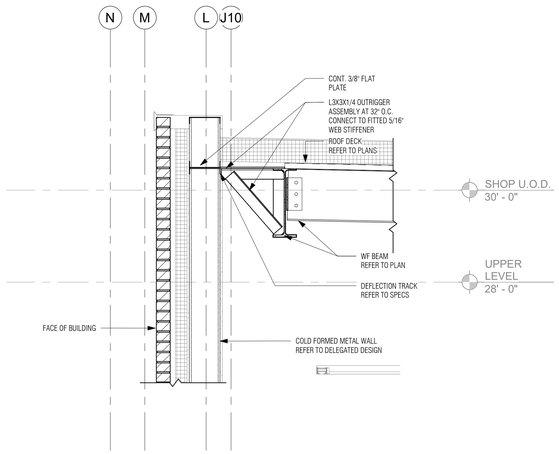




5 SECTION
3/4" = 1'-0"



6 SECTION
3/4" = 1'-0"



7 SECTION
3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S5.02

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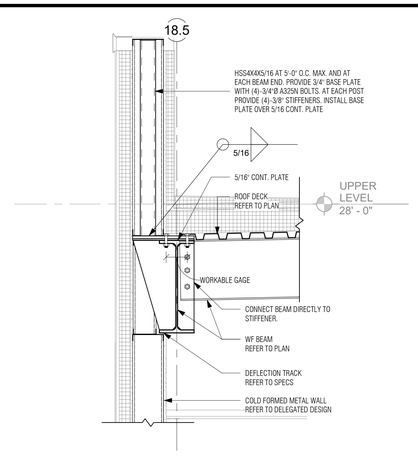
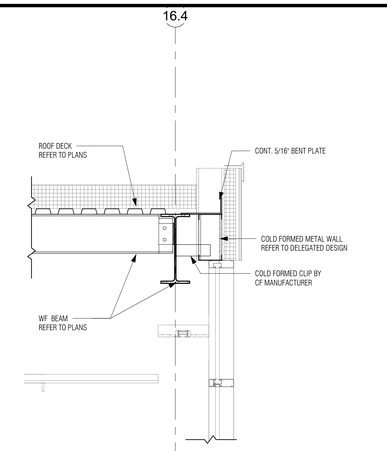
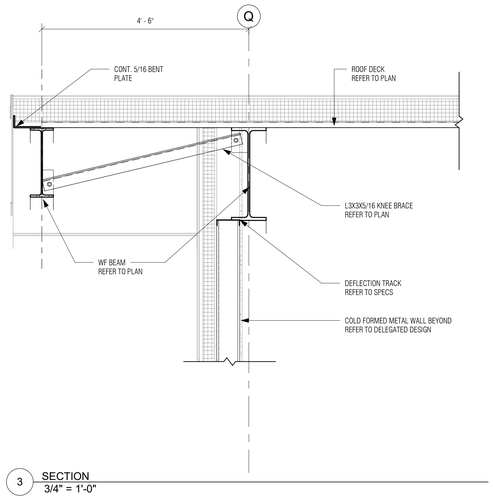


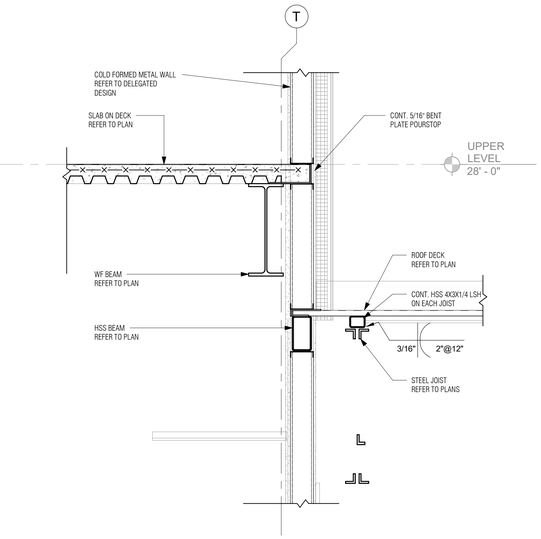
1 SECTION
3/4" = 1'-0"



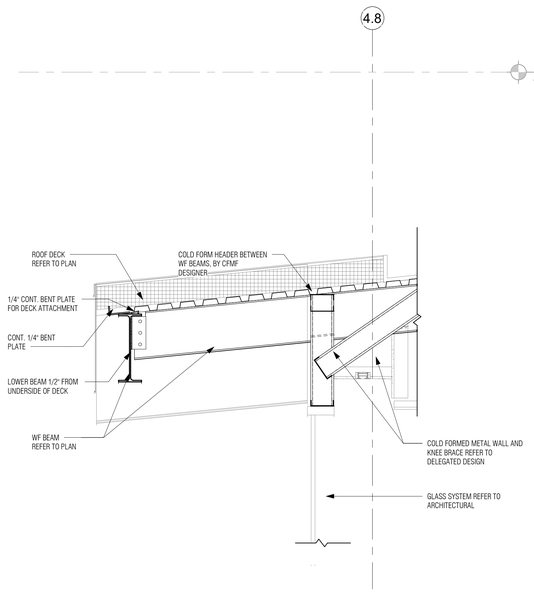
2 SECTION
3/4" = 1'-0"



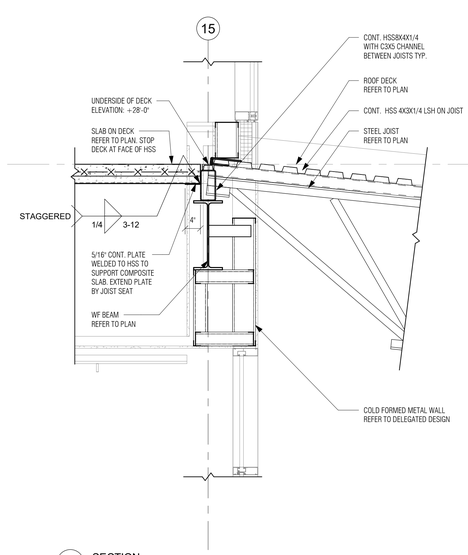
3 SECTION
3/4" = 1'-0"



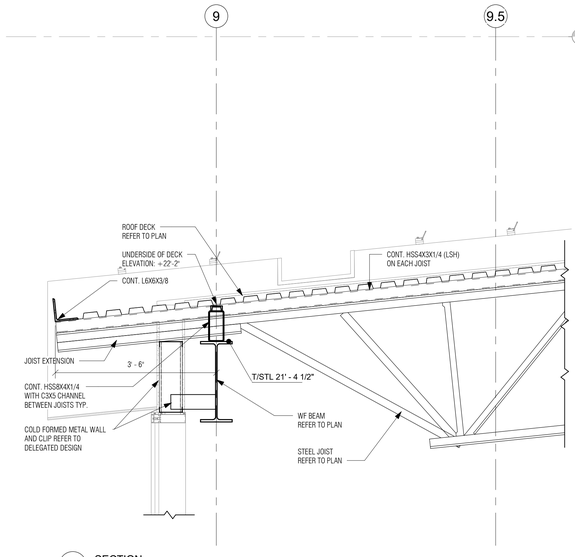
4 SECTION
3/4" = 1'-0"



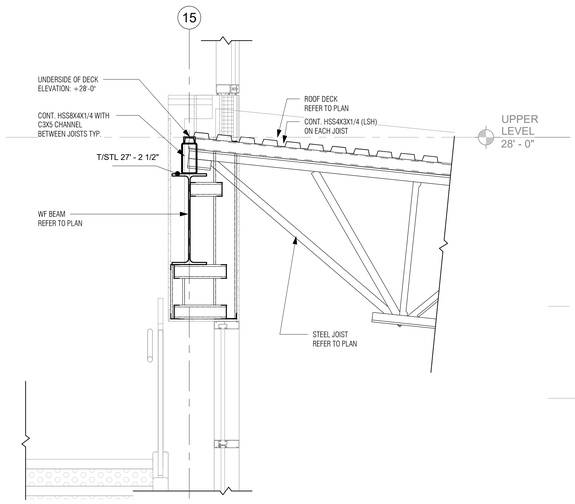
5 SECTION
3/4" = 1'-0"



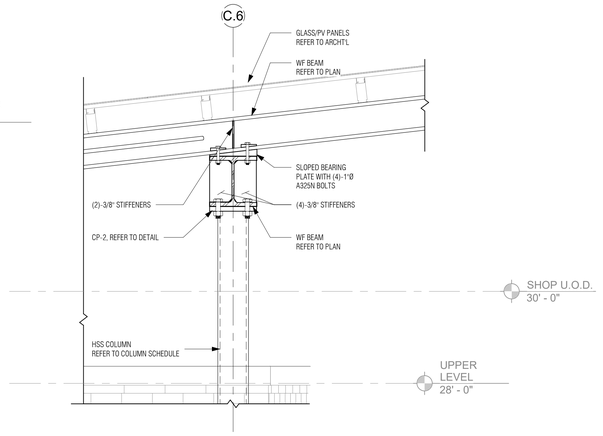
6 SECTION
3/4" = 1'-0"



7 SECTION
3/4" = 1'-0"



8 SECTION
3/4" = 1'-0"



9 SECTION
3/4" = 1'-0"

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530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
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ISSUE DATES

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S5.03

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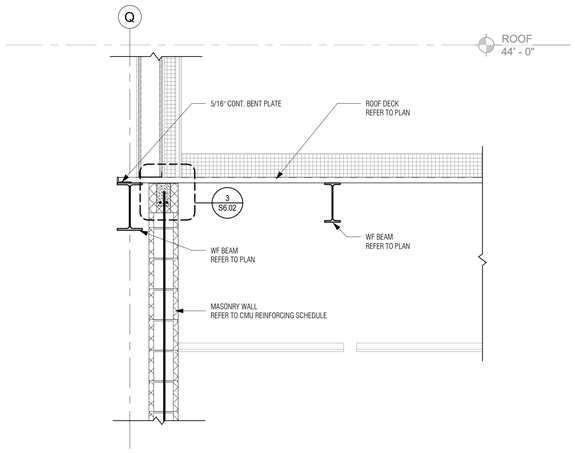
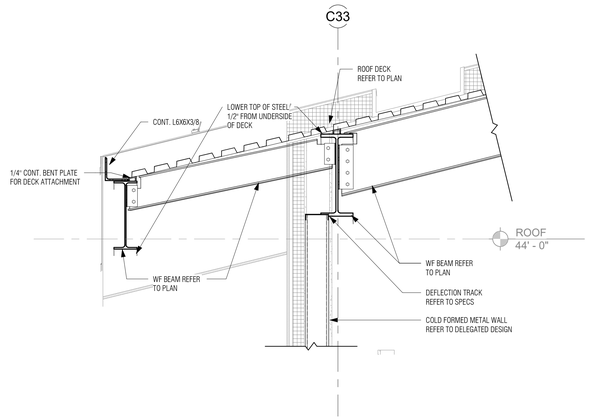


1 SECTION
3/4" = 1'-0"



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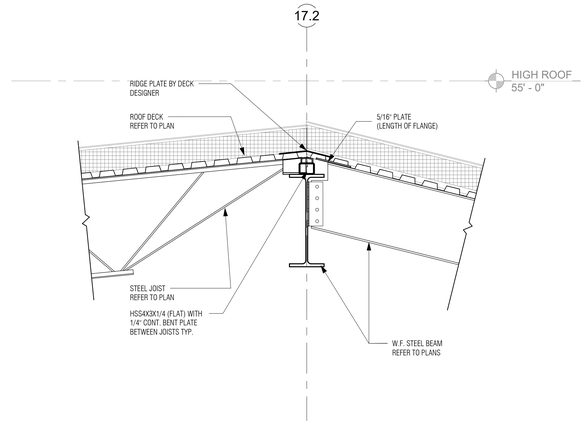
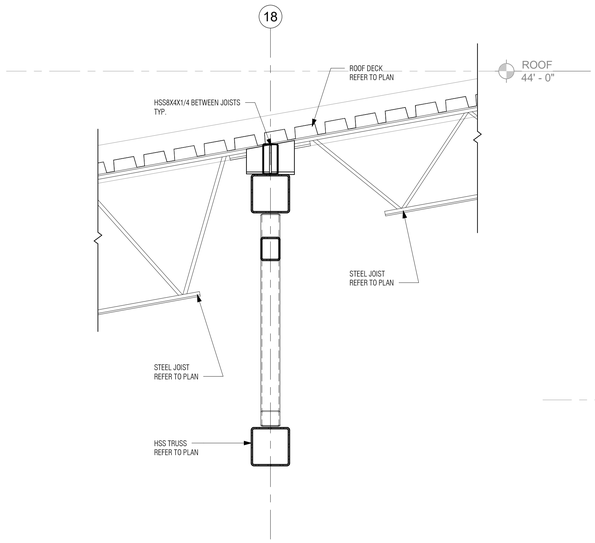
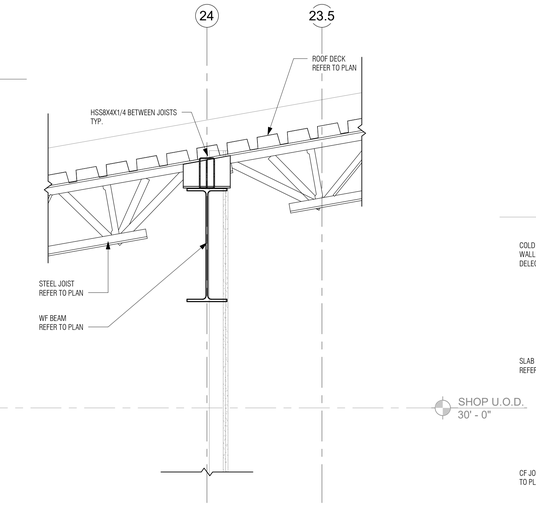
3/4" = 1'-0"



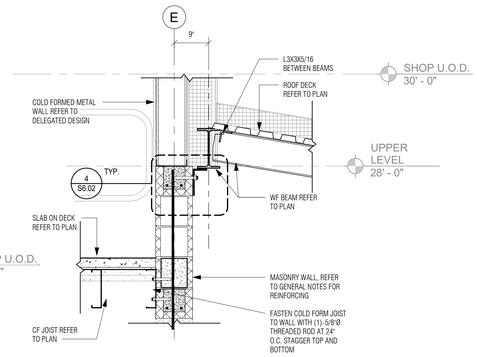
3 SECTION
3/4" = 1'-0"



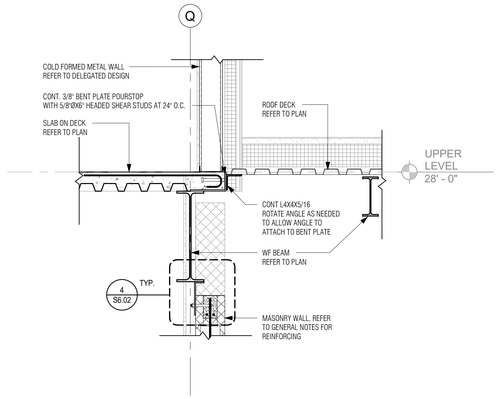
4 SECTION
3/4" = 1'-0"



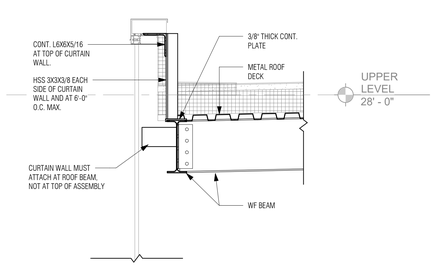
5 SECTION
3/4" = 1'-0"



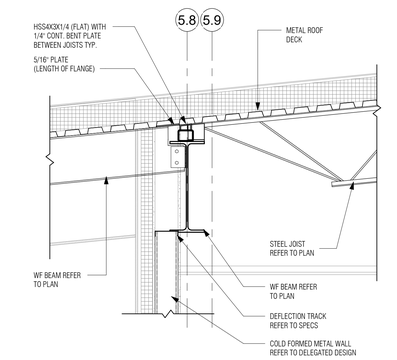
6 SECTION
3/4" = 1'-0"



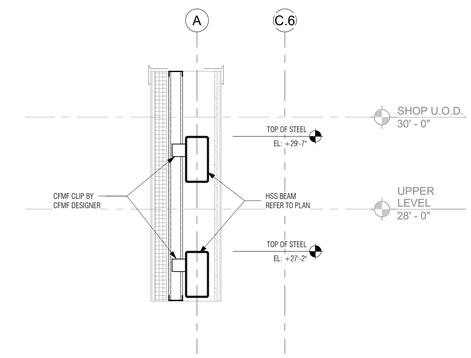
7 SECTION
3/4" = 1'-0"



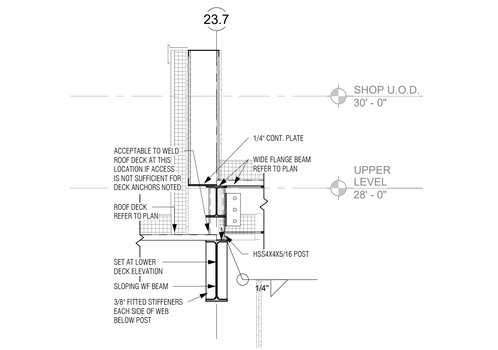
8 SECTION
3/4" = 1'-0"



9 SECTION
3/4" = 1'-0"



10 SECTION
3/4" = 1'-0"



11 SECTION
3/4" = 1'-0"

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STATE OF CONNECTICUT
MICHAEL J. SHEA
No. 0033408
LICENSED
PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN

DRAWING TITLE

ROOF SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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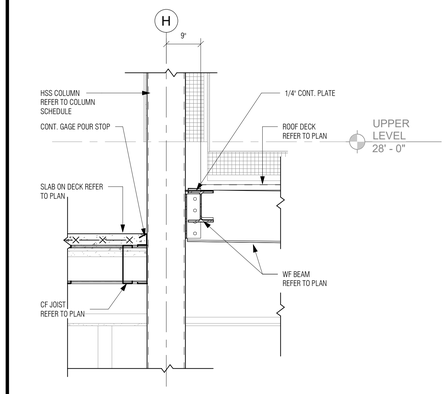
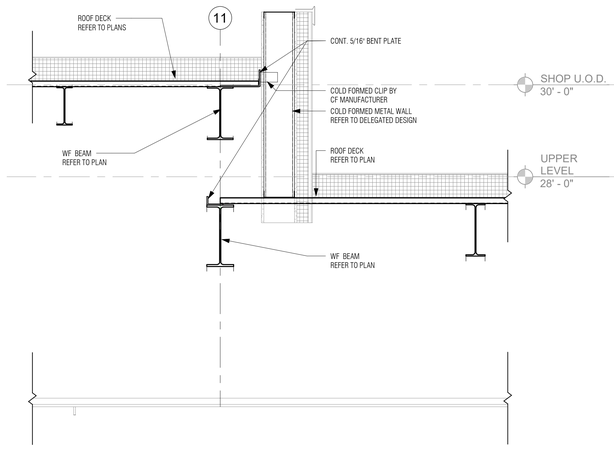


1 SECTION
3/4" = 1'-0"



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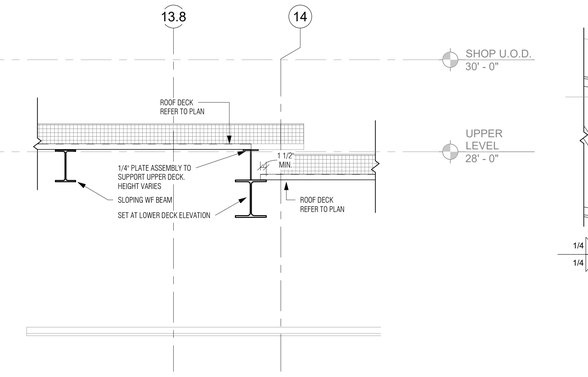

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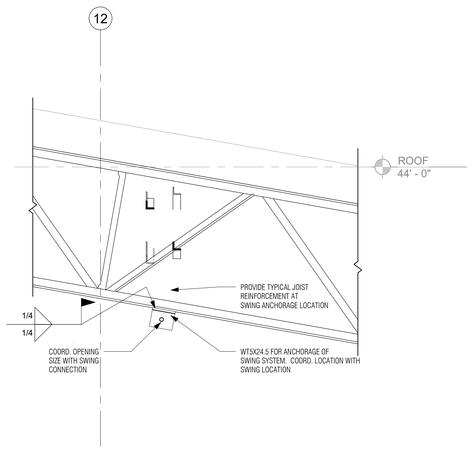
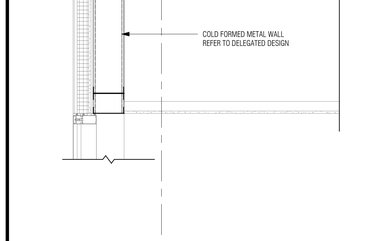
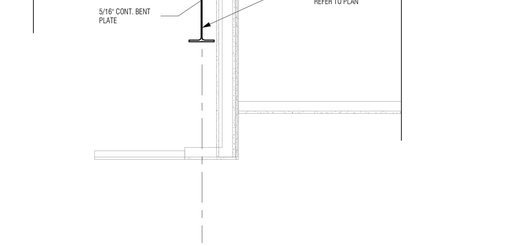
3/4" = 1'-0"



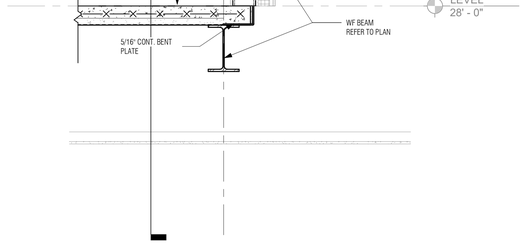
4 SECTION
3/4" = 1'-0"



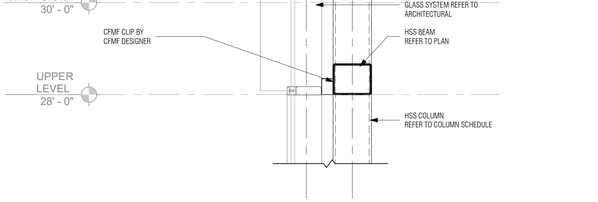
5 SECTION
3/4" = 1'-0"



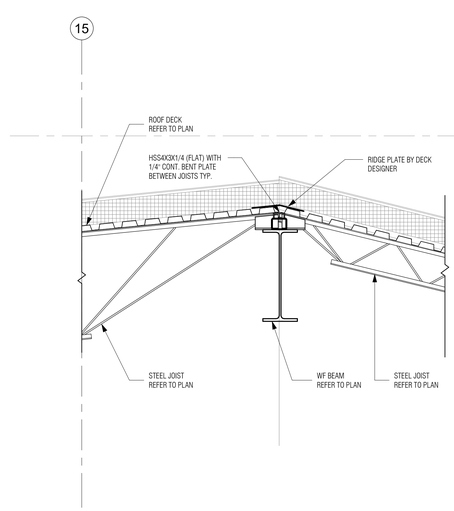
6 SECTION
3/4" = 1'-0"



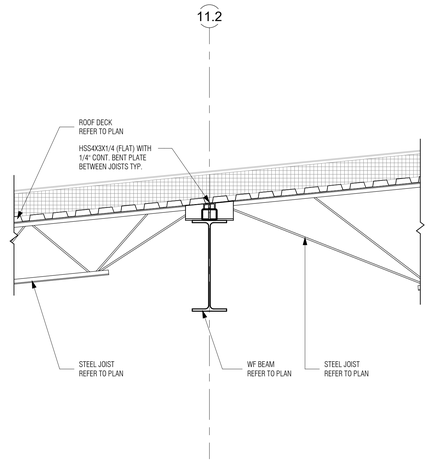
7 SECTION
3/4" = 1'-0"



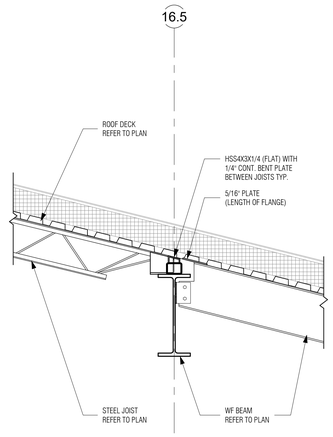
8 SECTION
3/4" = 1'-0"



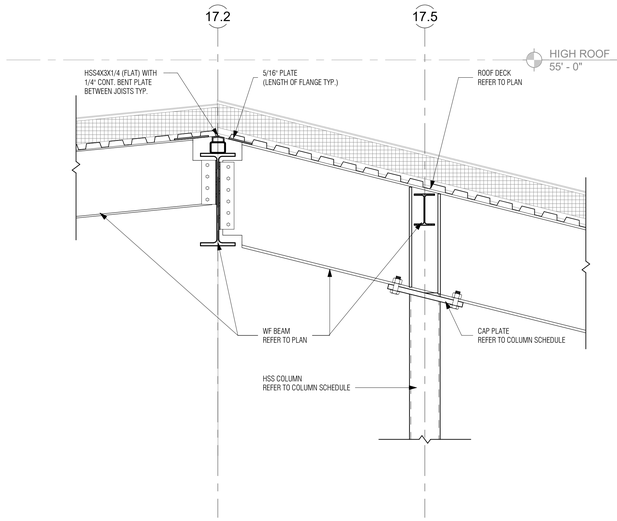
9 SECTION
3/4" = 1'-0"



10 SECTION
3/4" = 1'-0"



11 SECTION
3/4" = 1'-0"



12 SECTION
3/4" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

ROOF SECTIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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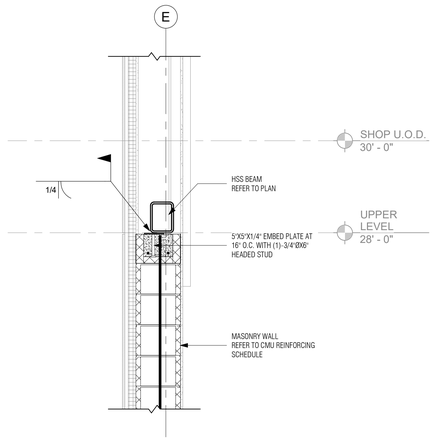
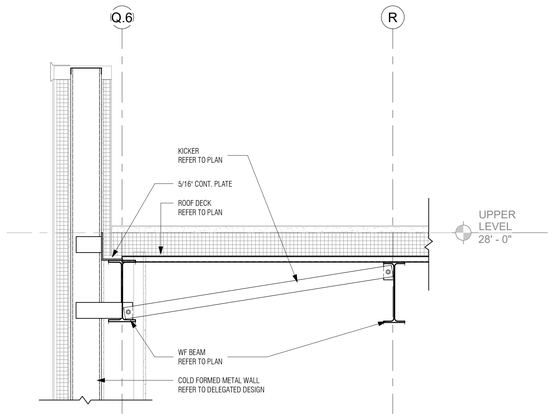
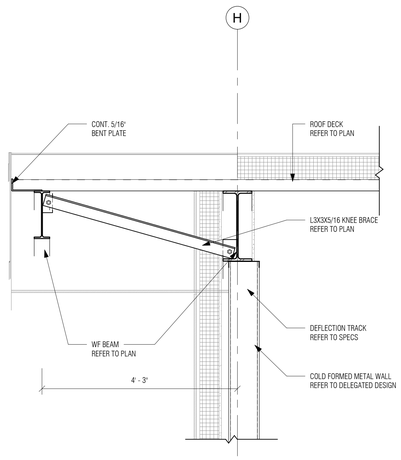


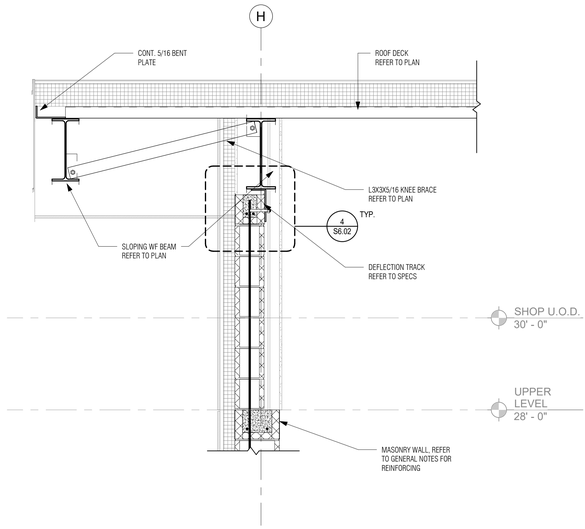
1 SECTION
3/4" = 1'-0"



2 SECTION
3/4" = 1'-0"



3 SECTION
3/4" = 1'-0"



4 SECTION
3/4" = 1'-0"

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PROFESSIONAL SEAL



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KEY PLAN



DRAWING TITLE

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STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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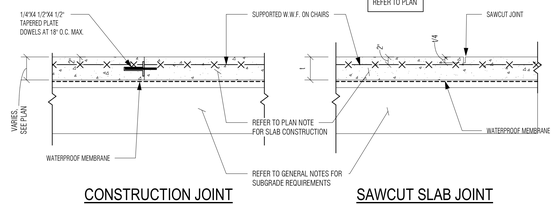
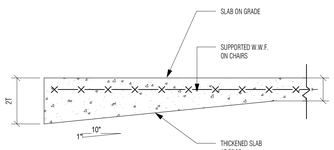


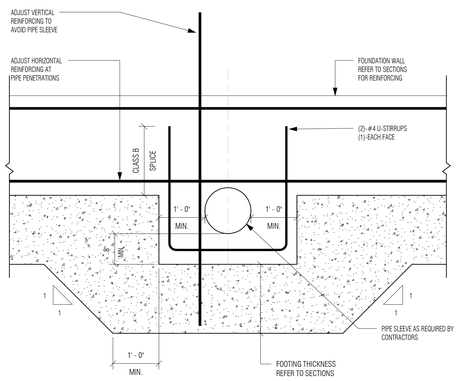
CONSTRUCTION JOINT SAWCUT SLAB JOINT



TYPICAL THICKENED EDGE

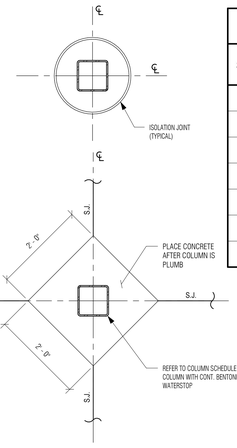
NOTE:
CONTRACTOR SHALL SUBMIT A PLAN INDICATING THE PROPOSED LOCATION OF CONTROL AND CONSTRUCTION JOINTS PRIOR TO PLACING CONCRETE FOR SLAB.
REFER TO GENERAL NOTES FOR SUBGRADE PREPARATION. REMOVE ALL FILL MATERIALS BELOW SLAB ON GRADE

1 TYPICAL SLAB ON GRADE DETAIL
3/4" = 1'-0"



NOTE: DO NOT PLACE PENETRATIONS THROUGH COLUMNS PIERS OR FOOTINGS.
REFER TO PLAN FOR LOCATIONS AND COORDINATE WITH SITE, MECHANICAL, PLUMBING, ELECTRICAL, AND FIRE PROTECTION DRAWINGS.

2 TYPICAL DETAIL OF PIPE PENETRATIONS THRU FOUNDATION WALLS
3/4" = 1'-0"

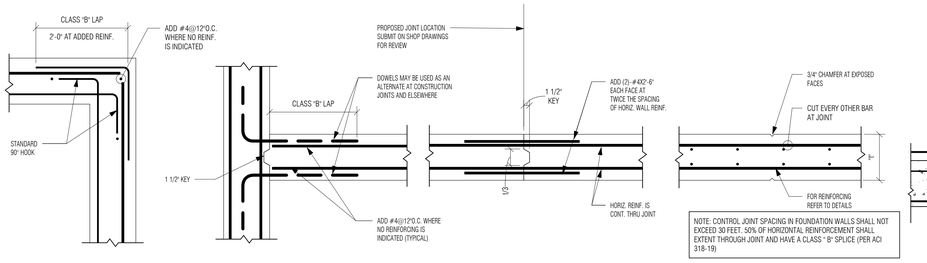


3 TYPICAL SLAB CONSTRUCTION JOINTS AT COLUMNS
3/4" = 1'-0"

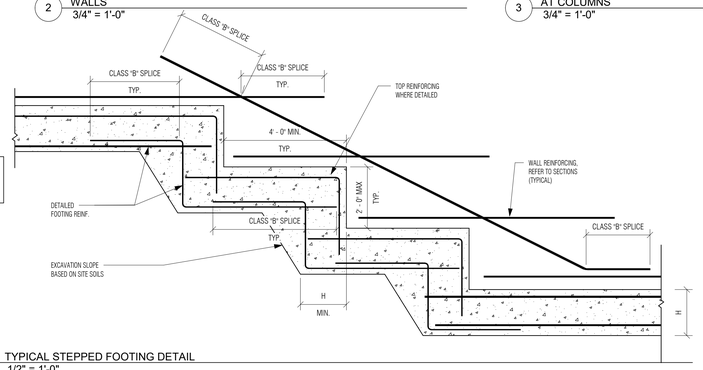
LAP SCHEDULE		
SIZE	3500 PSI	
	TOP	OTHERS
#3	26"	20"
#4	35"	27"
#5	43"	33"
#6	52"	40"
#7	75"	58"
#8	86"	66"
#9	97"	75"

LAP SCHEDULE		
SIZE	4000 PSI LIGHTWEIGHT	
	TOP	OTHERS
#3	33"	25"
#4	43"	33"
#5	54"	42"
#6	65"	50"
#7	94"	72"
#8	107"	83"
#9	121"	93"

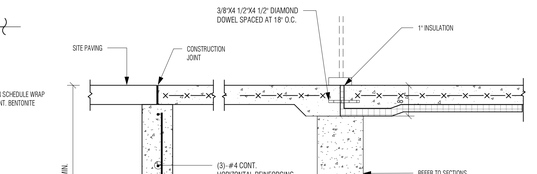
LAP SCHEDULE		
SIZE	4500 PSI	
	TOP	OTHERS
#3	24"	19"
#4	32"	25"
#5	40"	31"
#6	48"	37"
#7	70"	54"
#8	80"	62"
#9	91"	70"



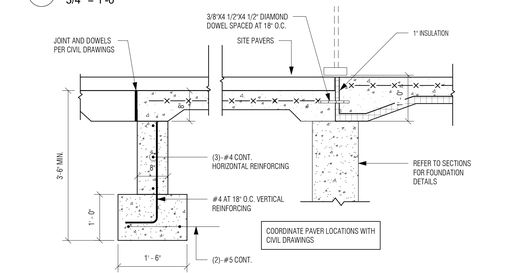
NOTE: CONTROL JOINT SPACING IN FOUNDATION WALLS SHALL NOT EXCEED 30 FEET. 50% OF HORIZONTAL REINFORCEMENT SHALL EXTENT THROUGH JOINT AND HAVE A CLASS " B" SPLICE (PER ACI 318-19)



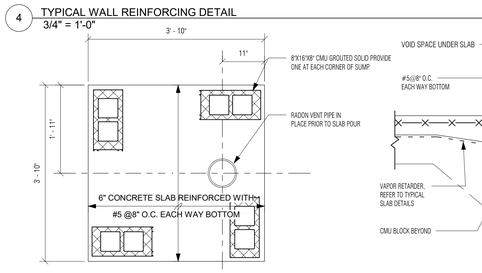
5 TYPICAL STEPPED FOOTING DETAIL
1/2" = 1'-0"

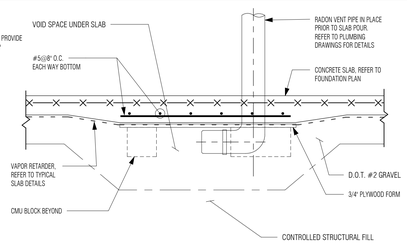


6 TYPICAL FOUNDATION AT DOORS
3/4" = 1'-0"



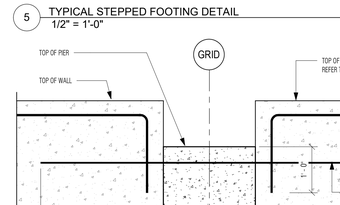
6A TYPICAL FOUNDATION DETAIL AT DOORS WITH PAVERS
3/4" = 1'-0"



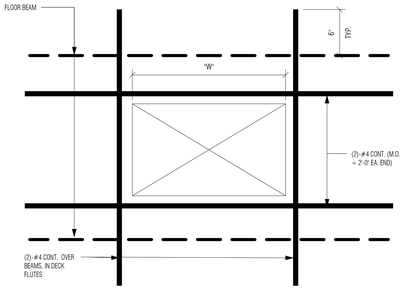


RADON SUMP LOCATIONS NOTED ON FOUNDATION PLAN WITH SYMBOL SHOWN AT LEFT.

7 TYPICAL SLAB ON GRADE RADON SUMP DETAIL
3/4" = 1'-0"

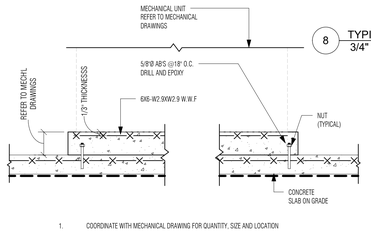


NOTE: REFER TO SECTIONS FOR REINFORCING.



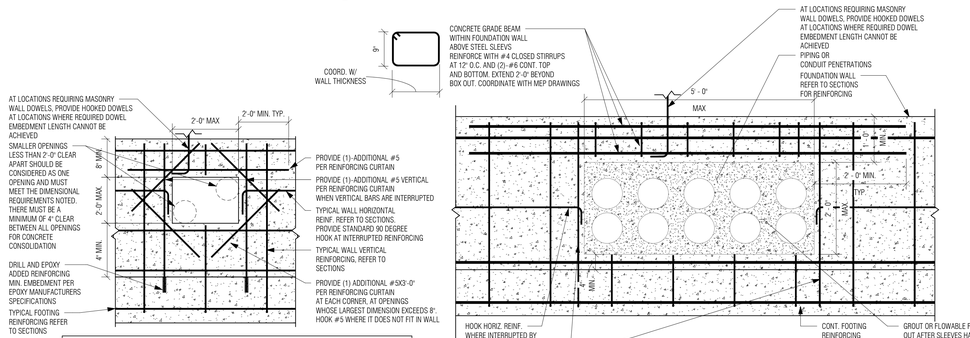
NOTES:
1. FOR OPENINGS WITH "W" GREATER THAN 4'-0" SUBMIT LOCATION FOR REVIEW.
2. FOR STEEL FRAME, REFER TO TYPICAL FLOOR OPENING DETAIL
3. PROVIDE AT ALL FLOOR BOXES IN SLAB ON GRADE AND SLAB ON DECK
4. COORDINATE QUANTITY AND LOCATIONS WITH MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS.

8 TYPICAL WALL REINFORCING DETAIL
3/4" = 1'-0"



1. COORDINATE WITH MECHANICAL DRAWING FOR QUANTITY, SIZE AND LOCATION

9 TYPICAL SLAB OPENING DETAIL
1 1/2" = 1'-0"



NOTE:
DO NOT LOCATE PENETRATIONS THROUGH COLUMN FOOTINGS.
COORDINATE WITH SITE, MECHANICAL, PLUMBING, ELECTRICAL, AND FIRE PROTECTION DRAWINGS, FOR LOCATIONS AND ELEVATIONS. THERE MUST BE A MINIMUM OF 2'-0" CLEAR BETWEEN OPENING GROUPS OTHERWISE THEY SHOULD BE CONSIDERED ONE GROUP.

AT GROUPED OPENINGS WHERE GROUP DIMENSION IS LESS THAN OR EQUAL TO 2'-0"

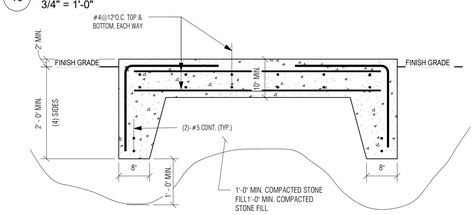
REFER TO 2/S-600 AND 14/S-600 FOR SINGLE OPENINGS MEETING MINIMUM CLEAR DISTANCE NOTED ABOVE

DETAIL IS NOT APPLICABLE AT WALLS WITH 2'-0" OR MORE OF UNBALANCED SOIL. NOTIFY MHAI OF GROUPED OPENING LOCATIONS IN WALLS WITH 2'-0" OR MORE OF UNBALANCED SOIL HEIGHT PRIOR TO CONSTRUCTION.

NOTE:
DO NOT LOCATE PENETRATIONS THROUGH COLUMN FOOTINGS.
COORDINATE WITH SITE, MECHANICAL, PLUMBING, ELECTRICAL, AND FIRE PROTECTION DRAWINGS, FOR LOCATIONS AND ELEVATIONS. THERE MUST BE A MINIMUM OF 2'-0" CLEAR BETWEEN OPENING GROUPS OTHERWISE THEY SHOULD BE CONSIDERED ONE GROUP.

AT GROUPED OPENINGS WHERE GROUP DIMENSION GREATER THAN 2'-0" AND LESS THAN OR EQUAL TO 5'-0"

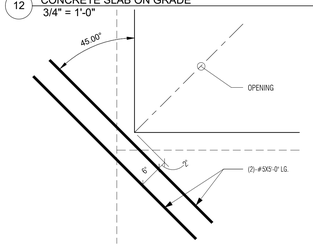
10 TYPICAL DETAIL OF PIPE PENETRATIONS BELOW WALL FOOTING
3/4" = 1'-0"



1. COORDINATE WITH MECHANICAL DRAWING FOR QUANTITY, SIZE AND LOCATION. 2. PROVIDE PADS AT GENERATORS, REFRIGERATOR AND FREEZER UNITS. COORDINATE WITH ELECTRICAL & KITCHEN DRAWINGS FOR SIZE AND LOCATION.

11 TYPICAL CONCRETE EQUIPMENT PAD ON GRADE
3/4" = 1'-0"

12 TYPICAL NEW CONCRETE PAD ON CONCRETE SLAB ON GRADE
3/4" = 1'-0"



13 TYPICAL AT REENTRANT SLAB CORNERS
3/4" = 1'-0"

14 TYPICAL GROUPED OPENINGS IN FOUNDATION WALLS
3/4" = 1'-0"

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

TYPICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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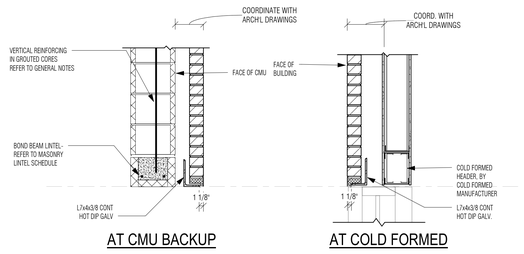
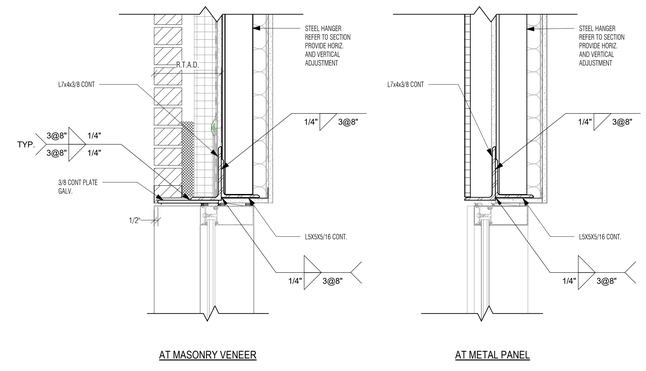
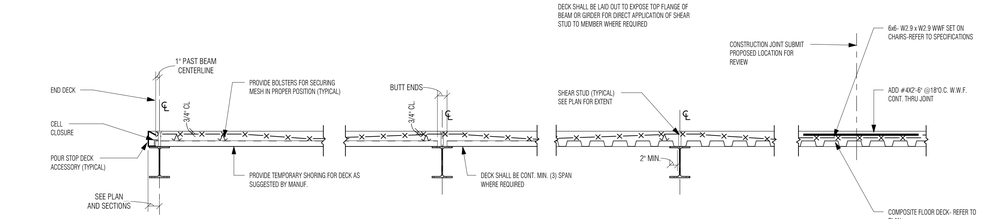


1 TYPICAL EXTERIOR LOOSE LINTEL.
3/4" = 1'-0"

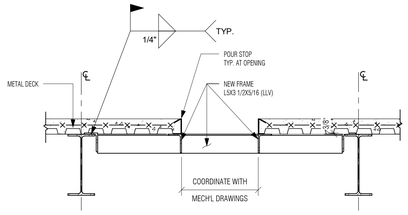


2 TYPICAL HUNG ANGLE DETAIL.
1 1/2" = 1'-0"

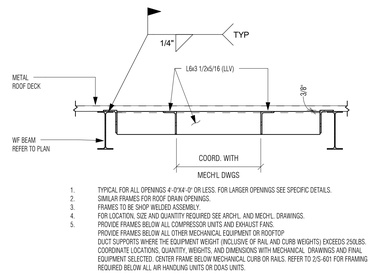


NOTE: REFER TO PLAN NOTES FOR FLOOR CONSTRUCTION.

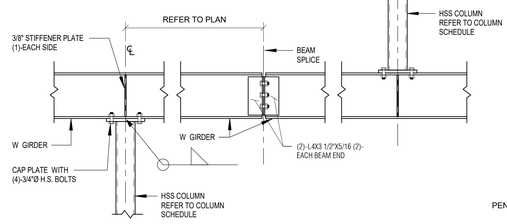
3 TYPICAL SUPPORTED SLAB DETAILS
3/4" = 1'-0"



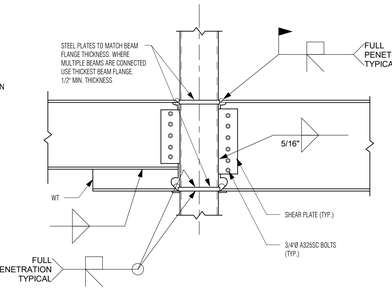
4 TYPICAL FLOOR OPENING DETAIL
3/4" = 1'-0"



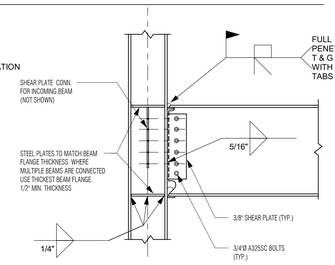
5 TYPICAL ROOF FRAME OPENING DETAIL (W BEAM)
3/4" = 1'-0"



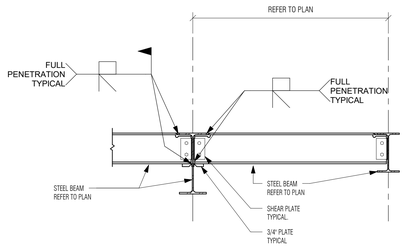
6 TYPICAL CANTILEVER AND CARRIED COLUMN DETAIL
3/4" = 1'-0"



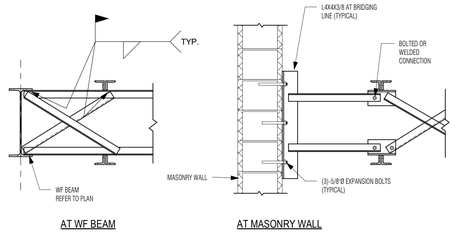
7 TYPICAL MOMENT CONNECTION DETAIL
3/4" = 1'-0"



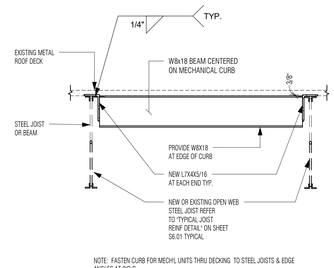
8 TYPICAL MOMENT CONNECTION DETAIL
3/4" = 1'-0"



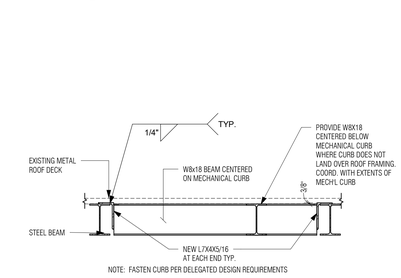
9 TYPICAL WF OUTRIGGER DETAIL
3/4" = 1'-0"



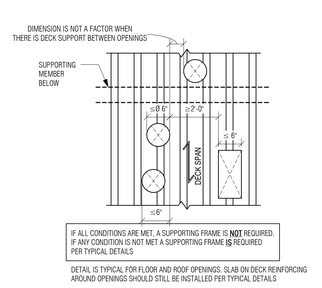
10 TYPICAL BRIDGING DETAIL
3/4" = 1'-0"



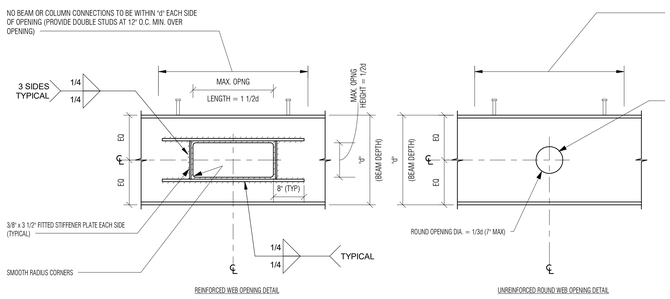
11 TYPICAL ROOF TOP EQUIPMENT SUPPORT (AT STEEL JOIST)
3/4" = 1'-0"



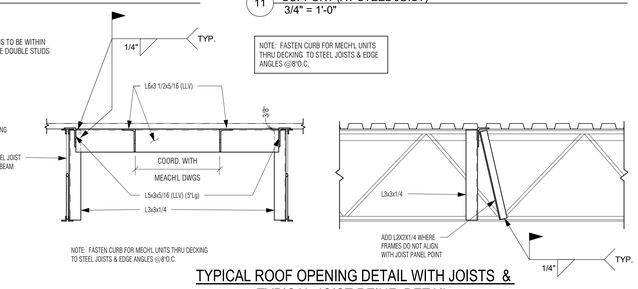
12 TYPICAL ROOF TOP EQUIPMENT SUPPORT
3/4" = 1'-0"



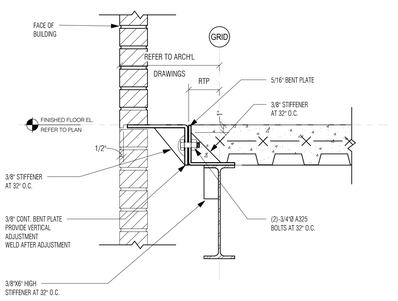
13 TYPICAL FLOOR AND ROOF DECK UNREINFORCED OPENINGS
3/4" = 1'-0"



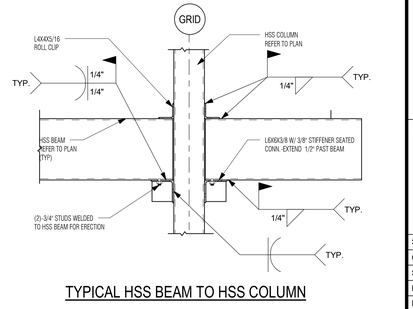
14 TYPICAL DETAIL AT BEAM WEB OPENINGS
NTS



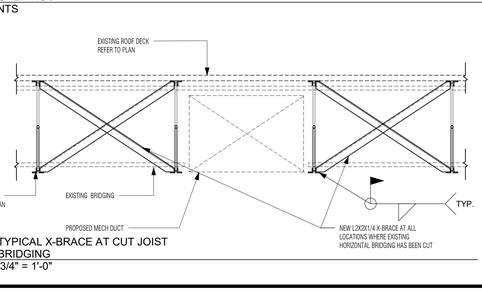
15 TYPICAL NEW ROOF OPENING DETAIL WITH JOISTS & TYPICAL JOIST REINF. DETAIL
3/4" = 1'-0"



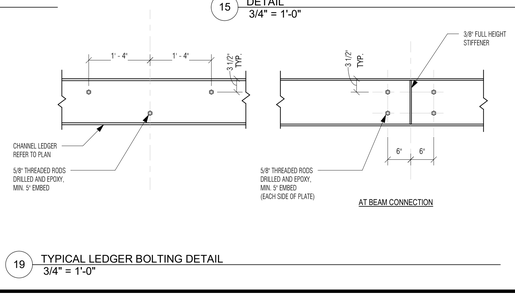
16 TYPICAL RELIEVING ANGLE.
1 1/2" = 1'-0"



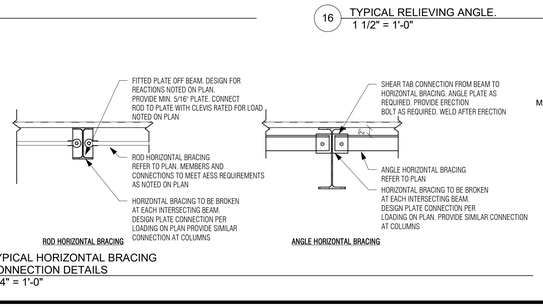
17 TYPICAL HSS BEAM TO HSS COLUMN
3/4" = 1'-0"



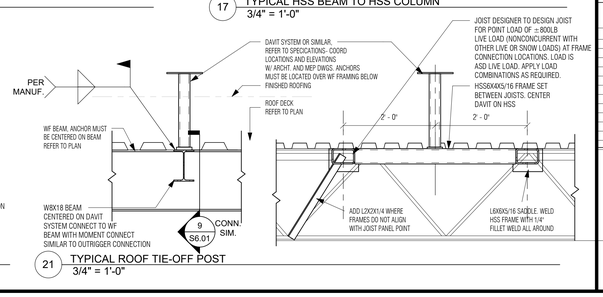
18 TYPICAL X-BRACE AT CUT JOIST BRIDGING
3/4" = 1'-0"



19 TYPICAL LEDGER BOLTING DETAIL
3/4" = 1'-0"



20 TYPICAL HORIZONTAL BRACING CONNECTION DETAILS
3/4" = 1'-0"



21 TYPICAL ROOF TIE-OFF POST
3/4" = 1'-0"

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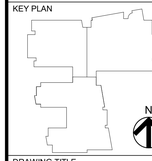
KEY PLAN



DRAWING TITLE

TYPICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

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3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

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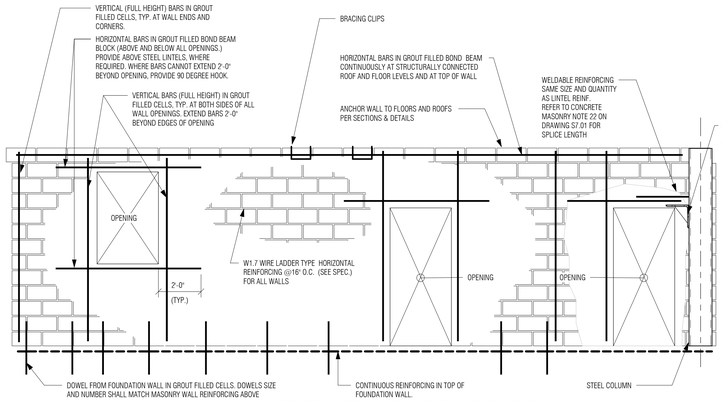


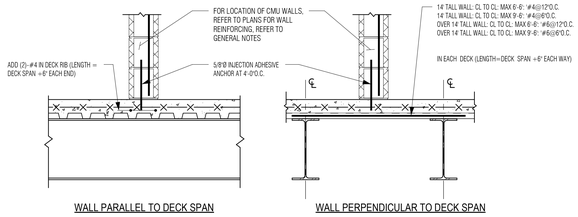
NOTE: REFER TO CONCRETE MASONRY GENERAL NOTES FOR WALL REINFORCING REQUIREMENTS.

1 TYPICAL CMU WALL REINFORCEMENT DETAIL
3/4" = 1'-0"

CONTROL JOINT NOTES:

PROVIDE VERTICAL CONTROL JOINTS IN THE CONCRETE MASONRY UNIT PORTION OF ALL WALLS AND PARTITIONS. CONTROL JOINTS SHALL BE SPACED AT NO MORE THAN 25 FEET AND SHOULD BE LOCATED AS FOLLOWS.

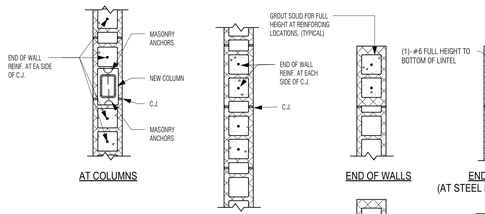
1. COORDINATE LOCATIONS WITH ARCHITECTURAL DRAWINGS.
2. AT JUNCTIONS OF BEARING AND NON-BEARING WALLS, CHANGES IN WALL HEIGHT OR THICKNESS JUNCTIONS OF WALL WITH COLUMNS AND PIERS, AND INTERSECTING WALLS.
3. AT NO MORE THAN HALF THE SPACING NOTED ABOVE FROM CORNERS OF WALLS.
4. AT CHASES AND RECESSES FOR PIPING OR FIXTURES.
5. CONTROL JOINTS MAY BE BEST LOCATED AT THE ENDS OF HORIZONTAL REINFORCING FOR LINTELS OVER OPENINGS OR AT THE ENDS OF STEEL LINTELS OVER OPENINGS AND EXTEND UP FOR THE REMAINDER OF THE WALL HEIGHT. CONTROL JOINTS SHOULD NO BE LOCATED THROUGH LINTEL REINFORCING.
6. CONTROL JOINTS TO EXTEND THRU ENTIRE WALL THICKENESS AND FOR FULL WALL HEIGHT.
7. SUBMIT CONTROL JOINT LOCATIONS AS SHOP DRAWING SUBMITTAL.
8. BOND BEAM HORIZONTAL REINFORCING SHALL BE CONTINUOUS THROUGH CONTROL JOINT. HORIZONTAL JOINT REINFORCING SHALL NOT CROSS OVER CONTROL JOINT.
9. CONTROL JOINTS IN CONCRETE MASORY UNIT PORTION OF WALL DO NOT NEED TO MATCH VENEER JOINT LOCATIONS. REFER TO ARCHITECTURAL DRAWINGS FOR JOINT LOCATIONS IN VENEER.



WALL PARALLEL TO DECK SPAN

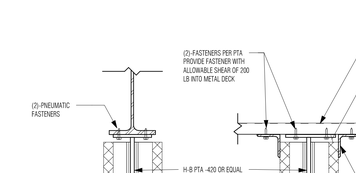
WALL PERPENDICULAR TO DECK SPAN

5 TYP. DETAIL OF CMU PARTITION ON SUPPORTED SLAB
3/4" = 1'-0"



NOTES:
1. REINFORCING DETAILS APPLY TO ALL CMU WALLS. FOR ACTUAL REINFORCING REQUIREMENTS, REFER TO GENERAL NOTES ON DRAWINGS
2. PROVIDE DOWELS FROM CONCRETE FOUNDATIONS TO CMU WALL ABOVE. SIZE AND NUMBER TO MATCH WALL REINFORCING.

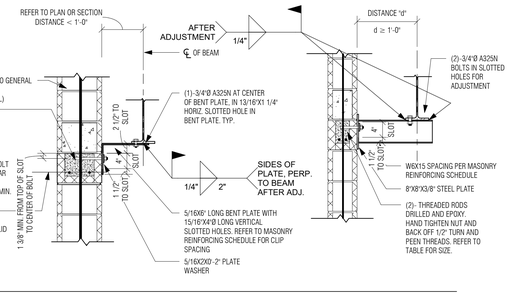
2 TYPICAL CMU REINFORCING PLAN DETAILS
3/4" = 1'-0"



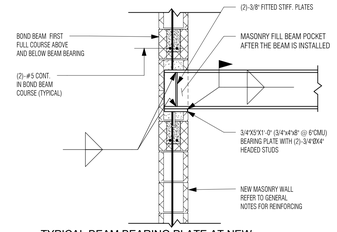
NOTE: APPLIES TO INTERIOR WALLS ONLY.

3 TYPICAL TOP OF WALL MASONRY ANCHORAGE TO STEEL
1 1/2" = 1'-0"

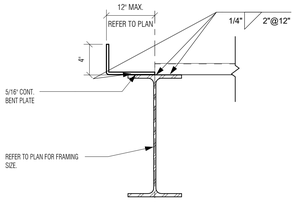
CMU WALL SIZE	NOMINAL EMBEDMENT	ROD DIAM.
6"	3 3/8"	3/8" Ø
8"	5 5/8"	3/4" Ø
10"	5 5/8"	3/4" Ø
12"	5 5/8"	3/4" Ø



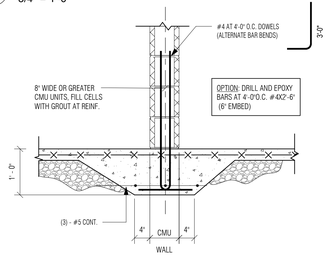
4 TYPICAL BEAM TO MASONRY CONNECTION
3/4" = 1'-0"



6 TYPICAL BEAM BEARING PLATE AT NEW CMU
3/4" = 1'-0"

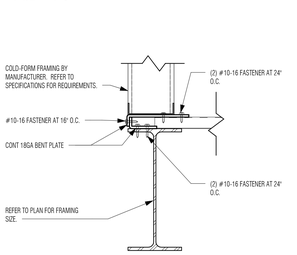


8 TYPICAL BENT PLATE AT METAL ROOF DECK PERIMETER
1 1/2" = 1'-0"

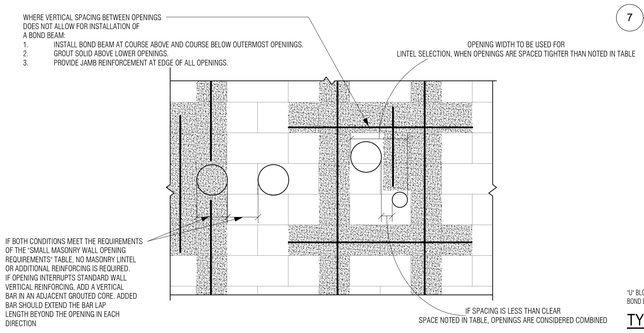


1. 6" CMU GREATER THAN 20'-0" IN HEIGHT.
2. 8" CMU GREATER THAN 15'-0" IN HEIGHT.
3. AND WHERE LABELED T.S. ON PLAN

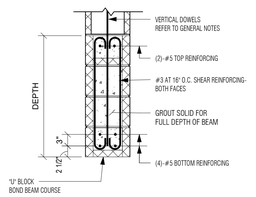
7 TYPICAL THICKENED SLAB DETAIL
3/4" = 1'-0"



9 TYPICAL WALL CONNECTION TO DECK DETAIL
1 1/2" = 1'-0"



10 TYPICAL MASONRY WALL DETAILS AT ADJACENT AND STAGGERED OPENINGS
3/4" = 1'-0"



TYPICAL MASONRY BEAM DETAIL

1. DO NOT REMOVE SHORING FOR 7 DAYS AFTER BEAM IS GROUTED.
3. REFER TO PLANS FOR BEAM LOCATIONS.

11 TYPICAL MASONRY BEAM DETAIL
3/4" = 1'-0"

SMALL MASONRY WALL OPENING REQUIREMENTS

OPENING GEOMETRY	MASONRY WALL TYPE	OPENING WIDTH	HEAD OF OPENING LINTEL	SILL OF OPENING REINFORCING	JAMB REINFORCING	MINIMUM CLEAR HORIZONTAL SPACE BETWEEN OPENINGS
ROUND	ALL	≤8'0	NONE	NONE	NONE	8"
	NON-SHEARWALLS	8'0≤OPENING≤16'0	SCHEDULE 40 PIPE SLEEVE	NONE	NONE	8"
	SHEARWALLS	8'0≤OPENING≤16'0	PER MASONRY LINTEL SCHEDULE	PER MASONRY REINFORCING SCHEDULE	PER MASONRY REINFORCING SCHEDULE	BEARING AS REQUIRED IN LINTEL SCHEDULE
	ALL	>16'0	PER MASONRY LINTEL SCHEDULE	PER MASONRY REINFORCING SCHEDULE	PER MASONRY REINFORCING SCHEDULE	BEARING AS REQUIRED IN LINTEL SCHEDULE
SQUARE OR RECTANGULAR	ALL	≤12"	GROUT COURSE ABOVE OPENING SOLID, EXTEND 8" BEYOND OPENING	NONE	GROUT JAMBS SOLID AT OPENING	8"
	ALL	>12"	PER MASONRY LINTEL SCHEDULE	PER MASONRY REINFORCING SCHEDULE	PER MASONRY REINFORCING SCHEDULE	BEARING AS REQUIRED IN LINTEL SCHEDULE

1. IF THE REQUIRED CLEAR SPACE BETWEEN OPENINGS IS NOT MET, A MASONRY LINTEL MUST BE PROVIDED PER THE MASONRY LINTEL SCHEDULE.

MASONRY LINTEL SCHEDULE_

MARK	CMU	OPENING WIDTH	LINTEL
	10" & 12" BLOCK	6'-1" TO 12'-0"	(2)-#6 CONT. TOP AND BOTTOM
	10" & 12" BLOCK	UP TO 6'-0"	(2)-#5 CONT.
	8" BLOCK	UP TO 5'-0"	(2)-#5 CONT.
	8" BLOCK	5'-1" TO 10'-0"	(2)-#6 CONT. TOP AND BOTTOM
	6" BLOCK	UP TO 6'-0"	(1)-#5 CONT.
	INTERIOR 4" MASONRY	UP TO 6'-0"	L5X3 1/2X5/16 (4" MIN. BEARING)
	INTERIOR 4" MASONRY	6'-0" TO 10'-0"	L7X4X3/8 (4" MIN. BEARING)

NOTE:

1. PROVIDE LINTELS WHERE NEEDED. NOT SHOWN ON THE DRAWINGS
2. ALL EXTERIOR STEEL SHALL BE HOT DIPPED GALVANIZED
3. COORDINATE ALL OPENINGS WITH ARCHT & MECH DRAWINGS.
4. GROUT ALL JAMBS SOLID PER TYPICAL CMU WALL REINF. DETAILS.
5. ALL CMU BOND BEAMS SHALL HAVE SOLID BOTTOM "U" BLOCK AS BOTTOM COURSE.

CMU REINFORCING SCHEDULE

DESCRIPTION	NOMINAL WALL THICKNESS	VERTICAL REINFORCING	VERTICAL ENDWALL CHORD REINFORCEMENT (IF APPLICABLE)	HORIZONTAL REINFORCING	SUPPLEMENTAL HORIZONTAL REINFORCEMENT (IF APPLICABLE)	NOTES	ATTACHMENT TO STRUCTURE
GENERIC MASONRY SHEARWALLS	COORD. W/ ARCH'L DRAWINGS	REFER TO ELEVATIONS	REFER TO ELEVATIONS	W1.7 GAGE LADUR TYPE @ 16" O.C.	--	--	4/S-602 AT 32"O.C. TYPICAL
GYM AND CAFE EXTERIOR NON-SHEAR WALLS	COORD. W/ ARCH'L DRAWINGS	#6 AT 16" O.C. TYPICAL	(2)-#6	W1.7 GAGE LADUR TYPE @ 16" O.C.	--	--	REFER TO SECTIONS, PROVIDE ANCHORS AT 16" O.C.
ELEVATOR NON-SHEARWALLS	COORD. W/ ARCH'L DRAWINGS	#5 AT 32" O.C. TYPICAL	(2)-#6	W1.7 GAGE LADUR TYPE @ 16" O.C.	8" BOND BEAM WITH (2)-#5 CONT. @6'-0" O.C.	COORDINATE ELEVATOR EMBED INSTALLATIONS	4/S-602 AT 32"O.C. TYPICAL
STAIR NON-SHEARWALLS	COORD. W/ ARCH'L DRAWINGS	#5 AT 32" O.C. TYPICAL	(2)-#6	W1.7 GAGE LADUR TYPE @ 16" O.C.	--	REFER TO TYPICAL STAIR WALL ELEVATION	4/S-602 AT 32"O.C. TYPICAL
EXTERIOR NON-SHEARWALLS AND NON-GYM WALLS	COORD. W/ ARCH'L DRAWINGS	#5 AT 32" O.C. TYPICAL	(2)-#6	W1.7 GAGE LADUR TYPE @ 16" O.C.	--	--	4/S-602 AT 32"O.C. TYPICAL
FIREWALL	10"	REFER TO ELEVATIONS	REFER TO ELEVATIONS	W1.7 GAGE LADUR TYPE @ 16" O.C.	8" BOND BEAM WITH (2)-#5 CONT. @4'-0" O.C.	--	NONE. CANTILEVERED WALL
INTERIOR PARTITION WALLS	COORD. W/ ARCH'L DRAWINGS	#4 AT 48" O.C. TYPICAL	(1)-#4	W1.7 GAGE LADUR TYPE @ 16" O.C.	--	PROVIDE (1)-#4 CONT. HORIZ AT TOP OF WALL, ABOVE AND BELOW ALL OPENINGS, AND IN BOND BEAMS CONNECTED TO FLOORS AND ROOFS	3/S-602 AT 24"O.C. TYPICAL
AREA A AND B MASONRY SHEARWALLS: TYPE 1	COORD. W/ ARCH'L DRAWINGS	REFER TO ELEVATIONS	REFER TO ELEVATIONS	W1.7 GAGE LADUR TYPE @ 16" O.C.	REFER TO ELEVATIONS	4/S-602 ANCHORS ARE 12" MIN. FROM TOP OF WALL.	4/S-602 AT 24"O.C. TYPICAL
							WALL UNDER BRACE FRAME: 4/S-602 AT 8"O.C. TYPICAL
AREA C MASONRY SHEARWALLS: TYPE 2	COORD. W/ ARCH'L DRAWINGS	REFER TO ELEVATIONS	REFER TO ELEVATIONS	W1.7 GAGE LADUR TYPE @ 16" O.C.	REFER TO ELEVATIONS	4/S-602 ANCHORS ARE 12" MIN. FROM TOP OF WALL	1ST-2ND: 4/S-602 AT 8" O.C.
							2ND-3RD: 4/S-602 AT 16" O.C.
							3RD-ROOF: 4/S-602 AT 24" O.C.
AREA C MASONRY SHEARWALLS: TYPE 3	COORD. W/ ARCH'L DRAWINGS	REFER TO ELEVATIONS	REFER TO ELEVATIONS	W1.7 GAGE LADUR TYPE @ 16" O.C.	REFER TO ELEVATIONS	4/S-602 ANCHORS ARE 12" MIN. FROM TOP OF WALL. REFER TO TYPICAL STAIR WALL ELEVATION	4/S-602 AT 24"O.C. TYPICAL

1. PROVIDE VERTICAL ENDWALL REINFORCEMENT NOTED AT BOTH SIDES OF DOOR, WINDOW, AND MECHANICAL OPENINGS AS WELL AS ON EACH SIDE OF CONTROL JOINTS.
   A. REFER TO "SMALL MASONRY WALL OPENING REQUIREMENTS" TABLE FOR MASONRY WALL OPENINGS THAT DO NOT REQUIRE ADDITIONAL REINFORCING AROUND OPENINGS.
   B. COORDINATE ALL OPENING LOCATIONS WITH ARCHITECTURAL AND MEP DRAWINGS
2. PROVIDE (2)-#5 CONT. MINIMUM FULLY GROUTED BOND BEAM COURSE AT THE TOP OF ALL WALLS AND AT BOND BEAMS CONNECTED AT FLOOR AND ROOFS, UNLESS OTHERWISE INDICATED.
   A. REFER TO MASONRY LINTEL SCHEDULE FOR HORIZOONTAL REINFORCEMENT REQUIRED ABOVE AND BELOW WINDOW AND MECHANICAL OPENINGS AND ABOVE ALL DOOR OPENINGS.
   B. REFER TO "SMALL MASONRY WALL OPENINGS REQUIREMENTS" TABLE FOR MASONRY WALL OPENINGS THAT DO NOT REQUIRE ADDITIONAL REINFORCING AROUND OPENINGS.

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

KEY PLAN



DRAWING TITLE

TYPICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	08/15/2025
DRAWN BY	AC
APPROVED BY	PS

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
4	03/26/2026	PHASE 1
5	05/19/2026	100% CD

S6.02

5/18/2026 3:36:02 PM Autodesk Docs://Trumbull Hillcrest Middle School/25-80-Trumbull Hillcrest MS-STR_RC26.rvt

TOWN OF TRUMBULL, CT

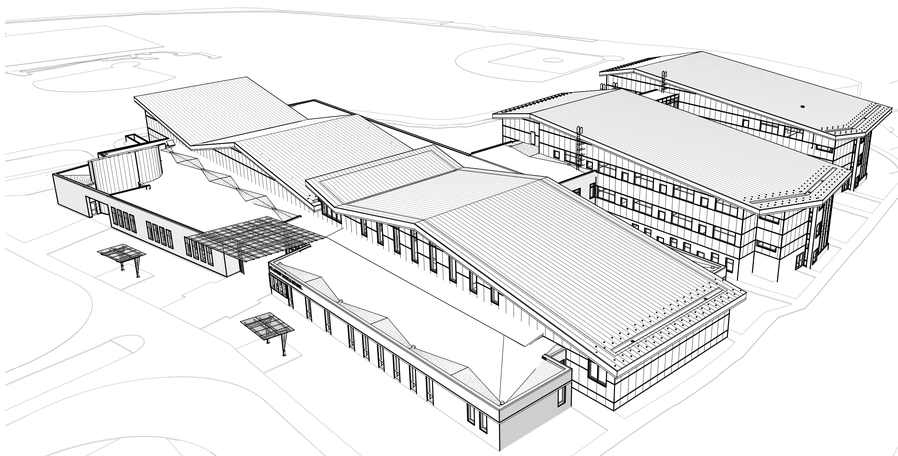
TRUMBULL HILLCREST MIDDLE SCHOOL

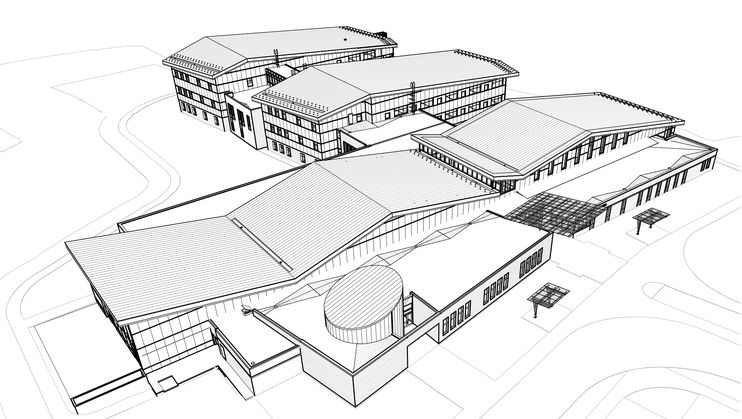
530 DANIELS FARM ROAD
TRUMBULL, CT 06611

STATE PROJECT # 144-0108N
05/19/2026

CONSTRUCTION DOCUMENTS 100%

VOLUME 2 OF 2





DRAWING LIST

MECHANICAL

UM1.01 - GEOTHERMAL WELLFIELD
UM1.02 - GEOTHERMAL DETAILS
M0.01 - MECHANICAL LEGENDS AND NOTES
M1.01 - LOWER LEVEL MECHANICAL ZONING
M1.02 - MAIN LEVEL MECHANICAL ZONING
M1.03 - UPPER LEVEL MECHANICAL ZONING
M2.01 - LOWER LEVEL MECHANICAL AIR DISTRIBUTION
M2.02A - MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA A
M2.02B - MAIN LEVEL MECHANICAL AIR DISTRIBUTION- AREA B
M2.02C - MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA C
M2.03 - UPPER LEVEL MECHANICAL AIR DISTRIBUTION
M2.04 - MECHANICAL ROOF PLAN
M3.01 - LOWER LEVEL MECHANICAL PIPING
M3.02A - MAIN LEVEL MECHANICAL PIPING - AREA A
M3.02B - MAIN LEVEL MECHANICAL PIPING - AREA B
M3.02C - MAIN LEVEL MECHANICAL PIPING - AREA C
M3.03 - UPPER LEVEL MECHANICAL PIPING
M4.01 - MAIN MECHANICAL ROOM ENLARGED PLAN
M5.01 - MECHANICAL ENLARGED PLANS, SECTIONS & ISOMETRICS
M6.01 - MECHANICAL DETAILS
M6.02 - MECHANICAL DETAILS
M6.03 - MECHANICAL DETAILS
M6.04 - MECHANICAL DETAILS
M7.01 - MECHANICAL CONTROLS LEGEND
M7.02 - MECHANICAL CONTROL SCHEMATIC
M7.03 - MECHANICAL CONTROLS-GEOTHERMAL
M7.04 - MECHANICAL CONTROLS-DOAS
M7.05 - MECHANICAL CONTROLS
M7.06 - MECHANICAL CONTROLS
M7.07 - MECHANICAL CONTROLS
M8.01 - MECHANICAL AIRFLOW DIAGRAM
M8.02 - MECHANICAL VENTILATION CALCULATIONS
M8.03 - MECHANICAL HEAT PUMP & TERM, BOX CONTROL SCHED.
M9.01 - MECHANICAL SCHEDULES
M9.02 - MECHANICAL SCHEDULES

ELECTRICAL

E0.01 – ELECTRICAL LEGEND
E1.01 – LOWER LEVEL ELECTRICAL LIGHTING PLAN
E1.02A – MAIN LEVEL ELECTRICAL LIGHTING PLAN – AREA A
E1.02B – MAIN LEVEL ELECTRICAL LIGHTING PLAN – AREA B
E1.02C – MAIN LEVEL ELECTRICAL LIGHTING PLAN – AREA C
E1.03A – UPPER LEVEL ELECTRICAL LIGHTING PLAN – AREA A
E1.03B – UPPER LEVEL ELECTRICAL LIGHTING PLAN – AREA B
E1.03C – UPPER LEVEL ELECTRICAL LIGHTING PLAN – AREA C
E2.01A – LOWER LEVEL ELECTRICAL POWER PLAN – AREA A
E2.01B – LOWER LEVEL ELECTRICAL POWER PLAN – AREA B
E2.01C – LOWER LEVEL ELECTRICAL POWER PLAN – AREA C
E2.02A – MAIN LEVEL ELECTRICAL POWER PLAN – AREA A
E2.02B – MAIN LEVEL ELECTRICAL POWER PLAN – AREA B
E2.02C – MAIN LEVEL ELECTRICAL POWER PLAN – AREA C
E2.03A – UPPER LEVEL ELECTRICAL POWER PLAN – AREA A
E2.03B – UPPER LEVEL ELECTRICAL POWER PLAN – AREA B
E2.03C – UPPER LEVEL ELECTRICAL POWER PLAN – AREA C
E3.01 – ROOF ELECTRICAL LIGHTNING PROTECTION PLAN – ADD ALTERNATE
E3.02 – MAIN LEVEL ELECTRICAL LIGHTNING PROTECTION PLAN – ADD ALTERNATE
E4.01 – ELECTRICAL SINGLE LINE DIAGRAM
E5.01 – ELECTRICAL ENLARGED PLANS
E5.02 – ELECTRICAL ENLARGED PLANS
E5.03 – ELECTRICAL ENLARGED PLANS
E5.04 – ELECTRICAL ENLARGED PLANS
E6.01 – ELECTRICAL DETAILS
E6.02 – ELECTRICAL DETAILS
E6.03 – ELECTRICAL DETAILS
E6.04 – ELECTRICAL LIGHTING CONTROL SCHEMATICS
E6.05 – ELECTRICAL LIGHTING CONTROL SCHEMATICS
E7.01 – ELECTRICAL PANEL SCHEDULES 480V
E7.02 – ELECTRICAL PANEL SCHEDULES 480V
E7.03 – ELECTRICAL PANEL SCHEDULES 480V
E7.04 – ELECTRICAL PANEL SCHEDULES 208V
E7.05 – ELECTRICAL PANEL SCHEDULES 208V
E7.06 – ELECTRICAL PANEL SCHEDULES 208V
E7.07 – ELECTRICAL PANEL SCHEDULES 208V
E7.08 – ELECTRICAL EMERGENCY PANEL SCHEDULES 480V
E7.09 – ELECTRICAL EMERGENCY PANEL SCHEDULES 208V
E7.10 – ELECTRICAL SCHEDULES
E7.11 – ELECTRICAL LIGHTING FIXTURE SCHEDULE
E7.12 – ELECTRICAL LIGHTING CONTROL PANEL SCHEDULES
E7.13 – ELECTRICAL SUBMETERING
PV0.01 – PHOTOVOLTAIC LEGEND
PV1.01 – ROOF PHOTOVOLTAIC PLAN
PV2.01 – PHOTOVOLTAIC SINGLE LINE DIAGRAM
PV2.02 – PHOTOVOLTAIC RISER
PV2.03 – PHOTOVOLTAIC RISER – ADD ALTERNATE
PV2.04 – PHOTOVOLTAIC RISER – ADD ALTERNATE
PV3.01 – PHOTOVOLTAIC DETAILS

FIRE ALARM

FA0.01 – FIRE ALARM LEGEND
FA1.01 – FIRE ALARM RISER DIAGRAM
FA2.01 – LOWER LEVEL FIRE ALARM PLAN
FA2.02A – MAIN LEVEL FIRE ALARM PLAN – AREA A
FA2.02B – MAIN LEVEL FIRE ALARM PLAN – AREA B
FA2.02C – MAIN LEVEL FIRE ALARM PLAN – AREA C
FA2.03A – UPPER LEVEL FIRE ALARM PLAN – AREA A
FA2.03B – UPPER LEVEL FIRE ALARM PLAN – AREA B
FA2.03C – UPPER LEVEL FIRE ALARM PLAN – AREA C
FA3.01 – FIRE ALARM DETAILS

FIRE PROTECTION

FP0.01 – FIRE PROTECTION LEGEND
FP1.01C – LOWER LEVEL FIRE PROTECTION PLAN - AREA C
FP1.02A – MAIN LEVEL FIRE PROTECTION PLAN - AREA A
FP1.02B – MAIN LEVEL FIRE PROTECTION PLAN - AREA B
FP1.02C – MAIN LEVEL FIRE PROTECTION PLAN - AREA C
FP1.03C – UPPER LEVEL FIRE PROTECTION PLAN - AREA C
FP4.01 – FIRE PROTECTION DETAILS

DRAWING LIST

PLUMBING

P0.01 – PLUMBING LEGEND
P2.01A – UNDERGROUND PLUMBING DRAINAGE PLAN - AREA A
P2.01B – UNDERGROUND PLUMBING DRAINAGE PLAN - AREA B
P2.01C – UNDERGROUND PLUMBING DRAINAGE PLAN - AREA C
P2.02C – LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.03A – MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA A
P2.03B – MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA B
P2.03C – MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.04C – UPPER LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.05A – ROOF PLUMBING DRAINAGE PLAN - AREA A
P2.05B – ROOF PLUMBING DRAINAGE PLAN - AREA B
P2.05C – ROOF PLUMBING DRAINAGE PLAN - AREA C
P3.01C – LOWER LEVEL PLUMBING SUPPLY PLAN - AREA C
P3.02A – MAIN LEVEL PLUMBING SUPPLY PLAN - AREA A
P3.02B – MAIN LEVEL PLUMBING SUPPLY PLAN - AREA B
P3.02C – MAIN LEVEL PLUMBING SUPPLY PLAN - AREA C
P3.03C – UPPER LEVEL PLUMBING SUPPLY PLAN - AREA C
P4.01 – PLUMBING DETAILS
P4.02 – PLUMBING DETAILS
P4.03 – PLUMBING DETAILS
P4.04 – PLUMBING DETAILS
P5.01 – PLUMBING STACK DIAGRAMS
P5.02 – PLUMBING STACK DIAGRAMS
P5.03 – PLUMBING STACK DIAGRAMS
P5.04 – PLUMBING STACK DIAGRAMS
P5.05 – PLUMBING STACK DIAGRAMS
P5.06 – PLUMBING STACK DIAGRAMS
P5.07 – PLUMBING STACK DIAGRAMS
P5.08 – PLUMBING STORM DIAGRAMS
P5.09 – PLUMBING STORM DIAGRAMS
P5.10 – PLUMBING STORM DIAGRAMS
P5.11 – PLUMBING DOMESTIC WATER DIAGRAMS
P5.12 – PLUMBING DOMESTIC WATER DIAGRAMS
P5.13 – PLUMBING DOMESTIC WATER DIAGRAMS
P5.14 – PLUMBING DOMESTIC WATER DIAGRAMS
P6.01 – PLUMBING SCHEDULES

TECHNOLOGY

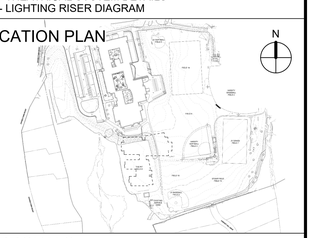
AV0.01 - AUDIO VISUAL LEGEND AND NOTES
AV7.01 - AUDIO VISUAL SIGNAL FLOW - CONFERENCE ROOM & MUSIC CLASSROOMS
AV7.02 - AUDIO VISUAL SIGNAL FLOW - CAFETERIA & GYM
AV7.03 - AUDIO VISUAL SIGNAL FLOW - BLACK BOX
AV8.01 - AUDIO VISUAL DETAILS
AVI0.01 - AUDIO VISUAL INFRASTRUCTURE LEGEND & NOTES
AVI1.01 - AUDIO VISUAL INFRASTRUCTURE - LOWER LEVEL
AVI1.02A - AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA A
AVI1.02B - AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA B
AVI2.12A - AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA A
AVI2.12B - AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA B
AVI6.01 - AUDIO VISUAL INFRASTRUCTURE ELEVATIONS
AVI6.02 - AUDIO VISUAL INFRASTRUCTURE ELEVATIONS
AVI7.01 - AUDIO VISUAL INFRASTRUCTURE DETAILS
AVI7.02 - AUDIO VISUAL INFRASTRUCTURE DETAILS

SC0.01 - SECURITY LEGEND, NOTES & ABBREVIATIONS
SC0.50 - SECURITY SITE PLAN
SC1.01 - SECURITY - LOWER LEVEL
SC1.02A - SECURITY - MAIN LEVEL AREA A
SC1.02B - SECURITY - MAIN LEVEL AREA B
SC1.02C - SECURITY - MAIN LEVEL AREA C
SC1.03 - SECURITY - UPPER LEVEL
SC1.04 - SECURITY - ROOF LEVEL
SC5.01 - SECURITY DETAIL
SC5.02 - SECURITY DETAIL
SC6.01 - SECURITY RISER DIAGRAMS

T0.01 - TELECOM LEGEND, NOTES AND ABBREVIATIONS
T0.50 - TELECOM - SITE PLAN
T1.01 - TELECOM - LOWER LEVEL
T1.02A - TELECOM - MAIN LEVEL AREA A
T1.02B - TELECOM - MAIN LEVEL AREA B
T1.02C - TELECOM - MAIN LEVEL AREA C
T1.03 - TELECOM - UPPER LEVEL
T1.04 - TELECOM - ROOF LEVEL
T4.01 - TELECOM ENLARGED PLANS - TELECOM ROOMS
T4.02 - TELECOM ENLARGED PLANS - TELECOM ROOMS
T5.01 - TELECOM DETAILS - PATHWAYS
T5.02 - TELECOM DETAILS - GROUNDING
T5.03 - TELECOM DETAILS - CABLE RUNWAY
T5.04 - TELECOM DETAILS
T5.05 - TELECOM DETAILS
T5.06 - TELECOM DETAILS
T5.07 - TELECOM DETAILS - CLASSROOM AV
T5.08 - TELECOM DETAILS - CLASSROOM AV
T5.09 - TELECOM DETAILS - CLASSROOM AV

TH0.00 - THEATRICAL TITLE & LEGEND
TH0.10 - THEATRICAL SPECIFICATIONS 1 STAGE EQUIPMENT
TH0.11 - THEATRICAL SPECIFICATIONS 2 PRODUCTION LIGHTING SYSTEM
TH0.20 - THEATRICAL SCHEDULES
TH1.02B - THEATRICAL - BLACK BOX ENLARGED PLAN & RCP
TH4.01 - BLACK BOX SECTIONS & ELEVATIONS
TH4.02 - BLACK BOX FIXTURE PLOT
TH5.01 - THEATRICAL SYSTEM DETAILS
TH6.01 - LIGHTING RISER DIAGRAM

LOCATION PLAN



APPROVALS

PUBLIC WORKS DATE

AGENCY DATE

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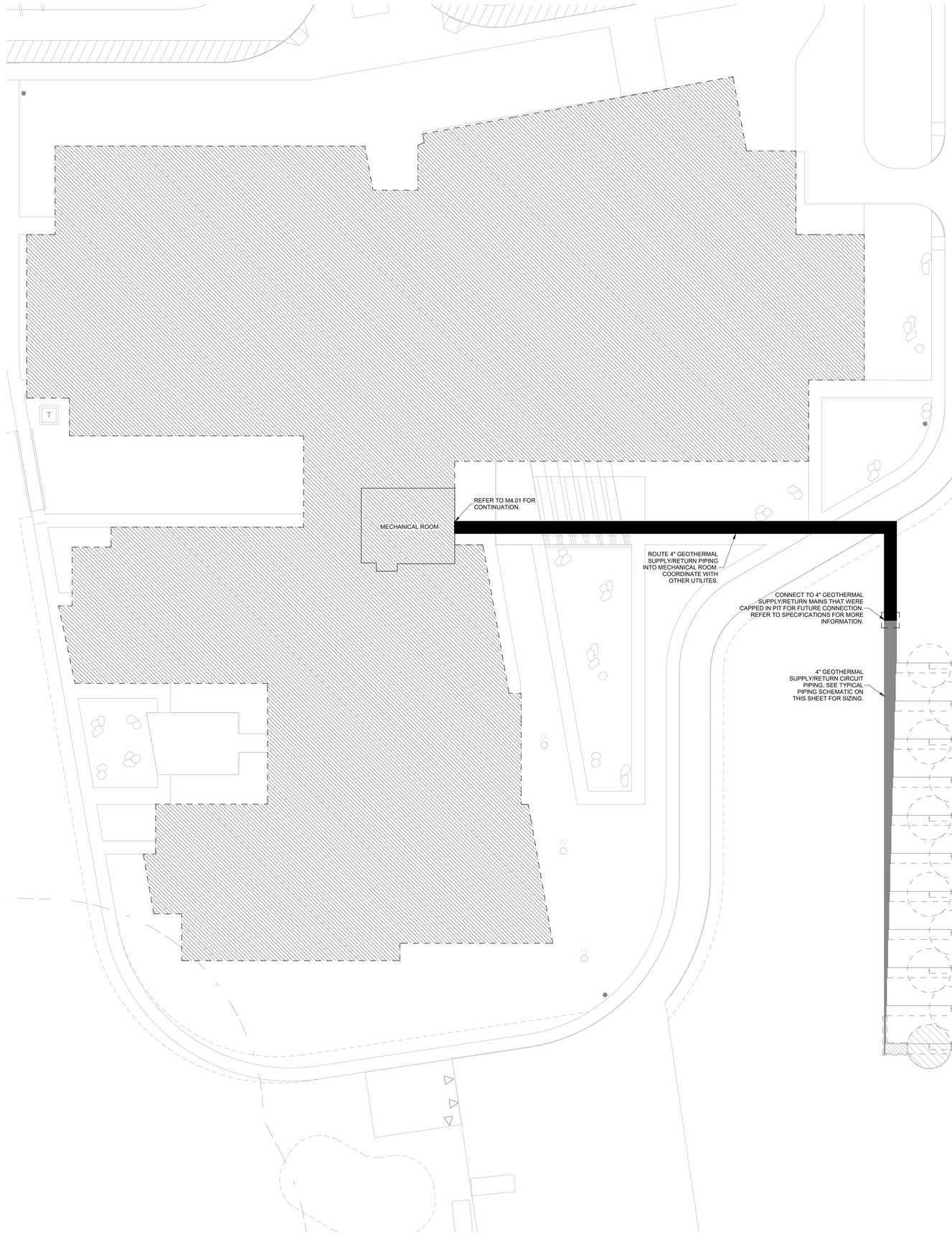
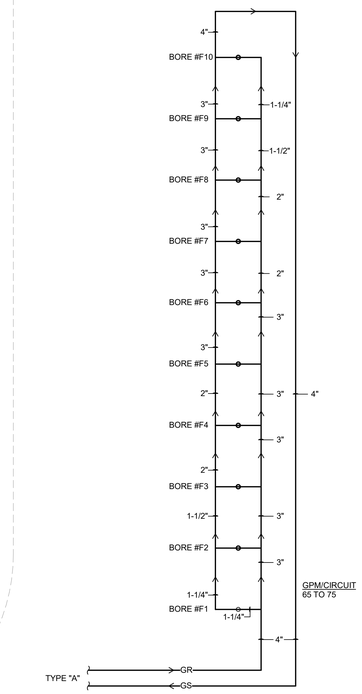


1 GEOTHERMAL WELLFIELD
1" = 20'-0"



NOTES:
1. PIPE SIZES TYPICAL.
2. WELLS SHALL BE LOCATED ON 20 FOOT CENTERS.

2 TYPICAL WELLFIELD CIRCUIT PIPING SCHEMATIC
NTS

GENERAL NOTES:

1. CONTRACTORS TO VISIT SITE AND BECOME FAMILIAR WITH PROJECT AREA PRIOR TO BIDDING.
2. MECHANICAL AND GEOTHERMAL CONTRACTORS TO COORDINATE SITE PREPARATION WORK WITH OWNER TWO WEEKS PRIOR TO ANY WORK COMMENCING.
3. MECHANICAL AND GEOTHERMAL CONTRACTOR TO FULLY COORDINATE WITH ALL TRADES BEFORE INSTALLING PIPING. MECHANICAL AND GEOTHERMAL CONTRACTOR TO REVIEW SITE CONDITIONS PRIOR TO BID AND INCLUDE ALL COSTS NECESSARY FOR SITE PREPARATION AND SLURRY CONTROL.
4. ALL GEOTHERMAL PIPING AND WELLS INSTALLED AS PART OF THE PROJECT AND ALL UTILITIES WITHIN PROJECT AREA SHALL BE SURVEYED BY A LAND LICENSED SURVEYOR.
5. CONTRACTOR SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES AT LEAST ONCE EVERY SEVEN (7) DAYS AND WITHIN 24 HOURS OF THE END OF A STORM THAT PRODUCES 0.5 INCHES OR GREATER OF RAINFALL ANY NECESSARY REPAIRS OR CLEANUP NEEDED TO MAINTAIN THE EFFECTIVENESS OF THE EROSION AND SEDIMENT CONTROL DEVICES SHALL BE MADE ACCORDINGLY.

SLURRY CONTROL NOTES:

1. SLURRY CONTROL MEASURES NOTED ON DRAWINGS ARE BY NO MEANS ABSOLUTE. THE MECHANICAL AND GEOTHERMAL CONTRACTORS ARE FULLY RESPONSIBLE TO ENSURE SLURRY/WATER CONTROL MEASURES ARE IN PLACE TO KEEP AREAS ADJACENT TO PROJECT SITE CLEAN OF MATERIAL. CONTRACTORS SHALL INSTALL ADDITIONAL MEASURES AS NECESSARY.
2. MECHANICAL AND GEOTHERMAL CONTRACTORS TO REVIEW WELL BORE LOG ALONG WITH PROJECT AND BORINGS.
3. CONTRACTOR TO PROVIDE TEMPORARY STONE SUB-BASE DURING DRILLING AS NEEDED. THIS IS TO ALLOW MOBILITY OF DRILL RIGS DURING WINTER CONDITIONS AS WELL AS SLURRY CONTROL.
4. PROTECT ALL OPENINGS TO PREVENT SLURRY RUN OFF FROM ENTERING. PROVIDE SILT FENCING, STRAW BALES AND SANDBAGS AS NECESSARY
5. PROVIDE SLURRY CONTROL AROUND PERIMETER OF PROJECT AREA. REFER TO DETAILS.
6. UTILIZE GEOTHERMAL PIPING DITCHES AS MEANS FOR SLURRY CONTROL.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING LOCALIZED SLURRY CONTROL AT EACH DRILL SITE TO ASSIST WITH WATER AND SLURRY MANAGEMENT.
8. IF RETENTION BASIN BECOMES 3/4-FULL, DRILLING SHALL STOP, AND GEOTHERMAL CONTRACTOR MAY PROVIDE PUMPING MEASURES TO ENSURE WATER ENCOUNTERED DURING DRILLING IS CONTROLLED.
9. EROSION AND SEDIMENT CONTROL SHALL BE MAINTAINED AND IF RETENTION BASIN BECOMES FULL, DRILLING TO STOP AND NOT RESUME UNTIL RETENTION IS POSSIBLE. PROJECT SCHEDULE SHALL ACCOMMODATE SLURRY CONTROL, INCLUDING RAIN EVENTS.
10. CONTRACTOR TO REPLACE STRAW BALES AND SAND BAGS AS NECESSARY TO MAINTAIN EFFECTIVE SLURRY CONTROL.
11. CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF EXCESS SLURRY FROM SITE.

SITE CLEANING NOTES:

1. MECHANICAL AND GEOTHERMAL CONTRACTORS TO PROVIDE APPROPRIATE CLEAN-UP PERSONNEL TO ENSURE SITE WORK DOES NOT IMPACT AREAS OUTSIDE OF SCOPE OF WORK. IF PERIMETER SLURRY/WATER CONTROL MEASURE AREA BREACHED, ALL DRILLING SHALL CEASE UNTIL PERIMETER IS SECURED AND AREA AFFECTED IS CLEANED UP TO OWNERS SATISFACTION. NOTIFY OWNER IMMEDIATELY. SCHEDULE SHALL NOT BE AFFECTED DUE TO LOSS OF TIME FROM CLEAN-UP WORK.
2. ALL STRUCTURES TO BE CLEANED AFTER DRILLING IS COMPLETE. PROVIDE BEFORE AND AFTER PICTURES. THESE LOCATIONS WILL BE INSPECTED AND CONTRACTOR WILL BE REQUIRED TO CONTINUE TO CLEAN UNTIL THEY ARE RESTORED TO ORIGINAL CONDITION.
3. ENTRANCE TO PROJECT AREA TO BE MAINTAINED AT ALL TIMES BY ON SITE CLEAN-UP PERSONNEL.

WELLFIELD FLUSHING & PURGING REQUIREMENTS:

1. THE ENTIRE WELL FIELD SHALL BE FLUSHED WITH WATER TO REMOVE ANY DEBRIS (DIRT, PIPING SHAVINGS, AND OTHER FOREIGN MATERIALS) TRAPPED WITHIN THE PIPING.
2. FILL THE WELL FIELD WITH CLEAN WATER AND PURGE. PURGING FLOW RATE FOR A BORE SHALL BE A MINIMUM FLOW OF 15GPM PER BORE AND 150 GPM PER CIRCUIT. THIS TOTAL FLOW RATE SHALL BE MAINTAINED FOR A MINIMUM OF (4 HOURS PER CIRCUIT) TO REMOVE AIR DEBRIS FROM THE HEAT EXCHANGER LOOP. PURGING IS ALLOWED FROM THE MECHANICAL ROOM, HOWEVER A SEPARATE PURGE CART SHALL BE PROVIDED TO PURGE WELL FIELD.
3. THE WELL FIELD PURGE SHALL BE WITNESSED AND VERIFIED BY A TEST, ADJUST, AND BALANCE (TAB) CONTRACTOR, COMMISSIONING AGENT, AND ENGINEER OF RECORD. THE TAB CONTRACTOR SHALL VERIFY THAT THE MINIMUM FLOW RATE AND VELOCITY IS ACHIEVED. ADDITIONALLY, THE TAB CONTRACTOR SHALL MEASURE AND DOCUMENT (WITHIN THEIR FINAL REPORT) THE TOTAL HEAD REQUIRED TO FLOW THE MINIMUM PURGE RATE REQUIREMENTS.
4. AFTER FLUSHING AND PURGING IS COMPLETE, BUT PRIOR TO BACKFILL, THE CONTRACTOR SHALL TEST THE SYSTEM TO CONFIRM THERE HAVE NOT BEEN ANY FABRICATION OR INSTALLATION ERRORS. THIS SHALL BE ACCOMPLISHED BY MEASURING AND RECORDING CIRCUIT PRESSURE DIFFERENTIALS (WITH PURGING FLOW RATES) AT THE SUPPLY AND RETURN PIPING WITHIN THE VAULT. THE PRESSURE DROP THROUGH THE CIRCUITS (UTILIZING ACTUAL INSTALLATION CONFIGURATION) SHALL BE ESTIMATED BY THE CONTRACTOR AND REVIEWED BY THE COMMISSIONING AGENT AND ENGINEER. IF INCONSISTENCIES ARISE FROM THE PROCESS, THIS CONTRACTOR SHALL INVESTIGATE AND REMEDY THE PROBLEMS AND RE-TEST THE CIRCUIT(S) AT NO ADDITIONAL COST.

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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

GEOTHERMAL WELLFIELD

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

UM1.01

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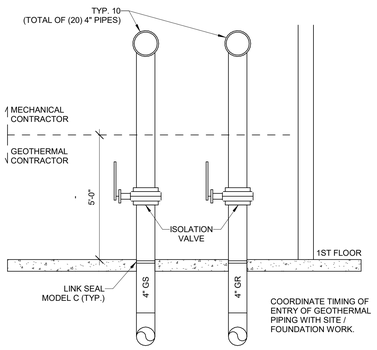
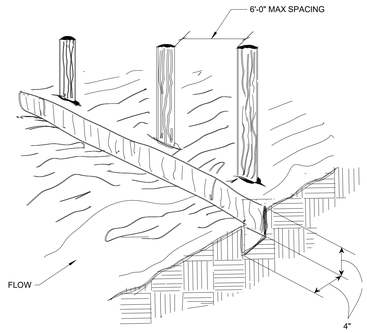


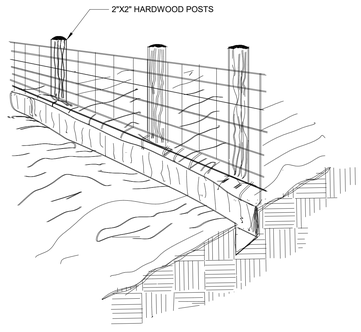
1 GEOTHERMAL BUILDING ENTRY SECTION
NTS

CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

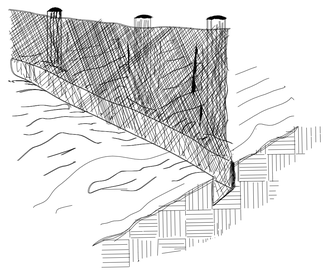
1. SET POSTS AND EXCAVATE A 4"X4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



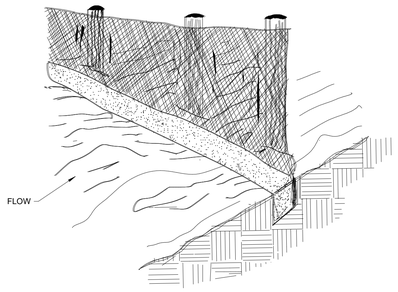
2. STAPLE WIRE FENCING TO THE POSTS.



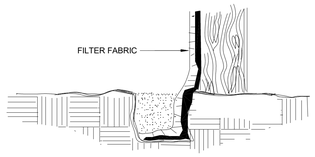
3. ATTACH THE FILTER FABRIC TO THE WIRE FENCE, AND EXTEND IT INTO THE TRENCH.



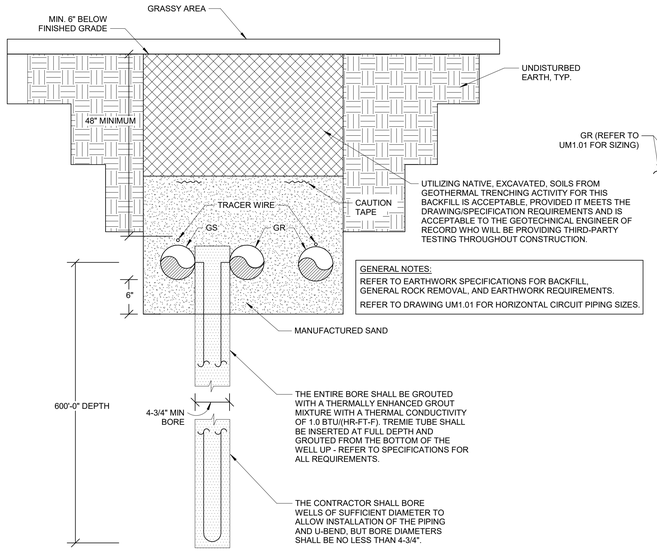
4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.

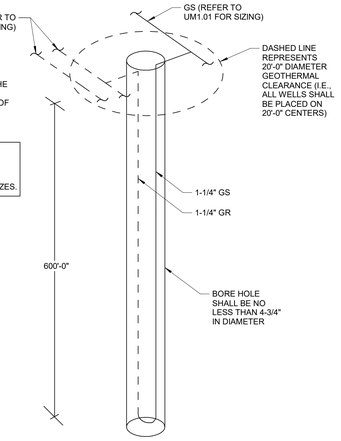


2 SILT FENCE DETAIL
NTS



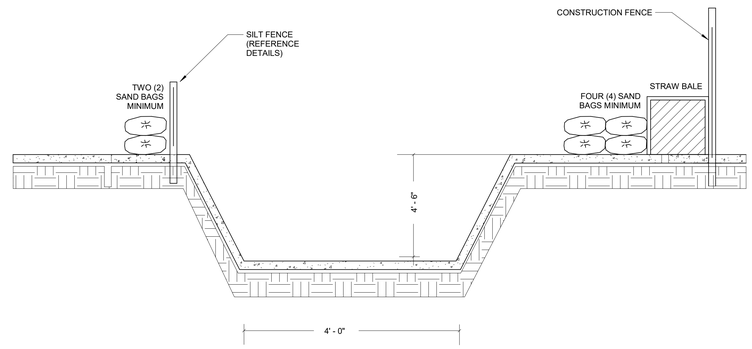
GENERAL NOTES:
REFER TO EARTHWORK SPECIFICATIONS FOR BACKFILL, GENERAL ROCK REMOVAL, AND EARTHWORK REQUIREMENTS.
REFER TO DRAWING UM1.01 FOR HORIZONTAL CIRCUIT PIPING SIZES.

TYPICAL GEOTHERMAL WELL - CROSS SECTION

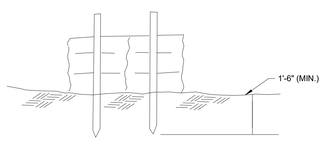


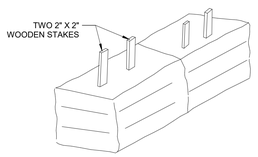
TYPICAL GEOTHERMAL WELL - ISOMETRIC

3 TYPICAL GEOTHERMAL TRENCH AND BORE DETAIL
NTS



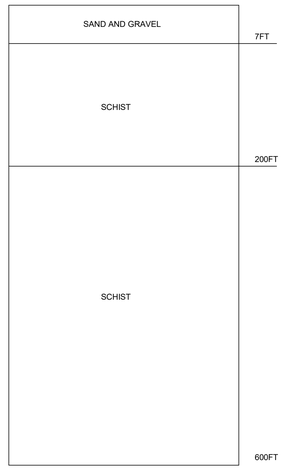
4 SLURRY CONTROL TRENCH DETAIL
NTS





NOTE:
EACH BALE SHALL BE SECURELY ANCHORED IN PLACE BY STAKES DRIVEN THROUGH THE BALE, MINIMUM (2) EACH BALE.

5 BALE SILT CHECK
NTS



NOTES:
1. BORE INSTALL OCCURRED 12/16/2026-12/18/2026
2. 6" STEEL CASING INSTALLED TO 20FT
3. BORE PRODUCED 2 GPM OF WATER AT 200FT
3. FORMATION CONDUCTIVITY = 2.2 BTU/HR-FT-F
4. FORMATION THERMAL DIFFUSIVITY = 1.3 FT² / DAY
5. UNDISTURBED FORMATION TEMPERATURE = 54F-57F

6 TEST WELL DATA
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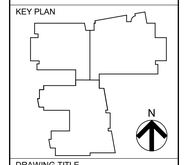

DRAWING TITLE

GEOTHERMAL DETAILS

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UM1.02

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GENERAL NOTES

A. GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO ALL M SERIES DRAWINGS. SOME SYMBOLS OR ABBREVIATIONS MAY NOT BE APPLICABLE.
B. PROVIDE ALL MATERIALS AND EQUIPMENT AND PERFORM ALL LABOR TO INSTALL COMPLETE AND OPERABLE MECHANICAL SYSTEMS AS INDICATED ON THE DRAWINGS AND AS SPECIFIED.
C. CONTRACT DOCUMENT DRAWINGS FOR MECHANICAL WORK ARE DIAGRAMMATIC AND ARE INTENDED TO CONVEY SCOPE AND GENERAL ARRANGEMENT ONLY. DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
D. THE MECHANICAL SUBCONTRACTOR SHALL BE REQUIRED TO READ THE SPECIFICATIONS AND REVIEW THE DRAWINGS FOR ALL DIVISIONS OF WORK. THE MECHANICAL SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF THE WORK OF THIS SECTION AND THE WORK OF ALL OTHER DIVISIONS OF WORK ASSOCIATED WITH THIS PROJECT.
E. THE LOCATIONS OF ALL ITEMS SHOWN ON THE DRAWINGS OR CALLED FOR IN THE SPECIFICATIONS THAT ARE NOT DEFINED BY DIMENSIONS ARE APPROXIMATE ONLY. THE EXACT LOCATIONS NECESSARY TO SECURE THE BEST CONDITIONS AND RESULTS MUST BE DETERMINED BY THE PROJECT SITE CONDITIONS AND SHALL HAVE THE APPROVAL OF THE ENGINEER PRIOR TO DEMOLITION. DO NOT SCALE THE DRAWINGS.
F. PROVIDE ACCESS PANELS FOR INSTALLATION IN WALLS AND CEILINGS, WHERE REQUIRED, TO SERVICE DAMPERS, VALVES, AND OTHER CONCEALED MECHANICAL EQUIPMENT. ACCESS PANELS SHALL BE TURNED OVER TO THE GENERAL CONTRACTOR FOR INSTALLATION. CONTRACTOR SHALL DEMONSTRATE PROPER ACCESS AT EACH ACCESS DOOR TO ADEQUATELY SERVICE SYSTEM COMPONENTS. ALL PIPING ABOVE GRADE SHALL BE PROPERLY SUPPORTED BY THE BUILDING STRUCTURE AND SHALL NOT REST ON CEILING STRUCTURE OR COMPONENTS.
G. ALL EQUIPMENT, PIPING, DUCTWORK, ETC. SHALL BE SUPPORTED AS DETAILED, SPECIFIED AND REQUIRED TO PROVIDE A VIBRATION FREE INSTALLATION.
H. LOCATIONS AND SIZES OF ALL FLOOR AND WALL OPENINGS SHALL BE COORDINATED WITH ALL TRADES INVOLVED.
I. ALL OPENINGS IN FIRE WALLS AND SMOKE BARRIERS DUE TO DUCTWORK, PIPING, CONDUIT, ETC. SHALL BE FIRE STOPPED WITH A PRODUCT SIMILAR TO HILTI OR APPROVED EQUAL.
J. INSTALL LINE SIZE ISOLATION VALVES ON BRANCH RUNOUTS AT THE RISER CONNECTION AND CAP.
K. ISOLATION BALL VALVES IN PIPING SYSTEMS ARE NOT SHOWN ON PLANS (FOR CLARITY) BUT ARE REQUIRED AT ALL PIPING BRANCHES THAT ARE CUT BACK AND CAPPED AT WALLS OR AT RISERS AS PART OF DEMOLITION.
L. ALL DUCTWORK AND PIPING WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN DUCTWORK AND PIPING AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
M. VOLUME DAMPERS IN DUCT SYSTEMS ARE NOT SHOWN IN EVERY INSTANCE ON PLANS (FOR CLARITY) BUT ARE REQUIRED AT ALL DUCT BRANCHES THAT ARE CUT BACK AND CAPPED AT WALLS OR AT RISERS AS PART OF DEMOLITION. DAMPERS SHALL BE RUSKIN #CD-50 OR EQUIVALENT.
N. CERTAIN ITEMS SUCH AS RISES AND DROPS IN DUCTWORK, VOLUME DAMPERS, ETC. ARE INDICATED ON THE CONTRACT DOCUMENT DRAWINGS FOR CLARITY AT A SPECIFIC LOCATION REQUIREMENT AND SHALL NOT BE INTERPRETED AS THE EXTENT OF SUCH ITEMS.
O. ALL DUCTWORK DIMENSIONS AS SHOWN ON THE DRAWINGS ARE INTERNAL CLEAR DIMENSIONS.
P. COORDINATE EXACT REGISTER, GRILLE AND DIFFUSER LOCATIONS WITH THE EXISTING ATC.
Q. ALL SHUTDOWNS SHALL OCCUR DURING NIGHTS AND WEEKENDS COORDINATED WITH OWNER.
R. DRAWINGS ARE DIAGRAMMATIC; DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
S. DIMENSIONS SHOWN ON PLAN ARE HORIZONTAL. DIMENSIONS SHOWN IN ELEVATION ARE VERTICAL.
T. DETERMINE EXACT LOCATIONS OF EXISTING UTILITIES IN FIELD, WHETHER OR NOT SHOWN ON DRAWINGS. EXERCISE CAUTION AND IDENTIFY LOCATIONS OF UNMARKED UTILITY LINES AS NECESSARY TO PERFORM WORK OF THIS SECTION.
U. ALL MECHANICAL WORK SHALL BE IN ACCORDANCE WITH THE LATEST MECHANICAL CODES AND ALL APPLICABLE LOCAL CODES.
V. THIS CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE WORK WITH ALL OTHER TRADES, INCLUDING BUT NOT LIMIT TO, ELECTRICAL, PLBG, PROCESS PIPING, SPRINKLER, STRUCTURAL AND GENERAL ARCHITECTURE.
W. ANY INTERFERENCE SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK.
X. NO WORK SHALL BE INSTALLED IN VIOLATION OF ANY GOVERNING CODES. ANY WORK SHOWN ON THE DRAWINGS WHICH IS IN VIOLATION OF SUCH CODES SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK.
Y. ALL PIPING PENETRATING EXTERIOR WALLS AND ROOFS SHALL BE FLASHED IN AN APPROVED MANNER AND SHALL BE SEALED WEATHERTIGHT. PIPING PENETRATING FIRE RATED PARTITIONS SHALL BE PROVIDED WITH FIRE RATED SEALS AS REQUIRED BY LOCAL CODE AUTHORITY.
Z. MANUFACTURERS' MODEL NUMBERS ARE SPECIFIED SOLELY TO ESTABLISH STANDARDS OF QUALITY FOR PERFORMANCE AND MATERIALS. INSTALLATION SHALL ADHERE TO MANUFACTURERS' RECOMMENDATIONS.
AA. ALL PIPING ABOVE GRADE SHALL BE PROPERLY SUPPORTED BY THE BUILDING STRUCTURE AND SHALL NOT REST ON CEILING STRUCTURE OR COMPONENTS.
BB. ALL HVAC EQUIPMENT, PIPING, INSULATION, ETC., INSTALLED IN PLENUM SPACES SHALL MEET CODE REQUIREMENTS FOR SMOKE AND COMBUSTIBILITY.
CC. PROVIDE SHUTOFF VALVES ON ALL BRANCH PIPING AND ON ALL SUPPLIES TO INDIVIDUAL EQUIPMENT. PROVIDE VALVES ON ALL MAINS AND BRANCHES WHERE INDICATED ON DRAWINGS.
DD. PROVIDE CLAMPS, OFFSETS, EXPANSION JOINTS, ANCHORS AND GUIDES AS NECESSARY TO PREVENT STRESS ON PIPING.
EE. PROVIDE VENTS AT HIGH POINTS IN PIPING SYSTEMS AND DRAIN VALVES AT LOW POINTS.

ABBREVIATIONS

AC	ALTERNATING CURRENT
ACM	ASBESTOS CONTAINING MATERIALS
ACT	ACOUSTIC CEILING TILE
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AFR	ABOVE FINISHED ROOF
AHU	AIR HANDLING UNIT
AMP	AMPERE (AMP, AMPS)
APD	AIR PRESSURE DROP
ARCH	ARCHITECT
AS	AIR SEPARATOR
ATC	AUTOMATIC TEMPERATURE CONTROL
AVG	AVERAGE
BAS	BUILDING AUTOMATION SYSTEM
BHP	BRAKE HORSEPOWER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BTU	BRITISH THERMAL UNIT
CAV	CONSTANT AIR VOLUME
CD	CONDENSATE DRAIN
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CLG	CEILING
CO	CARBON MONOXIDE
CO2	CARBON DIOXIDE
COND	CONDENS (-ER, -ING, -ATION, -ATE)
CONT	CONTINU (-ED, -OUS)
CT	COOLING TOWER
CUH	CABINET UNIT HEATER
CV	VALVE FLOW COEFFICIENT
dB	DECIBEL
DB	DRY BULB
DC	DIRECT CURRENT
DCR	DUPLEX CONDENSATE RECEIVER
DDC	DIRECT DIGITAL CONTROLS
DEG	DEGREE (-S)
DIA	DIAMETER (-S)
DN	DOWN
DWG	DRAWING
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EAHU	EXHAUST AIR HANDLING UNIT
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
ELEV	ELEVA (-TION, -TOR)
EMS	ENERGY MANAGEMENT SYSTEM
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK

ABBREVIATIONS (CONTINUED)

ETR	EXISTING TO REMAIN
EUH	ELECTRIC UNIT HEATER
EVAP	EVAPORAT (-E, -ING, -ED, -OR, -ION)
EWT	ENTERING WATER TEMPERATURE
EXP	EXPANSION
EXT	EXTERIOR
FA	FREE AREA
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FL	FLOOR
FLA	FULL LOAD AMPS
FPC	FIRE PROTECTION CONTRACTOR
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FT	FEET **OR** FOOT
FTR	FIN TUBE RADIATOR
GA	GAGE/GAUGE
GAL	GALLON (-S)
GC	GENERAL CONTRACTOR
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H	HUMIDITY
HD	HEAD
HHP	HORIZONTAL HEAT PUMP
HORIZ	HORIZONTAL
HP	H (-ORSEPOWER, -EAT PUMP)
HR	HOUR (-S)
HVAC	HEATING, VENTILATING, & AIR-CONDITIONING
Hz	HERTZ
HWP	HOT WATER PUMP
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
HX	HEAT EXCHANGER
ID	I (-DENTIFICATION, -NSIDE DIAMETER, -NSIDE DIMENSION)
IN	INCH (-ES)
INSUL	INSULAT (-ED, -ION)
kW	KILOWATT
kWh	KILOWATT HOUR
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MBH	BTU PER HOUR [THOUSANDS]
MC	MECHANICAL CONTRACTER
MCA	MINIMUM CIRCUIT AMPS
MFR	MANUFACTURER
MIN	MIN (-IMUM, -UTE)
MISC	MISCELLANEOUS
MOCP	MAXIMUM OVERCURRENT PROTECTION [AMPS]
N/A	NOT APPLICABLE
NC	NOISE CRITERIA **OR** NORMALLY CLOSED
NIC	NOT IN CONTRACT

ABBREVIATIONS (CONTINUED)

NO	NORMALLY OPEN **OR** NUMBER
NPCW	NON-POTABLE COLD WATER
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OD	OUTSIDE DI (-AMETER, -MENSION)
PC	PLUMBING CONTRACTOR
PD	PRESSURE DROP
PH	PHASE [ELECTRICAL]
PHE	PLATE HEAT EXCHANGER
PLBG	PLUMBING
PPM	PARTS PER MILLION
PRS	PRESSURE REDUCING STATION
PRV	PRESSURE REDUCING VALVE (STEAM, WATER, GAS)
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	PSI GAUGE
RFR	REFRIGERANT RETURN (SUCTION)
RFS	REFRIGERANT SUPLY (LIQUID)
RH	RELATIVE HUMIDITY [%]
RLA	RUNNING LOAD AMPS
RPM	REVOLUTIONS PER MINUTE
RTU	ROOF TOP UNIT
SA	SUPPLY AIR
SD	SMOKE DAMPER
SP	STATIC PRESSURE
SQ FT	SQUARE FEET **OR** FOOT
SQ IN	SQUARE INCH **OR** INCHES
S/T	SHELL AND TUBE
TAB	TESTING AND BALANCING
TBD	TO BE DETERMINED
TE	TOP ELEVATION
TEMP	TEMPERATURE
TOD	TOP OF DUCT
TOP	TOP OF PIPE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
V	VOLT (-AGE, -S)
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FEQUENCY DRIVE
VHP	VERTICAL HEAT PUMP
W	WATT (-AGE, -S)
WB	WET BULB
WMS	WIRE MESH SCREEN
WPD	WATER PRESSURE DROP
WT	WEIGHT
W/	WITH
W/O	WITHOUT
%	PERCENT
ΔP	DIFFERENTIAL PRESSURE
ΔT	TEMPERATURE DIFFERENCE
℄	CENTERLINE

GENERAL SYMBOLS

#	TAGGED NOTE DESIGNATOR
1	REVISION TRIANGLE
ROOM NUMBER / ROOM NAME	ROOM TAG
TYPE XXX-# / INSTANCE ###	EQUIPMENT TAG
TAG (XXX) / AIRFLOW XXXX	AIR DEVICE TAG (REGISTER, GRILLE, DIFFUSER,LOUVER)
	POINT OF CONNECTION / CONNECT TO EXISTING

HVAC LEGEND

	SUPPLY AIR DIFFUSER
	RETURN AIR DIFFUSER
	EXHAUST AIR DIFFUSER
	TRANSFER AIR DIFFUSER W/ SOUND ATTENUATING BOOT
	SIDEWALL DIFFUSER/GRILLE
	PUMP
	CENTRIFUGAL FAN
##x##	RECTANGULAR DUCT
#ø	ROUND/SPIRAL DUCT
##/##	FLAT OVAL DUCT
SA	SUPPLY AIR DUCT
RA	RETURN AIR DUCT
EA	EXHAUST AIR DUCT
OA	OUTSIDE AIR DUCT
TA	TRANSFER AIR DUCT
SA	SA AIR DUCT TURNING UP
SA	SA AIR DUCT TURNING DOWN
RA	RA AIR DUCT TURNING UP
RA	RA AIR DUCT TURNING DOWN
EA	EA AIR DUCT TURNING UP
EA	EA AIR DUCT TURNING DOWN
	MITERED ELBOW WITH TURNING VANES
	FLEXIBLE DUCT
T	THERMOSTAT
T	TEMPERATURE SENSOR
H	HUMIDITY SENSOR
C	CARBON DIOXIDE SENSOR
T/C	TEMPERATURE & CARBON DIOXIDE SENSOR
SD	DUCT SMOKE DETECTOR
VERT. HORIZ.	AUTOMATIC BALANCING (ABD) / VOLUME DAMPER (VD)
VERT. HORIZ.	MOTORIZED DAMPER
VERT. HORIZ.	FIRE DAMPER
VERT. HORIZ.	SMOKE DAMPER
VERT. HORIZ.	COMBINATION FIRE & SMOKE DAMPER

MECHANICAL PIPING LEGEND

	PIPE ELBOW TURNING UP
	PIPE ELBOW TURNING DOWN
	PIPE TEE; CONNECTION ON TOP
	PIPE TEE; CONNECTION ON BOTTOM
	PIPE CAP
CD	CONDENSATE DRAIN
CHWS/R	CHILLED WATER SUPPLY/RETURN
CWS/R	CONDENSER WATER SUPPLY/RETURN
DTS/R	DUAL TEMP. WATER SUPPLY/RETURN
GS/R	GEOTHERMAL WATER SUPPLY/RETURN
HWS/R	HEATING WATER SUPPLY/RETURN
MPCW	MAKEUP CITY WATER
RFR	REFRIGERANT RETURN
RFS	REFRIGERANT SUPPLY
	TWO-WAY CONTROL VALVE
	THREE-WAY CONTROL VALVE
	THREE-POSITION CONTROL VALVE
	TWO-POSITION CONTROL VALVE
	AUTOMATIC AIR VENT (AAV)
	MANUAL AIR VENT (MAV)
	MANUAL BALANCING VALVE (BV)
	BALL VALVE
	BUTTERFLY VALVE
	TRIPLE DUTY VALVE (TDV)
	STRAINER
	MANUAL ISOLATION VALVE
	GLOBE VALVE
	OS&Y (GATE) VALVE
	PRESSURE REDUCING VALVE (STEAM, GAS, WATER, ETC.)
	AUTO-FLOW CONTROL VALVE
	CHECK VALVE
	FLEXIBLE PIPE CONNECTION
	FLOW METER (VENTURI)
	PIPING UNION
	FLOW SWITCH
	THERMOMETER
T	PETE'S PLUG; TEMPERATURE/PRESSURE PORT

NOTE: NOT ALL SYMBOLS AND ABBREVIATIONS MAY BE USED ON THIS PROJECT

Sheet List - Mechanical

SHEET #	SHEET NAME
UM1.01	GEOTHERMAL WELLFIELD
UM1.02	GEOTHERMAL DETAILS
M0.01	MECHANICAL LEGENDS AND NOTES
M1.01	LOWER LEVEL MECHANICAL ZONING
M1.02	MAIN LEVEL MECHANICAL ZONING
M1.03	UPPER LEVEL MECHANICAL ZONING
M2.01	LOWER LEVEL MECHANICAL AIR DISTRIBUTION
M2.02A	MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA A
M2.02B	MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA B
M2.02C	MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA C
M2.03	UPPER LEVEL MECHANICAL AIR DISTRIBUTION
M2.04	MECHANICAL ROOF PLAN
M3.01	LOWER LEVEL MECHANICAL PIPING
M3.02A	MAIN LEVEL MECHANICAL PIPING - AREA A
M3.02B	MAIN LEVEL MECHANICAL PIPING - AREA B
M3.02C	MAIN LEVEL MECHANICAL PIPING - AREA C
M3.03	UPPER LEVEL MECHANICAL PIPING
M4.01	MAIN MECHANICAL ROOM
M5.01	MECHANICAL ENLARGED PLANS, SECTIONS, & ISOMETRICS
M6.01	MECHANICAL DETAILS
M6.02	MECHANICAL DETAILS
M6.03	MECHANICAL DETAILS
M6.04	MECHANICAL DETAILS
M7.01	MECHANICAL CONTROLS LEGEND
M7.02	MECHANICAL CONTROLS SCHEMATIC
M7.03	MECHANICAL CONTROLS - GEOTHERMAL
M7.04	MECHANICAL CONTROLS - DOAS
M7.05	MECHANICAL CONTROLS
M7.06	MECHANICAL CONTROLS
M7.07	MECHANICAL CONTROLS
M8.01	MECHANICAL AIRFLOW DIAGRAM
M8.02	MECHANICAL VENTILATION CALCULATIONS
M8.03	MECHANICAL HEAT PUMP & TERMINAL BOX CONTROL SCHEDULE
M9.01	MECHANICAL SCHEDULES
M9.02	MECHANICAL SCHEDULES

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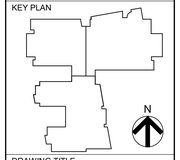
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL LEGENDS AND NOTES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M0.01

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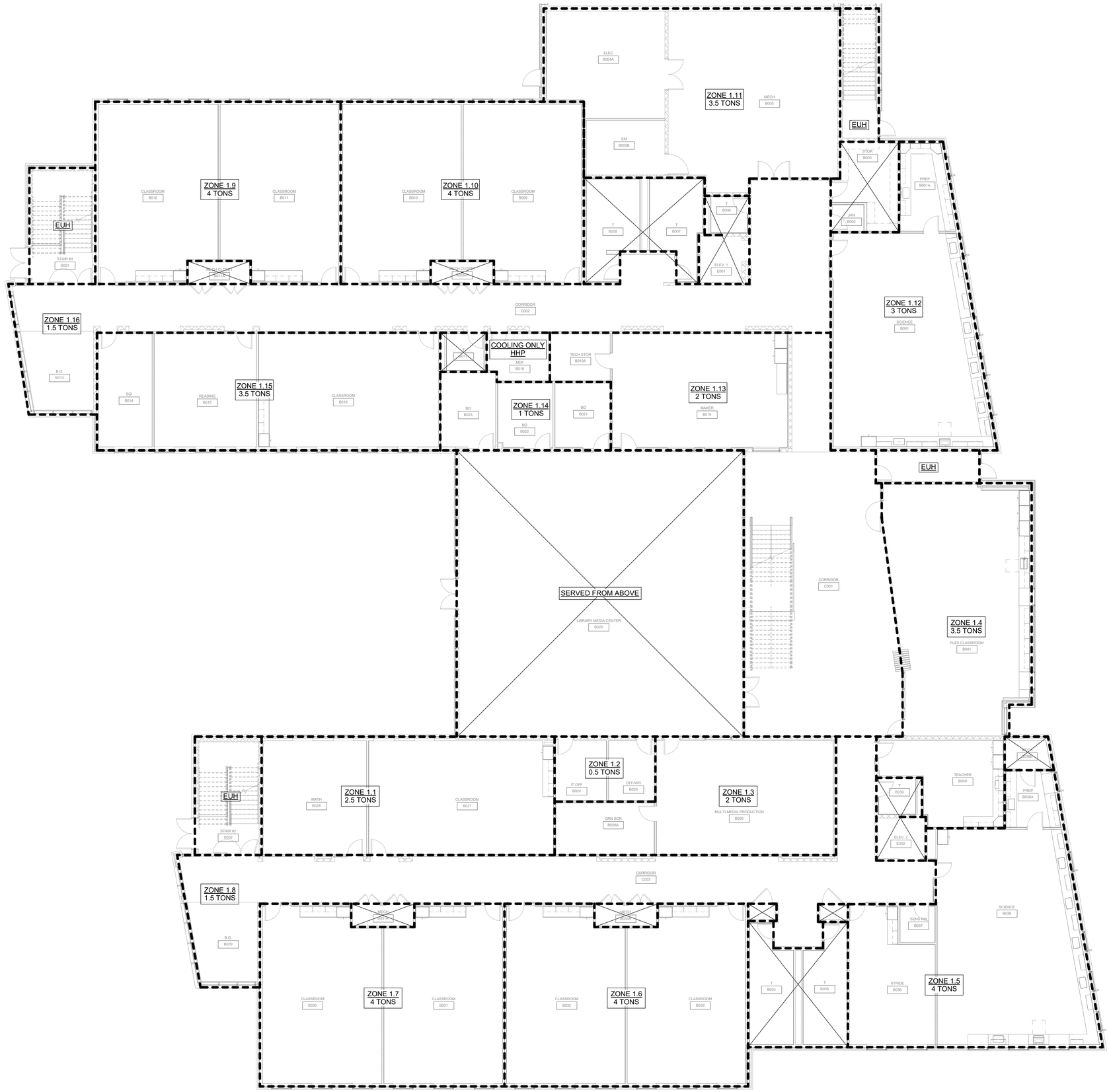

1 LOWER LEVEL MECHANICAL ZONING PLAN
1/8" = 1'-0"

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BRIAN H. KOLLER
24058
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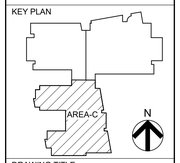
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL
MECHANICAL ZONING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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M1.01

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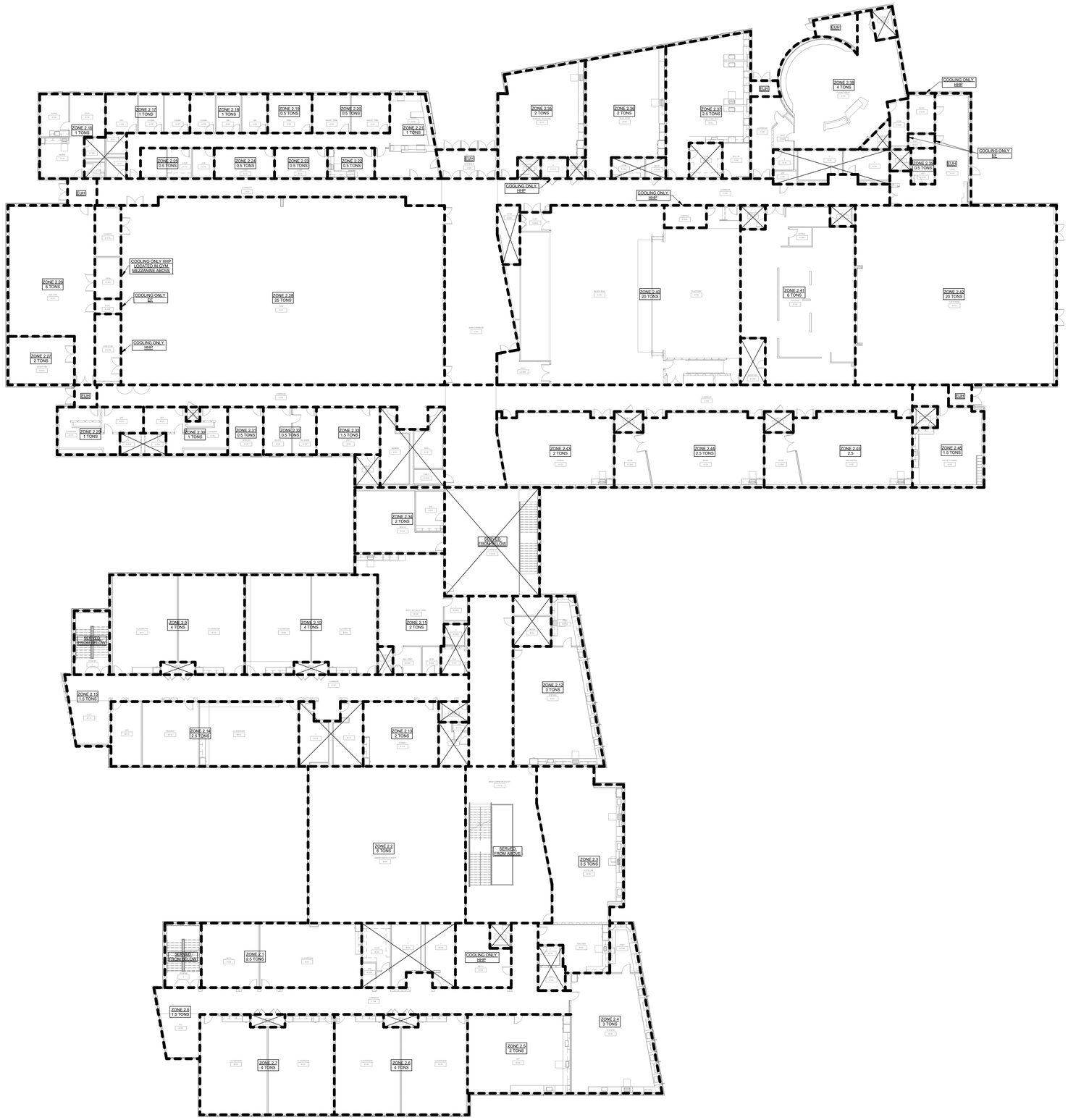

1 MAIN LEVEL MECHANICAL ZONING PLAN
1/16" = 1'-0"

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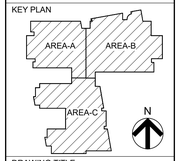
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL MECHANICAL ZONING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	5/19/2026
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M1.02

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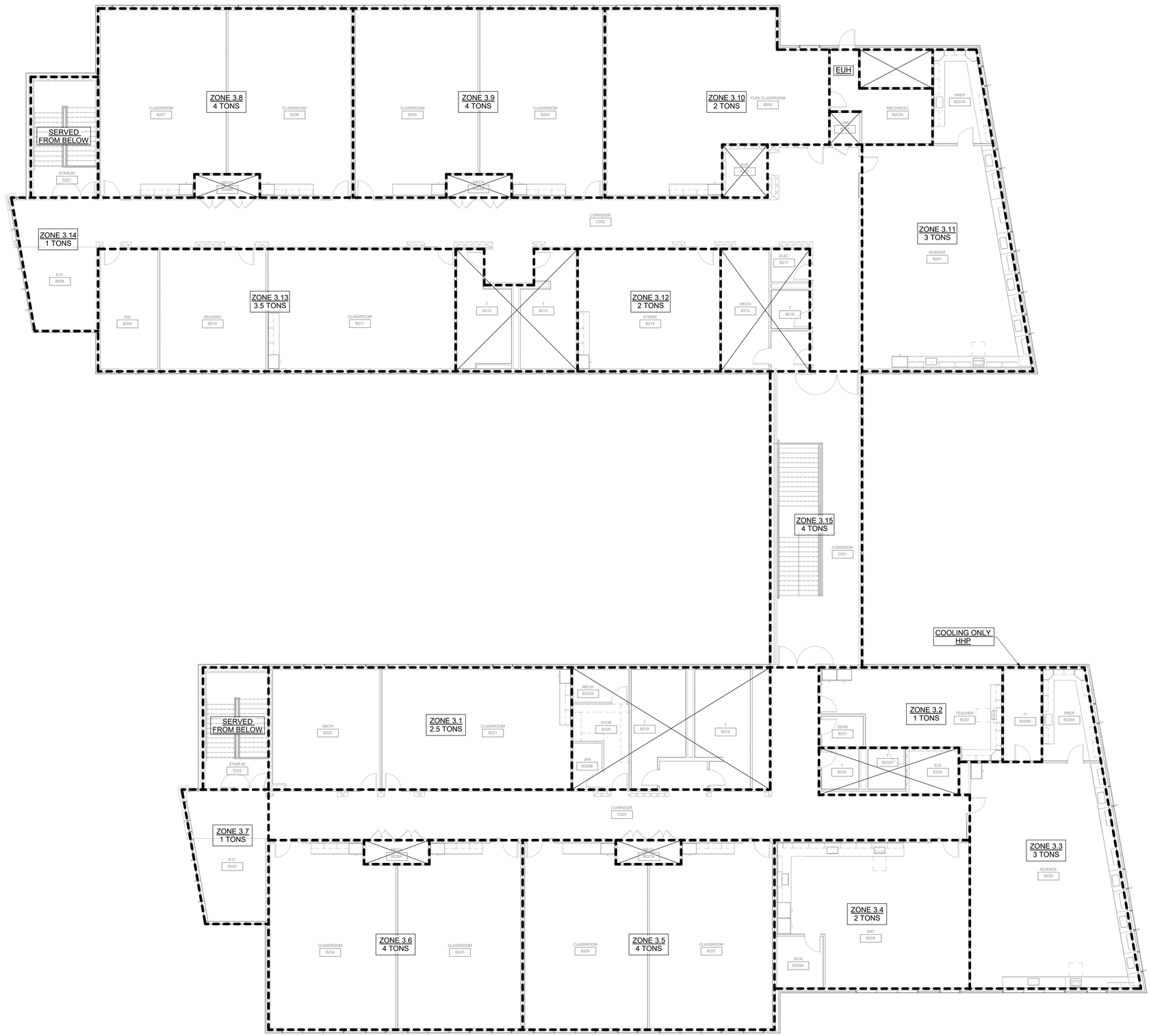

1 UPPER LEVEL MECHANICAL ZONING PLAN
1/8" = 1'-0"

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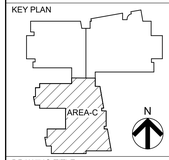

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UPPER LEVEL MECHANICAL ZONING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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M1.03

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TAGGED NOTES

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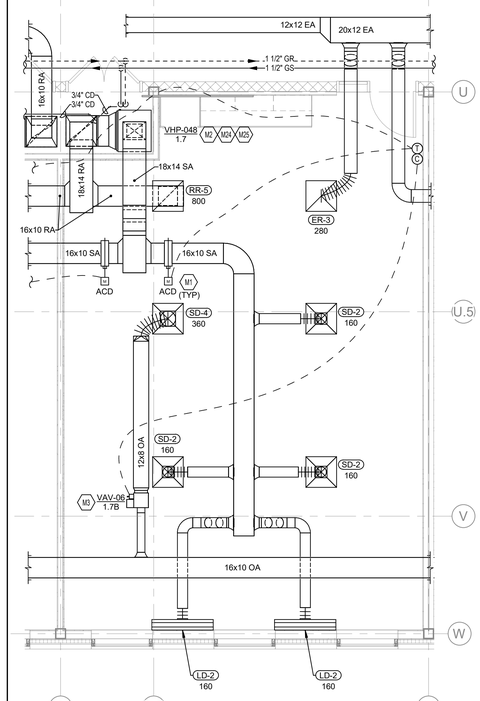
- M1 PROVIDE AUTOMATIC CONTROL DAMPERS DEDICATED TO EACH CLASSROOM, INTERLOCKED WITH THERMOSTAT. TYPICAL OF ALL HEAT PUMPS SERVING MORE THAN ONE SPACE.
- M2 REFER TO DETAILS FOR TYPICAL VHP DUCTWORK INSTALLATION INFORMATION.
- M3 REFER TO DETAILS FOR VAV/CAV/EVAV INSTALLATION INFORMATION. PROVIDE WITH 3 STRAIGHT DUCT DIAMETERS AT INLETS FOR ALL UNITS. PROVIDE WITH AIRFLOW SUMMATION DEVICE. TYPICAL OF ALL.
- M5 PROVIDE CABLE OPERATED VOLUME DAMPERS TO BALANCE AIR TERMINALS IN AREAS WITH HARD CEILING. PROVIDE WITH ACCESS DOOR AS REQUIRED.
- M7 PROVIDE RECESSED ELECTRIC UNIT HEATER INSTALLED IN WALL. EUH TO BE FURNISHED WITH INTEGRAL DISCONNECT AND THERMOSTAT. COORDINATE INSTALLATION, FINISH, AND FINAL LOCATION WITH ARCHITECT.
- M8 PROVIDE RECESSED ELECTRIC UNIT HEATER INSTALLED IN CEILING. EUH TO BE FURNISHED WITH INTEGRAL DISCONNECT AND THERMOSTAT. COORDINATE INSTALATION AND FINAL LOCATION WITH ARCHITECT.
- M10 PROVIDE CAR-III DAMPER. BALANCE TO AIRFLOWS INDICATED ON PLAN.
- M24 ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
- M25 REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
- M44 ATC CONTRACTOR TO INSTALL DUCT STATIC PRESSURE SENSOR IN LOCATION INDICATED. REFER TO CONTROL DRAWINGS FOR MORE INFORMATION.
- M56 ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
- M61 PROVIDE 2-HOUR RATED COMBINATION FIRE/SMOKE DAMPER AT SHAFT ALL SHAFT PENETRATIONS. COORDINATE WITH FIRE ALARM CONTRACTOR.
- M63 REFER TO M2.02C FOR CONTINUATION OF SUPPLY/RETURN DUCTWORK.
- M95 FULLY LINE RETURN AIR DUCTWORK, REFER TO SPECIFICATIONS FOR DUCT LINING REQUIREMENTS.



2 TYPICAL CLASSROOM - MECHANICAL
1/4" = 1'-0"

1 LOWER LEVEL MECHANICAL AIR DISTRIBUTION PLAN
1/8" = 1'-0"

SERVED FROM ABOVE
REFER TO M2.02B

REFER TO M4.01

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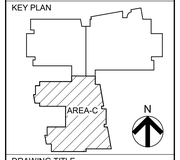
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL MECHANICAL AIR DISTRIBUTION

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

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M2.01

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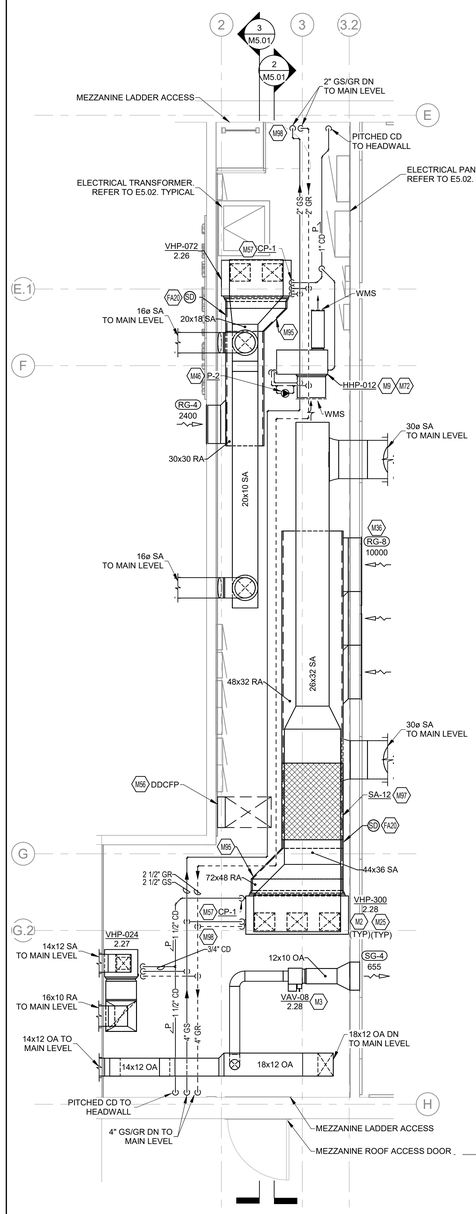
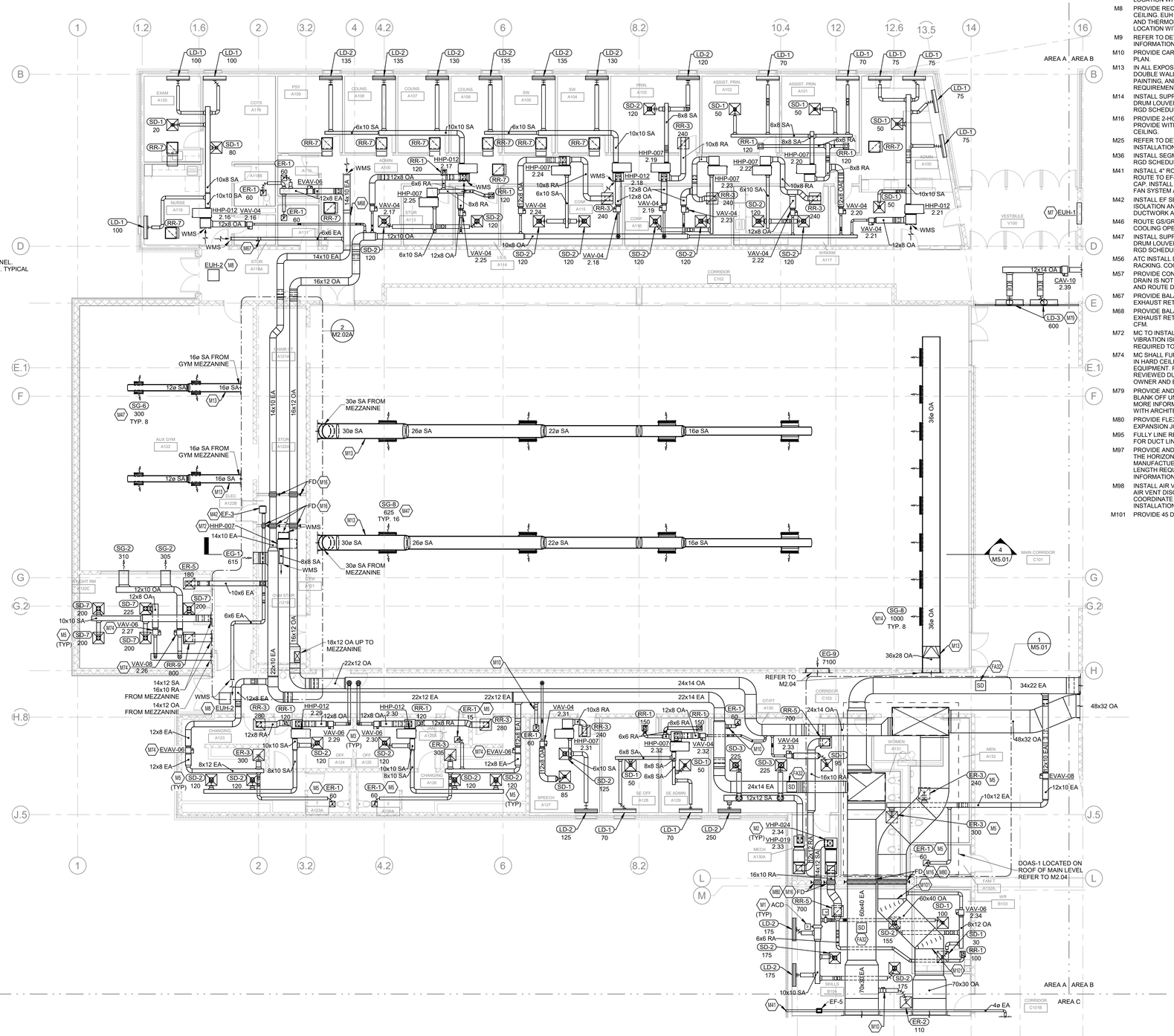
TAGGED NOTES

FA20	PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.
FA32	DUCT SMOKE DETECTOR SHALL BE INSTALLED IN DUCTWORK WHERE INDICATED. FIRE ALARM CONTRACTOR SHALL PROVIDE, INSTALL, WIRE, AND INTEGRATE DETECTOR WITH BUILDING FIRE ALARM SYSTEM. COORDINATE FINAL LOCATION WITH DUCTWORK, ACCESS PANELS, AND EQUIPMENT MANUFACTURER REQUIREMENTS.
M1	PROVIDE AUTOMATIC CONTROL DAMPERS DEDICATED TO EACH CLASSROOM, INTERLOCKED WITH THERMOSTAT. TYPICAL OF ALL HEAT PUMPS SERVING MORE THAN ONE SPACE.
M2	REFER TO DETAILS FOR TYPICAL VHP DUCTWORK INSTALLATION INFORMATION.
M3	REFER TO DETAILS FOR VAV/CAV/EVAV INSTALLATION INFORMATION. PROVIDE WITH 3 STRAIGHT DUCT DIAMETERS AT INLETS FOR ALL UNITS. PROVIDE WITH AIRFLOW SUMMATION DEVICE. TYPICAL OF ALL.
M5	PROVIDE CABLE OPERATED VOLUME DAMPERS TO BALANCE AIR TERMINALS IN AREAS WITH HARD CEILING. PROVIDE WITH ACCESS DOOR AS REQUIRED.
M7	PROVIDE RECESSED ELECTRIC UNIT HEATER INSTALLED IN WALL. EUH TO BE FURNISHED WITH INTEGRAL DISCONNECT AND THERMOSTAT. COORDINATE INSTALLATION, FINISH, AND FINAL LOCATION WITH ARCHITECT.
M8	PROVIDE RECESSED ELECTRIC UNIT HEATER INSTALLED IN CEILING. EUH TO BE FURNISHED WITH INTEGRAL DISCONNECT AND THERMOSTAT. COORDINATE INSTALATION AND FINAL LOCATION WITH ARCHITECT.
M9	REFER TO DETAILS FOR TYPICAL HHP DUCTWORK INSTALLATION INFORMATION.
M10	PROVIDE CAR-III DAMPER. BALANCE TO AIRFLOWS INDICATED ON PLAN.
M13	IN ALL EXPOSED CEILING CONDITIONS DUCTWORK SHALL BE DOUBLE WALL SPIRAL, INTERALLY LINED, PREPARED FOR PAINTING, AND PAINTED ACCORDING TO ARCHITECTURAL REQUIREMENTS.
M14	INSTALL SUPPLY GRILLES IN DUCTWORK, HEAVY DUTY STEEL DRUM LOUVERS WITH BLADE SCOOP MOUNTED AT 30°. REFER TO RGD SCHEDULE FOR MORE INFORMATION.
M16	PROVIDE 2-HOUR RATED FIRE DAMPER AT WALL PENETRATION. PROVIDE WITH 12"X12" ACCESS PANEL IN LOCATIONS WITH HARD CEILING.
M25	REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
M36	INSTALL SEGMENTED 3SRL RETURN GRILLE AT WALL. REFER TO RGD SCHEDULE FOR MORE INFORMATION.
M41	INSTALL 4" ROUND EXHAUST DUCTWORK FROM DRYER VENT AND ROUTE TO EF-4. TERMINATE AT WALL WITH 6"x6" ALUMINUM VENT CAP. INSTALL ALL CONTROLS AND ACCESSORIES PROVIDED WITH FAN SYSTEM AND INTERLOCK WITH DRYER.
M42	INSTALL EF SECURED FROM DECK. PROVIDE VIBRATION ISOLATION AND UNISTRUT SUPPORTS AS REQUIRED. TERMINATE DUCTWORK ABOVE CEILING WITH WIRE MESH SCREEN.
M46	ROUTE GSI/GR PIPING TO CIRCULATION PUMP P-2 FOR OFF-HOURS COOLING OPERATION. REFER TO CONTROLS ON M7.05.
M47	INSTALL SUPPLY GRILLES IN DUCTWORK, HEAVY DUTY STEEL DRUM LOUVERS WITH BLADE SCOOP MOUNTED AT 45°. REFER TO RGD SCHEDULE FOR MORE INFORMATION.
M56	ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
M57	PROVIDE CONDENSATE PUMP FOR HEAT PUMP WHERE GRAVITY DRAIN IS NOT POSSIBLE. PROVIDE OVERFLOW SAFETY SHUTOFF AND ROUTE DISCHARGE TO DRAIN OR HEADWALL AS REQUIRED.
M67	PROVIDE BALANCING VOLUME DAMPER IN ABOVE CEILING PLENUM EXHAUST RETURN FOR NURSE AREA. BALANCE TO 90 CFM.
M68	PROVIDE BALANCING VOLUME DAMPER IN ABOVE CEILING PLENUM EXHAUST RETURN FOR ADMINISTRATION AREA. BALANCE TO 430 CFM.
M72	MC TO INSTALL HHP SECURED FROM DECK. PROVIDE ALL VIBRATION ISOLATION AND SUPPLEMENTAL STEEL/UNISTRUT AS REQUIRED TO SUPPORT UNIT IN TWO DIRECTIONS OF MOVEMENT.
M74	MC SHALL FURNISH 24"x24" ACCESS PANELS FOR GC TO INSTALL IN HARD CEILING AS REQUIRED TO MAINTAIN TERMINAL BOX AND EQUIPMENT. FINAL LOCATION OF ALL ACCESS PANELS SHALL BE REVIEWED DURING COORDINATION DRAWING REVIEW WITH THE OWNER AND ENGINEER PRIOR TO INSTALLATION.
M79	PROVIDE AND INSTALL CONTINUOUS LINEAR SLOT DIFFUSER LD-3, BLANK OFF UNUSED SECTIONS, REFER TO RGD SCHEDULE FOR MORE INFORMATION. COORDINATE FINISH AND FINAL LOCATION WITH ARCHITECT.
M80	PROVIDE FLEX EXPANSION FITTING AT EACH SIDE OF THE EXPANSION JOINT WALL. REFER TO SPECIFICATIONS.
M95	FULLY LINE RETURN AIR DUCTWORK. REFER TO SPECIFICATIONS FOR DUCT LINING REQUIREMENTS.
M97	PROVIDE AND INSTALL DUCT MOUNTED SOUND ATTENUATOR IN THE HORIZONTAL PATH OF SUPPLY AIR DUCTWORK PER MANUFACTUER'S REQUIREMENTS. INSTALL WITH STRAIGHT LENGTH REQUIREMENTS. SEE SILENCER SCHEDULE FOR MORE INFORMATION.
M98	INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M6.02 FOR INSTALLATION DETAILS.
M101	PROVIDE 45 DEGREE ELBOW WITH SMOOTH RADIUS VANES.



2 GYM MEZZANINE ENLARGED PLAN
1/4" = 1'-0"



1 MAIN LEVEL MECHANICAL AIR DISTRIBUTION PLAN - AREA A
1/8" = 1'-0"

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PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
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APPROVED BY	BKK

ISSUE DATES

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M2.02A

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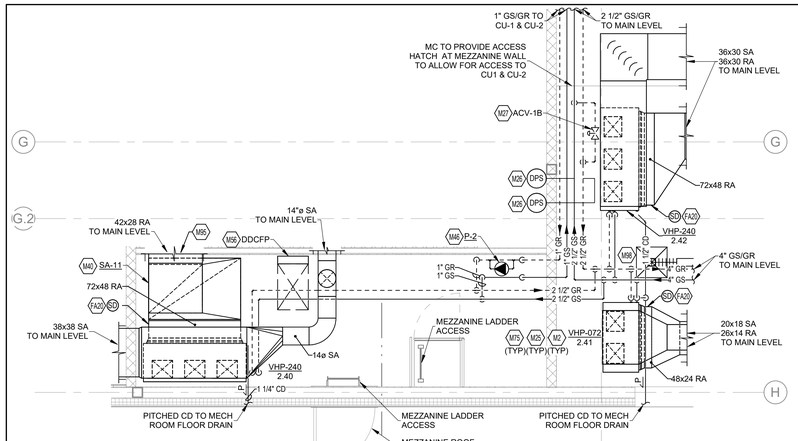
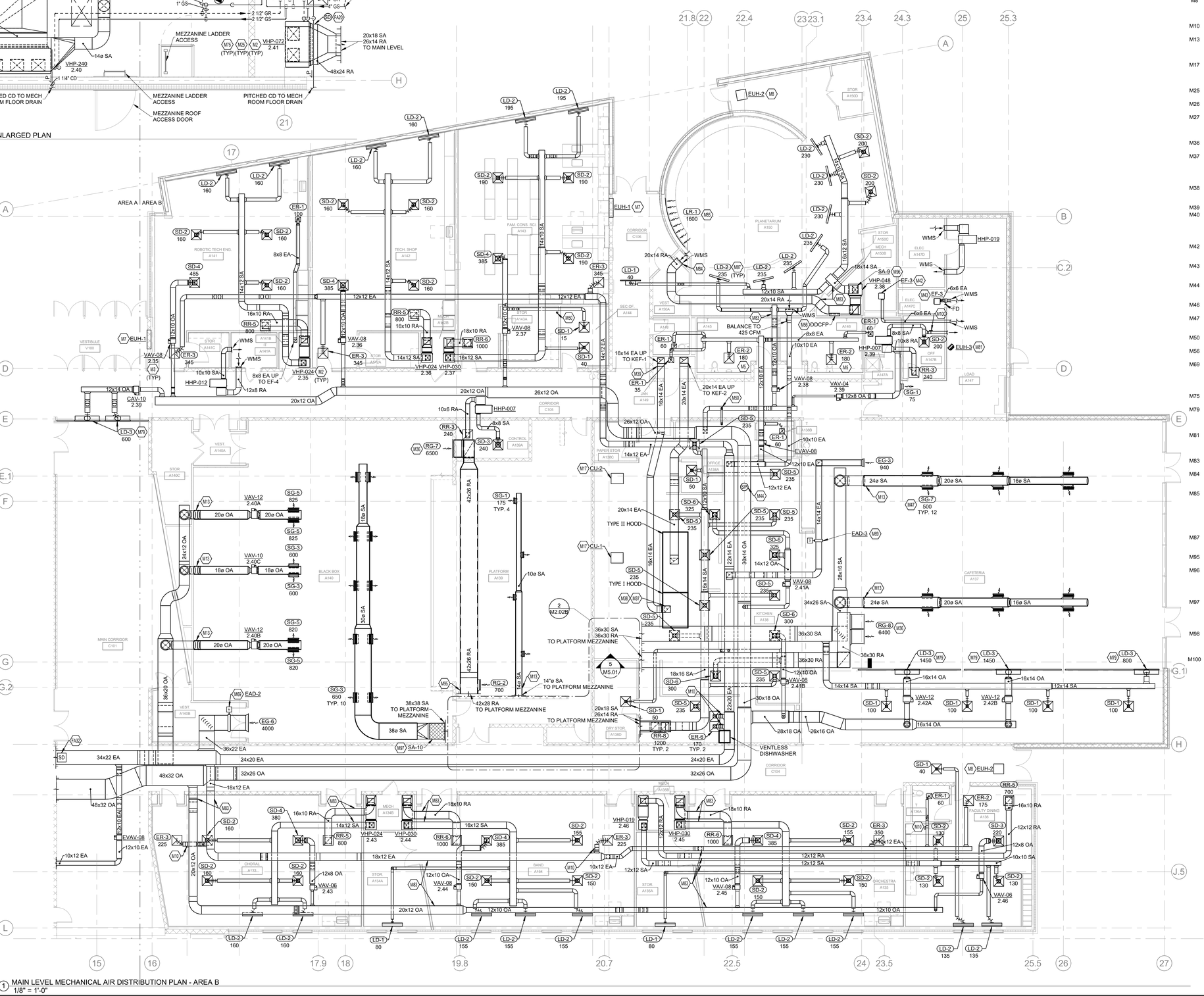
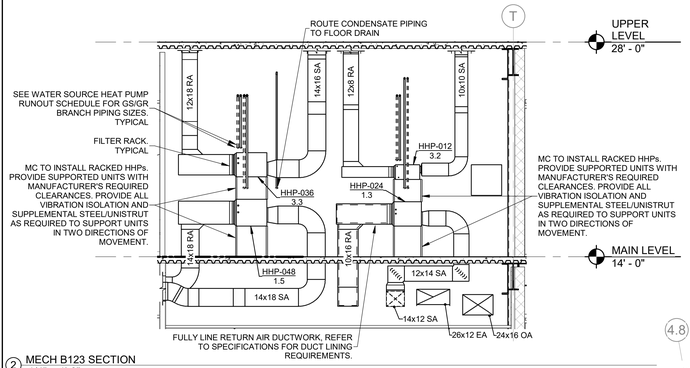


2 PLATFORM MEZZANINE ENLARGED PLAN
1/4" = 1'-0"

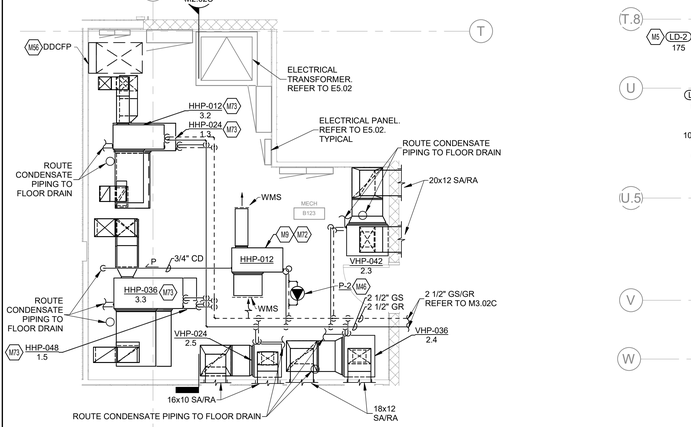

AREA A
AREA B
EUH-1 M7
EUH-2 M8
LR-1 1600 M5
20x14 RA
WMS
M4
LD-2 235 (TYP)
LD-1 40
ER-3 345
SD-4 385
SD-2 190
SD-1 15
SD-1 40
ER-1 100
SD-2 160
LD-2 160
LD-2 195
8x8 EA
12x12 EA
14x12 SA
16x10 RA
RR-5 800
RR-6 1000
VAV-08 2.37
VHP-024 2.36
VHP-030 2.37
18x10 RA
RR-4 1000
16x12 SA
VAV-08 2.36
VHP-024 2.35
M2 (TYP)
M7 EUH-1
VAV-08 2.35
M3 (TYP)
VESTIBULE V100
STOR A141C
ER-3 345
WMS
10x10 SA
HHP-012
8x8 EA UP TO EF-4
12x8 RA
12x14 OA
CAV-10 2.39
LD-3 M79 600
20x12 OA
26x12 OA
16x10 OA
14x12 EA
10x6 RA
HHP-007
8x8 SA
RR-3 240
M56 RG-7 6500
SD-3 240
CORRIDOR C105
CONTROL A139A
PAPER STOR A139C
M17 CU-2
SG-1 175 TYP. 4
42x26 RA
10ø SA
2 M2.02B
5 M5.01
36x30 SA
36x30 RA
TO PLATFORM MEZZANINE
18x16 SA
SD-6 300
M13
14"ø SA
TO PLATFORM MEZZANINE
RG-2 700
14ø SA
M55
42x28 RA
TO PLATFORM MEZZANINE
SG-3 650 TYP. 10
38x38 SA
TO PLATFORM MEZZANINE
38ø SA
M57 SA-10
20x18 SA
26x14 RA
TO PLATFORM MEZZANINE
RR-8 1200 TYP. 2
ER-6 170 TYP. 2
VENTLESS DISHWASHER
CORRIDOR C104
22x20 EA
30x18 OA
28x18 OA
26x16 OA
12x10 OA
VAV-08 2.41B
SD-1 50
SD-5 235
SD-6 325
SD-6 300
M17 CU-1
TYPE II HOOD
TYPE I HOOD
20x14 EA
16x14 EA
22x14 EA
20x14 OA
14x12 OA
VAV-08 2.41A
M38 M37
KITCHEN A138
M56 DDCFP
BALANCE TO 425 CFM
8x8 EA
10x10 EA
HHP-007 2.39
VAV-08 2.38
VAV-04 2.39
12x8 OA
SG-1 75
20x14 EA UP TO KEF-2
16x14 EA UP TO KEF-1
M55
ER-1 60
ER-2 180
M6
ER-1 35
M55
M56 DDCFP
8x8 EA
10x10 EA
HHP-007 2.39
VAV-08 2.38
VAV-04 2.39
12x8 OA
SG-1 75
ER-1 60
ER-2 180
M6
8x8 SA
10x8 RA
SD-2 200
EUH-3 M81
RR-3 240
OFF A147B
LOAD A147
WMS
HHP-019
EF-3 M42
6x6 EA
FD
6x6 EA
M102
SA-9 M56
18x14 SA
VHP-048 2.38
EF-3 M43
ELEC A147C
ELEC A147D
MECH A150B
STOR A150C
STOR A150D
PLANETARIUM A150
LD-2 230
SD-2 200
LD-2 235
16x12 SA
14x14 SA
12x10 SA
20x14 RA
SEC OF A144
VEST A150A
ER-1 60
ER-2 180
M6
M83
BALANCE TO 425 CFM
8x8 EA
10x10 EA
HHP-007 2.39
VAV-08 2.38
VAV-04 2.39
12x8 OA
SG-1 75
20x14 EA UP TO KEF-2
16x14 EA UP TO KEF-1
M55
ER-1 35
M55
ER-1 60

TAGGED NOTES

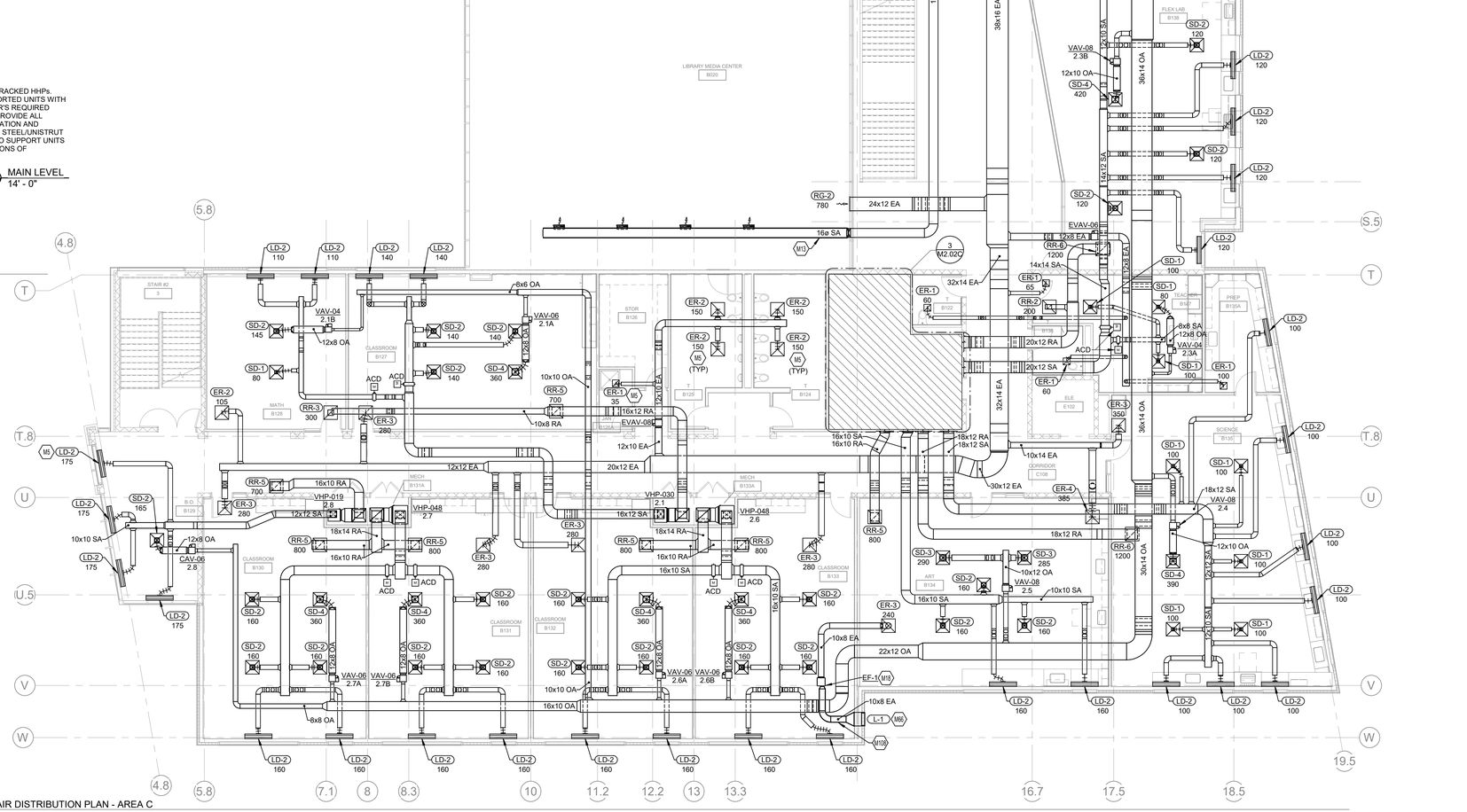
FA20	PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.
M1	PROVIDE AUTOMATIC CONTROL DAMPERS DEDICATED TO EACH CLASSROOM, INTERLOCKED WITH THERMOSTAT. TYPICAL OF ALL HEAT PUMPS SERVING MORE THAN ONE SPACE.
M2	REFER TO DETAILS FOR TYPICAL VHP DUCTWORK INSTALLATION INFORMATION.
M3	REFER TO DETAILS FOR VAV/CAV/EVAV INSTALLATION INFORMATION. PROVIDE WITH 3 STRAIGHT DUCT DIAMETERS AT INLETS FOR ALL UNITS. PROVIDE WITH AIRFLOW SUMMATION DEVICE. TYPICAL OF ALL.
M5	PROVIDE CABLE OPERATED VOLUME DAMPERS TO BALANCE AIR TERMINALS IN AREAS WITH HARD CEILING. PROVIDE WITH ACCESS DOOR AS REQUIRED.
M9	REFER TO DETAILS FOR TYPICAL HHP DUCTWORK INSTALLATION INFORMATION.
M10	PROVIDE CAR-III DAMPER. BALANCE TO AIRFLOWS INDICATED ON PLAN.
M13	IN ALL EXPOSED CEILING CONDITIONS DUCTWORK SHALL BE DOUBLE WALL SPIRAL, INTERALLY LINED, PREPARED FOR PAINTING, AND PAINTED ACCORDING TO ARCHITECTURAL REQUIREMENTS.
M18	INSTALL INLINE EF ABOVE CEILING INTERLOCKED WITH SWITCH TIMER AND VAV BOX. TERMINATE DUCTWORK AT EXTERIOR WALL WITH LOUVER.
M46	ROUTE GS/GR PIPING TO CIRCULATION PUMP P-2 FOR OFF-HOURS COOLING OPERATION. REFER TO CONTROLS ON M7.05.
M47	INSTALL SUPPLY GRILLES IN DUCTWORK, HEAVY DUTY STEEL DRUM LOUVERS WITH BLADE SCOOP MOUNTED AT 45°. REFER TO RGD SCHEDULE FOR MORE INFORMATION.
M56	ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
M61	PROVIDE 2-HOUR RATED COMBINATION FIRE/SMOKE DAMPER AT SHAFT ALL SHAFT PENETRATIONS. COORDINATE WITH FIRE ALARM CONTRACTOR.
M62	REFER TO M2.01 FOR CONTINUATION OF SUPPLY/RETURN DUCTWORK.
M66	PROVIDE AND INSTALL LOUVER IN WALL PER ARCHITECTURAL REQUIREMENTS, ARCHITECT TO SELECT COLOR. REFER TO LOUVER SCHEDULE.
M70	IN ROOM B105, FINAL ROUTING OF DUCTWORK IS TO BE FIELD VERIFIED AND COORDINATED WITH PLUMBING AND FIRE PROTECTION PIPING, ROOF DRAINAGE, ELECTRICAL CONDUIT, AND LIGHTING FIXTURES.
M71	PROVIDE CUSTOM WYE FITTING IN SHAFT. TAPS/TEES ARE NOT ACCEPTABLE.
M72	MC TO INSTALL HHP SECURED FROM DECK. PROVIDE ALL VIBRATION ISOLATION AND SUPPLEMENTAL STEEL/UNISTRUT AS REQUIRED TO SUPPORT UNIT IN TWO DIRECTIONS OF MOVEMENT.
M73	STACKED HHP, REFER TO SECTION VIEW ON M2.02C FOR MORE DETAILS.
M95	FULLY LINE RETURN AIR DUCTWORK, REFER TO SPECIFICATIONS FOR DUCT LINING REQUIREMENTS.
M108	ALL DUCTWORK DOWNSTREAM OF EF SHALL BE INSULATED, SEAL WEATHERTIGHT AT EXTERIOR PENETRATION.

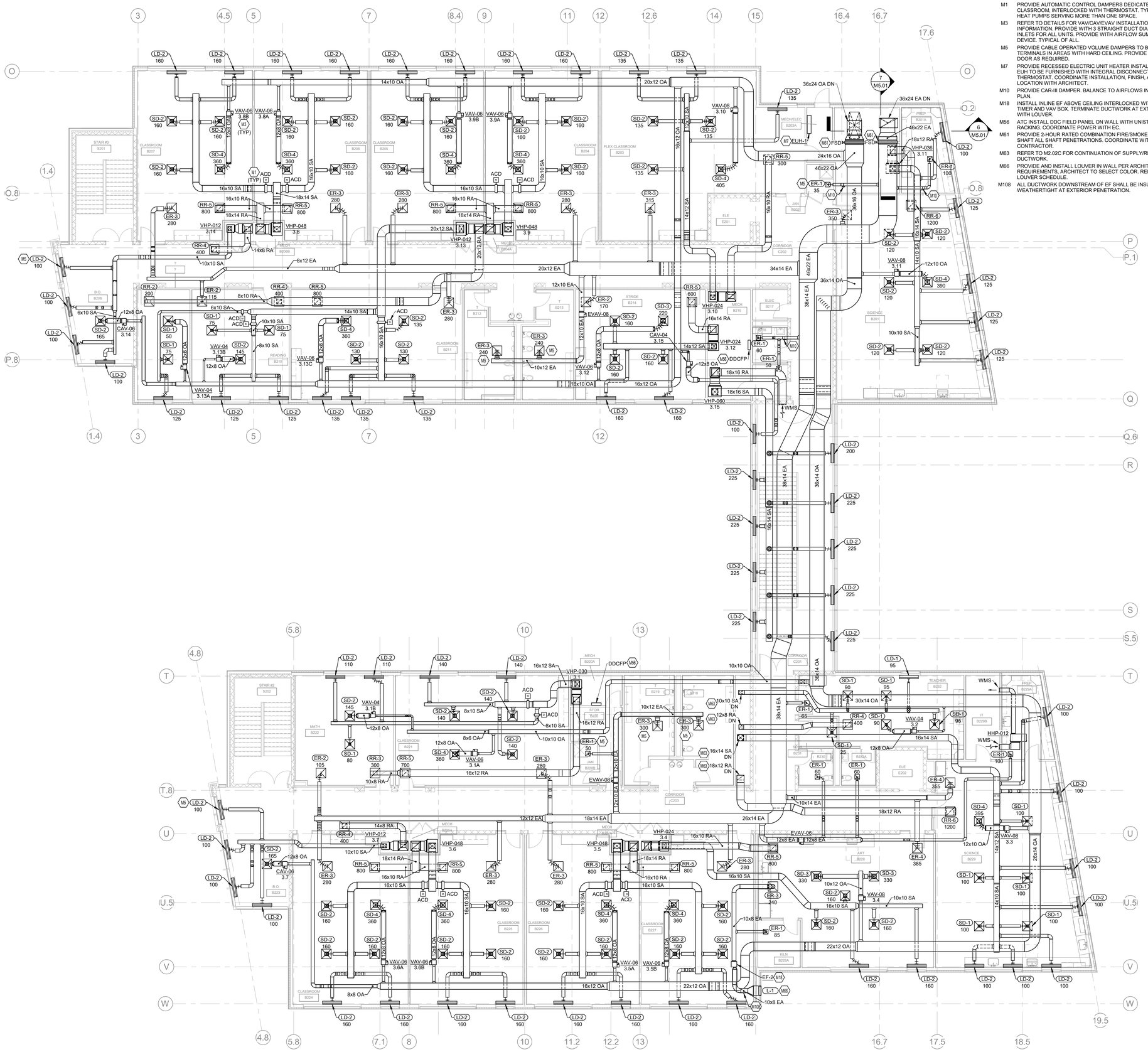


2 MECH B123 SECTION
1/4" = 1'-0"



3 MECH B123 ENLARGED PLAN
1/4" = 1'-0"


MAIN LEVEL MECHANICAL AIR DISTRIBUTION - AREA C
LIBRARY MEDIA CENTER B020
MAIN CORRIDOR SOUTH C101S
SCIENCE B101
CLASSROOM B127
CLASSROOM B130
CLASSROOM B131
CLASSROOM B132
CLASSROOM B133
ART B134
FLEX LAB B138
PREP B135A
ELE B102
MECH B133A
MECH B131A
CORRIDOR C108
SCIENCE B135
STOR B126
MATH B128
B.O. B129
ELE B125
ELE B124
ELE B122
TEACHER B137
B139
B.O. B112
MECH B123
READING B114
CLASSROOM B115
CLASSROOM B116
CLASSROOM B117
MECH B121
STRIDE B118
MECH B115A
MECH B108A
ELE B107
ELE B106
ELE B105
ELE E101
SPEC. ED. SELF CONS. B105
JAN. B121A
MECH B102
PREP B101A
TED PREP B105C
CORRIDOR C107
STAIR #2
STAIR #3
CLASSROOM B111
CLASSROOM B110
CLASSROOM B109
CLASSROOM B108
MECH B123
MECH B133
MECH B133A
MECH B131A
MECH B121
MECH B102
MECH B115A
MECH B108A
ELE B107
ELE B106
ELE B105
ELE E101
ELE B102
ELE B125
ELE B124
ELE B122



1 UPPER LEVEL MECHANICAL AIR DISTRIBUTION PLAN
1/8" = 1'-0"

TAGGED NOTES

- M1 PROVIDE AUTOMATIC CONTROL DAMPERS DEDICATED TO EACH CLASSROOM, INTERLOCKED WITH THERMOSTAT. TYPICAL OF ALL HEAT PUMPS SERVING MORE THAN ONE SPACE.
- M3 REFER TO DETAILS FOR VAV/CAV/EVAV INSTALLATION INFORMATION. PROVIDE WITH 3 STRAIGHT DUCT DIAMETERS AT INLETS FOR ALL UNITS. PROVIDE WITH AIRFLOW SUMMATION DEVICE. TYPICAL OF ALL.
- M5 PROVIDE CABLE OPERATED VOLUME DAMPERS TO BALANCE AIR TERMINALS IN AREAS WITH HARD CEILING. PROVIDE WITH ACCESS DOOR AS REQUIRED.
- M7 PROVIDE RECESSED ELECTRIC UNIT HEATER INSTALLED IN WALL. EUH TO BE FURNISHED WITH INTEGRAL DISCONNECT AND THERMOSTAT. COORDINATE INSTALLATION, FINISH, AND FINAL LOCATION WITH ARCHITECT.
- M10 PROVIDE CAR-III DAMPER. BALANCE TO AIRFLOWS INDICATED ON PLAN.
- M18 INSTALL INLINE EF ABOVE CEILING INTERLOCKED WITH SWITCH TIMER AND VAV BOX. TERMINATE DUCTWORK AT EXTERIOR WALL WITH LOUVER.
- M56 ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
- M61 PROVIDE 2-HOUR RATED COMBINATION FIRE/SMOKE DAMPER AT SHAFT ALL SHAFT PENETRATIONS. COORDINATE WITH FIRE ALARM CONTRACTOR.
- M63 REFER TO M2.02C FOR CONTINUATION OF SUPPLY/RETURN DUCTWORK.
- M66 PROVIDE AND INSTALL LOUVER IN WALL PER ARCHITECTURAL REQUIREMENTS, ARCHITECT TO SELECT COLOR. REFER TO LOUVER SCHEDULE.
- M108 ALL DUCTWORK DOWNSTREAM OF EF SHALL BE INSULATED, SEAL WEATHERTIGHT AT EXTERIOR PENETRATION.

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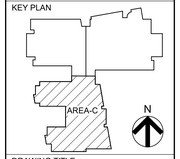
STATE OF CONNECTICUT
JOSEPH M. FAY
24058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL MECHANICAL AIR DISTRIBUTION

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

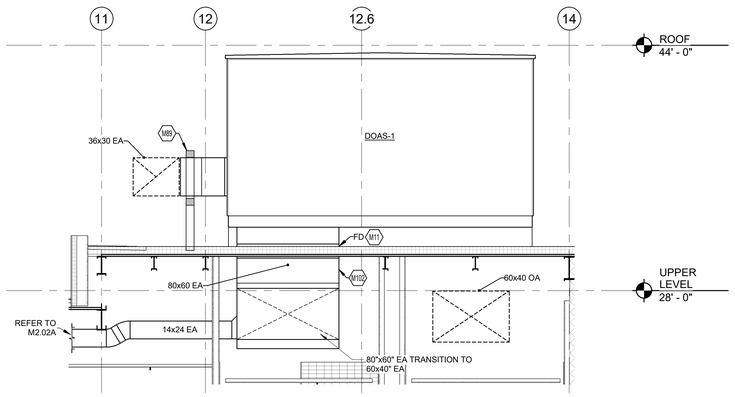
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M2.03

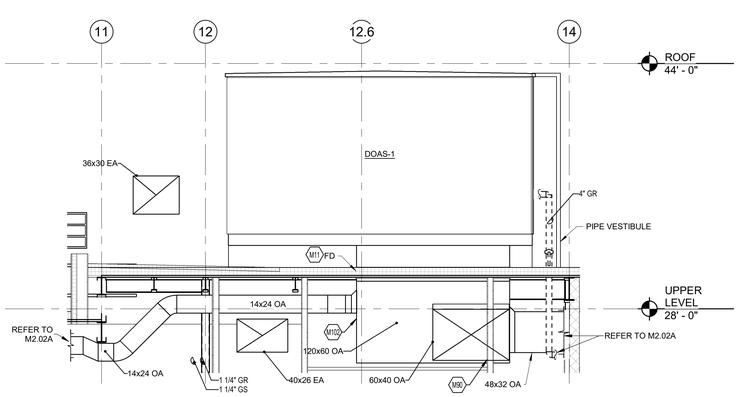
5/18/2026 11:06:42 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

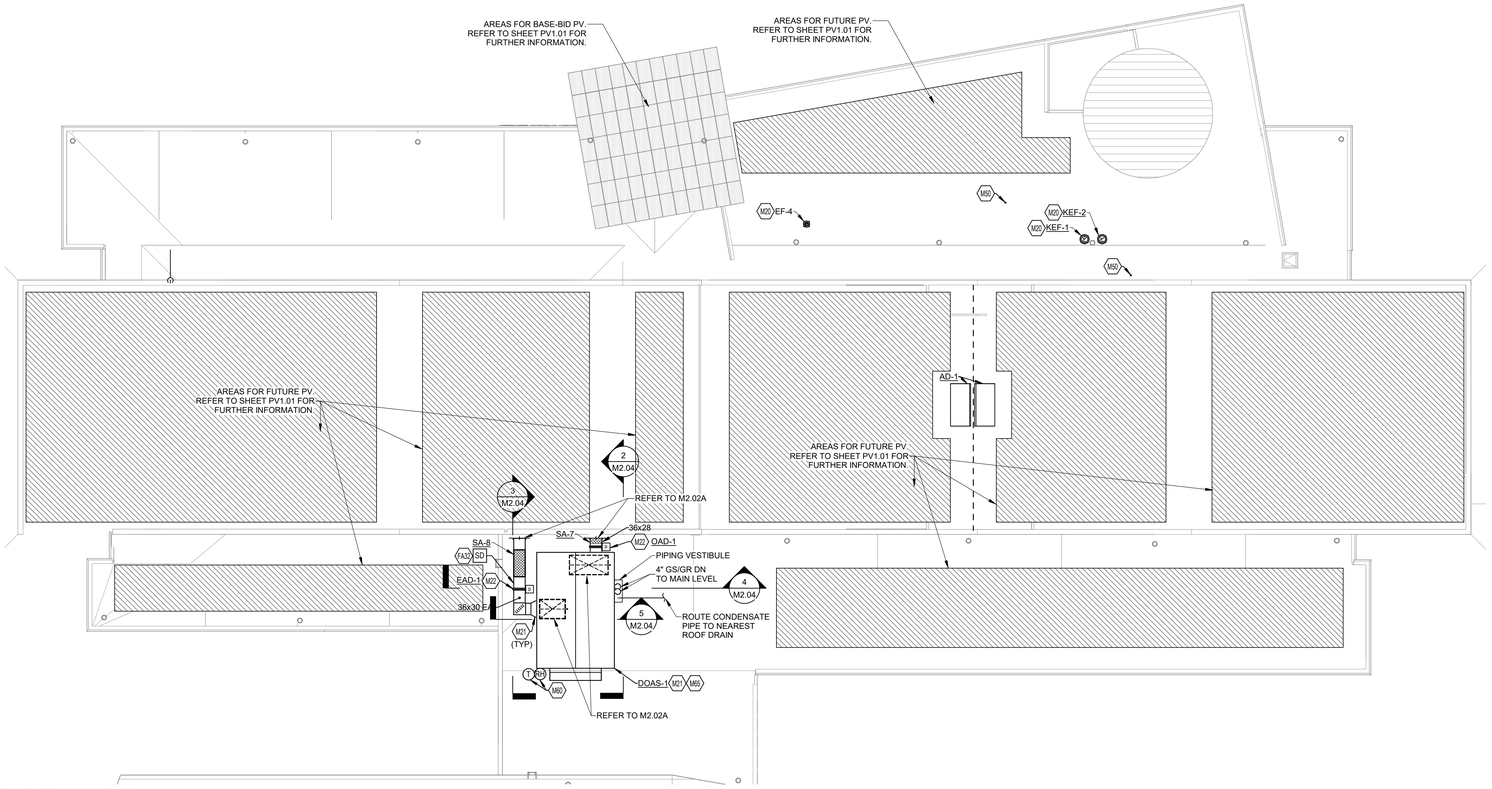
FA32	DUCT SMOKE DETECTOR SHALL BE INSTALLED IN DUCTWORK WHERE INDICATED. FIRE ALARM CONTRACTOR SHALL PROVIDE, INSTALL, WIRE, AND INTEGRATE DETECTOR WITH BUILDING FIRE ALARM SYSTEM. COORDINATE FINAL LOCATION WITH DUCTWORK, ACCESS PANELS, AND EQUIPMENT MANUFACTURER REQUIREMENTS.
M11	PROVIDE 2-HOUR RATED FIRE DAMPER AT ROOF PENETRATION. PROVIDE WITH 12"X12" ACCESS PANEL IN HARD CEILING.
M20	EF SHALL BE INSTALLED WITH ROOF CURB. COORDINATE WITH EC FOR POWER.
M21	INSTALL ROOF MOUNTED DUCTWORK WITH APPROVED WEATHERPROOF JACKETING AND INSULATION, SEE SPECIFICATIONS. INSTALL WITH ROOF SUPPORT PER DETAIL.
M22	PROVIDE CONTROL DAMPERS IN EXHAUST AND OUTSIDE AIR DUCTWORK AT ROOF. DAMPERS SHALL BE RATED FOR OUTDOOR INSTALLATION AND SUITABLE FOR EXPOSED CONDITIONS. INTEGRATE AND INTERLOCK WITH BMS PER DOAS-1 CONTROL SEQUENCE.
M50	INSTALL 4" ROUND EXHAUST DUCTWORK FROM DRYER VENT AND TERMINATE WITH GOOSENECK MINIMUM 3 FEET ABOVE ROOF.
M60	ATC CONTRACTOR TO PROVIDE GLOBAL OUTSIDE TEMPERATURE SENSOR AND RELATIVE HUMIDITY SENSOR MOUNTED ON DOAS-1. FIELD COORDINATE FINAL LOCATION TO BE APPROVED BY ENGINEER.
M65	DOAS-1 SHALL BE PLACED ON CUSTOM ACOUSTICAL VIBRATION CURB, REFER TO SPECIFICATIONS.
M78	PROVIDE AND INSTALL DUCT MOUNTED SOUND ATTENUATOR PER MANUFACTUER'S REQUIREMENTS. INSTALL WITH STRAIGHT LENGTH REQUIREMENTS. SEE SILENCER SCHEDULE FOR MORE INFORMATION.
M88	CONTRACTOR TO COORDINATE RIGGING REQUIREMENTS WITH FINAL DIMENSION OF UNIT FROM OVERHANG.
M89	ROOF DUCT SUPPORTS. SEE DETAILS.
M90	COORDINATE CONSTRUCTION OF WALL WITH INSTALLATION OF DUCTWORK MAINS.
M91	UNIT SHALL NOT BE INSTALLED OVER THE FIRE WALL AND BUILDING EXPANSION JOINT.
M92	CUSTOM VIBRATION ISOLATING ACOUSTICAL ROOF CURB COORDINATED WITH FOOTPRINT OF UNIT AND SLOPE OF ROOF. REFER TO SPECIFICATIONS.
M93	INSTALL SOUND ATTENUATOR THROUGH WALL WITH SLEEVE. SEAL WEATHER TIGHT.
M102	FULLY LINE MAIN DUCTWORK FROM DOAS-1 BOTTOM CONNECTION, REFER TO SPECIFICATIONS FOR DUCT LINING REQUIREMENTS.



5 DOAS SECTION - 4
1/4" = 1'-0"

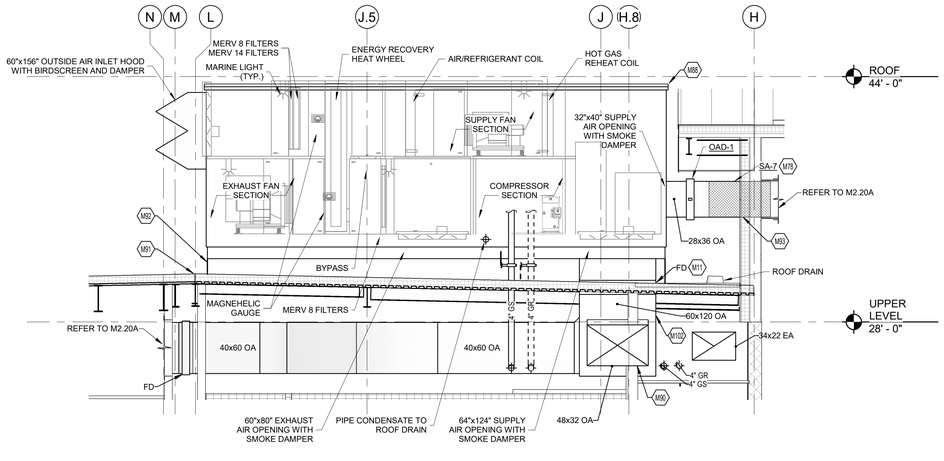


4 DOAS SECTION - 3
1/4" = 1'-0"



1 ROOF MECHANICAL PLAN
1/16" = 1'-0"

3 DOAS SECTION - 2
1/4" = 1'-0"



2 DOAS SECTION - 1
1/4" = 1'-0"

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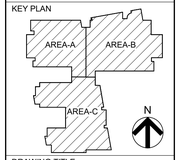
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL ROOF PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M2.04

5/19/2026 11:06:50 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

WATER SOURCE HEAT PUMP RUNOUT SCHEDULE

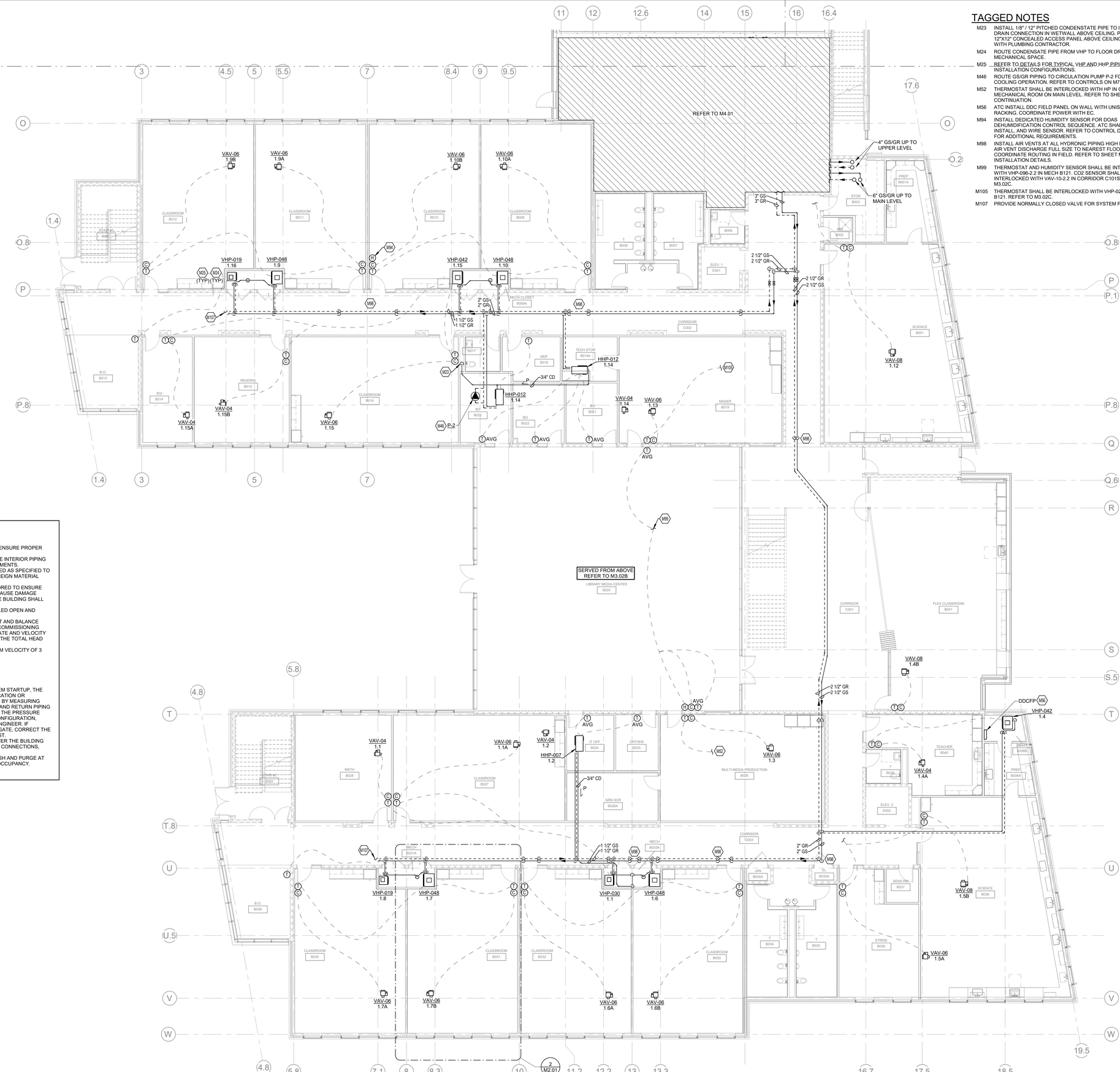
MARK	GS/GR HOSE KIT PIPING SIZE (Ø)
HHP-007	¾"
HHP-012	1"
HHP-019	1"
HHP-024	1"
HHP-036	1-1/4"
HHP-048	1-1/2"
VHP-012	1"
VHP-019	1"
VHP-024	1"
VHP-030	1-1/4"
VHP-036	1-1/4"
VHP-042	1-1/4"
VHP-048	1-1/2"
VHP-060	1-1/2"
VHP-072	1-1/2"
VHP-096	2"
VHP-240	2-1/2"
VHP-300	3"

REMARKS :

1. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE AS SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.

PURGING NOTES

1. THE INTERIOR PIPING SYSTEM SHALL BE SUCCESSFULLY PURGED TO ENSURE PROPER REMOVAL OF AIR AND DEBRIS.
2. THE WELLFIELD PURGE IS REQUIRED AND SHALL OCCUR PRIOR TO THE INTERIOR PIPING PURGE. REFER TO DRAWING UM1.01 FOR WELLFIELD PURGE REQUIREMENTS.
3. THE ENTIRE INTERIOR GEOTHERMAL PIPING SYSTEM SHALL BE FLUSHED AS SPECIFIED TO REMOVE DEBRIS, INCLUDING DIRT, PIPING SHAVINGS, AND OTHER FOREIGN MATERIAL TRAPPED WITHIN THE PIPING.
4. DURING THE PURGE PROCESS, PRESSURE GAUGES SHALL BE MONITORED TO ENSURE THE SYSTEM IS NOT OVER-PRESSURIZED IN A MANNER THAT COULD CAUSE DAMAGE WITHIN THE BUILDING OR THE WELLFIELD. MAXIMUM PRESSURE IN THE BUILDING SHALL NOT EXCEED 75 PSI, MEASURED AT THE PUMP.
5. ALL VALVES ASSOCIATED WITH EACH HEAT PUMP UNIT SHALL BE CYCLED OPEN AND CLOSED TO FACILITATE BYPASS OPERATION.
6. THE SYSTEM PURGE SHALL BE WITNESSED AND VERIFIED BY THE TEST AND BALANCE (T&B) CONTRACTOR, OWNER'S REPRESENTATIVE (O.R.), AND/OR THE COMMISSIONING AGENT. THE T&B CONTRACTOR SHALL VERIFY THAT MINIMUM FLOW RATE AND VELOCITY ARE ACHIEVED. IN ADDITION, THE T&B CONTRACTOR SHALL MEASURE THE TOTAL HEAD REQUIRED TO ACHIEVE THE MINIMUM PURGE FLOW REQUIREMENTS.
7. PURGING FLOW RATES SHALL BE AS FOLLOWS TO MAINTAIN A MINIMUM VELOCITY OF 3 FPS:
   A. 2" PIPING: 35 GPM
   B. 2-1/2" PIPING: 50 GPM
   C. 3" PIPING: 70 GPM
   D. 4" PIPING: 125 GPM
   E. 6" PIPING: 275 GPM
8. AFTER FLUSHING AND PURGING ARE COMPLETE, BUT PRIOR TO SYSTEM STARTUP, THE CONTRACTOR SHALL TEST THE SYSTEM TO CONFIRM THAT NO FABRICATION OR INSTALLATION ERRORS ARE PRESENT. THIS SHALL BE ACCOMPLISHED BY MEASURING AND RECORDING CIRCUIT PRESSURE DIFFERENTIALS AT THE SUPPLY AND RETURN PIPING AT THE MAIN HEADER WHILE PURGING AT THE REQUIRED FLOW RATE. THE PRESSURE DROP THROUGH THE CIRCUITS, BASED ON THE ACTUAL INSTALLED CONFIGURATION, SHALL BE ESTIMATED BY THE CONTRACTOR AND REVIEWED BY THE ENGINEER. IF INCONSISTENCIES ARE IDENTIFIED, THE CONTRACTOR SHALL INVESTIGATE, CORRECT THE ISSUE, AND RETEST THE AFFECTED CIRCUIT(S) AT NO ADDITIONAL COST.
9. FLUSHING AND PURGING AT THE HEAT PUMP UNITS SHALL OCCUR AFTER THE BUILDING MAINS HAVE BEEN PURGED, USING THE ISOLATION VALVES AND HOSE CONNECTIONS, EACH UNIT SHALL BE FLUSHED AND FILLED.
10. INCLUDE IN THE BID AN ADDITIONAL COMPLETE PIPING NETWORK FLUSH AND PURGE AT PROJECT COMPLETION AND AGAIN AT 3, 6, 9, AND 12 MONTHS AFTER OCCUPANCY.



1 LOWER LEVEL MECHANICAL PIPING PLAN
1/8" = 1'-0"

TAGGED NOTES

M23	INSTALL 1/8" / 12" PITCHED CONDENSTATE PIPE TO INDIRECT DRAIN CONNECTION IN WETWALL ABOVE CEILING. PROVIDE WITH 12"X12" CONCEALED ACCESS PANEL ABOVE CEILING. COORDINATE WITH PLUMBING CONTRACTOR.
M24	ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
M25	REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
M46	ROUTE GS/GR PIPING TO CIRCULATION PUMP P-2 FOR OFF-HOURS COOLING OPERATION. REFER TO CONTROLS ON M7.05.
M52	THERMOSTAT SHALL BE INTERLOCKED WITH HP IN GROUPED MECHANICAL ROOM ON MAIN LEVEL. REFER TO SHEET M2.02C FOR CONTINUATION.
M56	ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
M94	INSTALL DEDICATED HUMIDITY SENSOR FOR DOAS DEHUMIDIFICATION CONTROL SEQUENCE. ATC SHALL FURNISH, INSTALL, AND WIRE SENSOR. REFER TO CONTROL DRAWING M7.04 FOR ADDITIONAL REQUIREMENTS.
M98	INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M6.02 FOR INSTALLATION DETAILS.
M99	THERMOSTAT AND HUMIDITY SENSOR SHALL BE INTERLOCKED WITH VHP-096-2.2 IN MECH B121. CO2 SENSOR SHALL BE INTERLOCKED WITH VAV-10-2.2 IN CORRIDOR C101S. REFER TO M3.02C.
M105	THERMOSTAT SHALL BE INTERLOCKED WITH VHP-024-1.13 IN MECH B121. REFER TO M3.02C.
M107	PROVIDE NORMALLY CLOSED VALVE FOR SYSTEM FLUSHING.

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

LOWER LEVEL MECHANICAL PIPING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M3.01

5/19/2026 11:06:56 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

WATER SOURCE HEAT PUMP RUNOUT SCHEDULE

MARK	GS/GR HOSE KIT PIPING SIZE (Ø)
HHP-007	¾"
HHP-012	1"
HHP-019	1"
HHP-024	1"
HHP-036	1-1/4"
HHP-048	1-1/2"
VHP-012	1"
VHP-019	1"
VHP-024	1"
VHP-030	1-1/4"
VHP-036	1-1/4"
VHP-042	1-1/4"
VHP-048	1-1/2"
VHP-060	1-1/2"
VHP-072	1-1/2"
VHP-096	2"
VHP-240	2-1/2"
VHP-300	3"

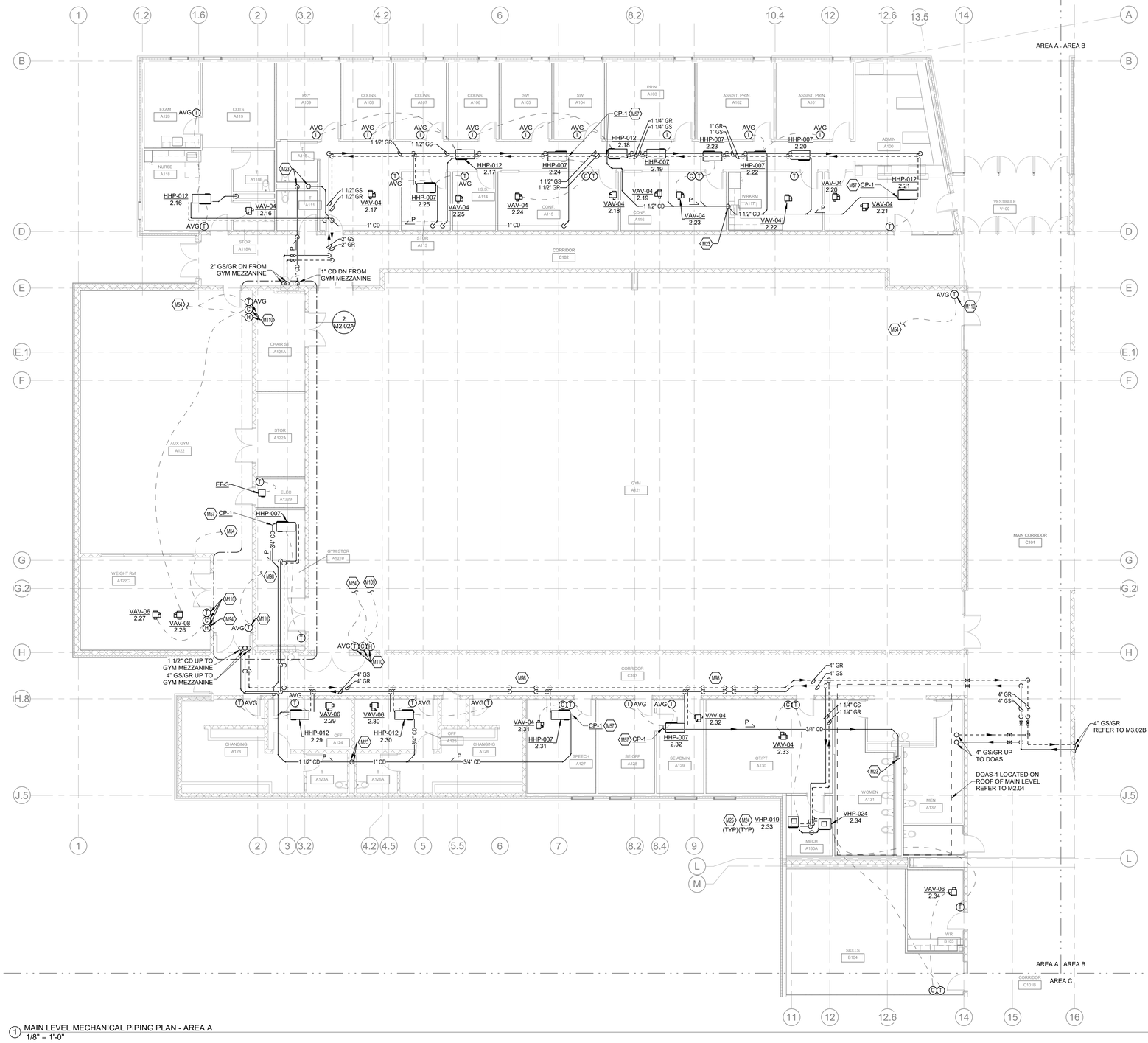
REMARKS :

1. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE AS SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.

TAGGED NOTES

(##)

- M23 INSTALL 1/8" / 12" PITCHED CONDENSTATE PIPE TO INDIRECT DRAIN CONNECTION IN WETWALL ABOVE CEILING. PROVIDE WITH 12"X12" CONCEALED ACCESS PANEL ABOVE CEILING. COORDINATE WITH PLUMBING CONTRACTOR.
- M24 ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
- M25 REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
- M54 THERMOSTATS AND HUMIDITY SENSORS SHALL BE INTERLOCKED WITH HP IN GYM MEZZANINE. REFER TO ENLARGED PLAN ON M2.02A.
- M57 PROVIDE CONDENSATE PUMP FOR HEAT PUMP WHERE GRAVITY DRAIN IS NOT POSSIBLE. PROVIDE OVERFLOW SAFETY SHUTOFF AND ROUTE DISCHARGE TO DRAIN OR HEADWALL AS REQUIRED.
- M94 INSTALL DEDICATED HUMIDITY SENSOR FOR DOAS DEHUMIDIFICATION CONTROL SEQUENCE. ATC SHALL FURNISH, INSTALL AND WIRE SENSOR. REFER TO CONTROL DRAWING M7.04 FOR ADDITIONAL REQUIREMENTS.
- M98 INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M8.02 FOR INSTALLATION DETAILS.
- M109 CO2 SENSOR SHALL BE INTERLOCKED WITH VAV-08-2.28 IN GYM MEZZANINE. REFER TO ENLARGED PLAN ON M2.02A.
- M110 PROVIDE WITH CAGE OR COVER.



1 MAIN LEVEL MECHANICAL PIPING PLAN - AREA A
1/8" = 1'-0"

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STATE OF CONNECTICUT · JOSEPH E. KOSIOREK · 24058 · LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL MECHANICAL PIPING - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M3.02A

5/18/2026 11:07:01 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

WATER SOURCE HEAT PUMP RUNOUT SCHEDULE

MARK	GS/GR HOSE KIT PIPING SIZE (Ø)
HHP-007	¾"
HHP-012	1"
HHP-019	1"
HHP-024	1"
HHP-036	1-1/4"
HHP-048	1-1/2"
VHP-012	1"
VHP-019	1"
VHP-024	1"
VHP-030	1-1/4"
VHP-036	1-1/4"
VHP-042	1-1/4"
VHP-048	1-1/2"
VHP-060	1-1/2"
VHP-072	1-1/2"
VHP-096	2"
VHP-240	2-1/2"
VHP-300	3"

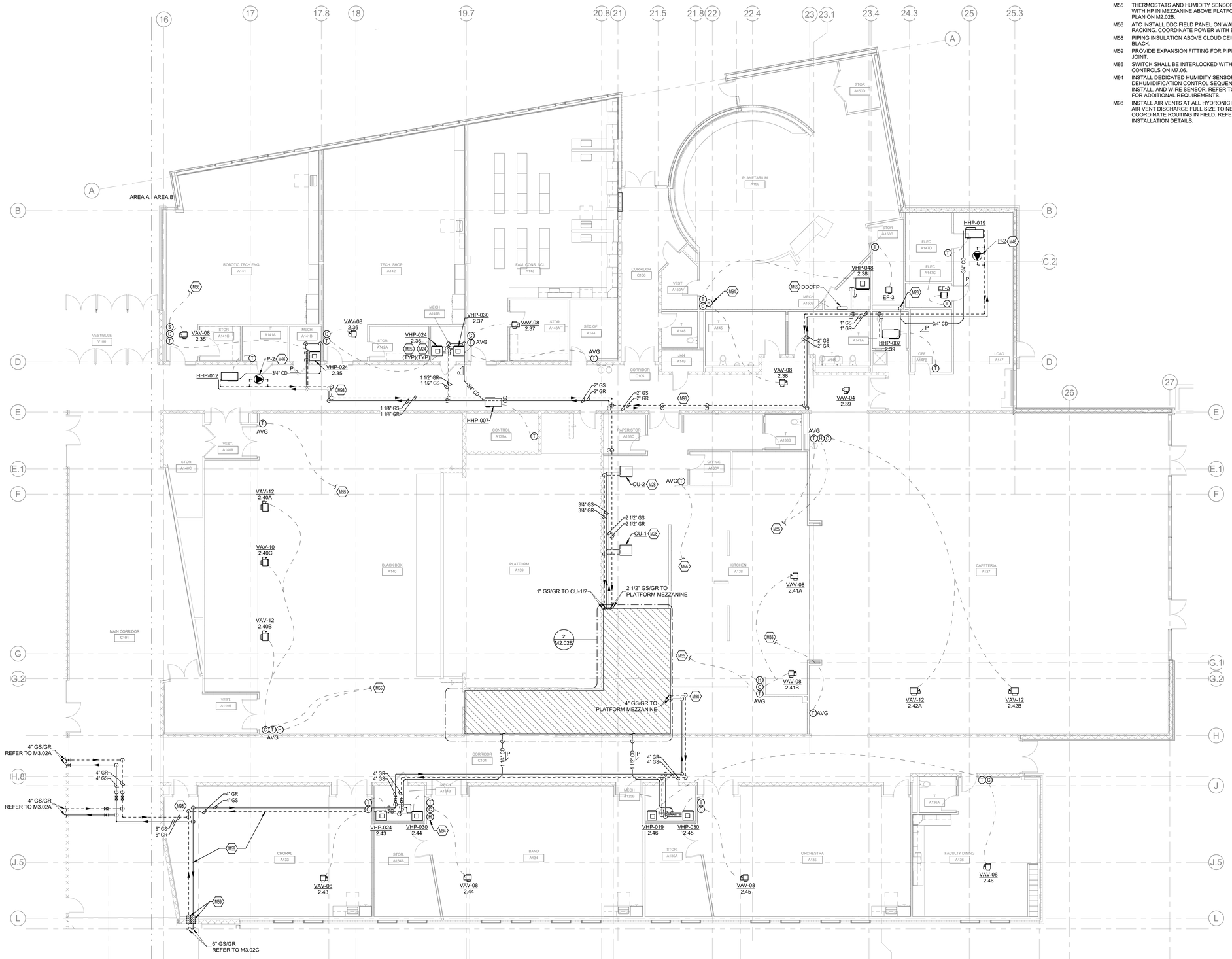
REMARKS :

1. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE AS SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.

TAGGED NOTES

(##)

- M23 INSTALL 1/8" / 12" PITCHED CONDENSTATE PIPE TO INDIRECT DRAIN CONNECTION IN WETWALL ABOVE CEILING. PROVIDE WITH 12"X12" CONCEALED ACCESS PANEL ABOVE CEILING. COORDINATE WITH PLUMBING CONTRACTOR.
- M24 ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
- M25 REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
- M28 PIPE GS/GR TO INLINE RECIRCULATING PUMP IN MEZZ. ROUTE TO CU-1/2 ABOVE CEILING ON PLATFORM. CONDENSERS SHALL BE PROVIDED WITH EMERGENCY POWER, COORDINATE WITH EC. REFER TO CONTROL DRAWINGS FOR MORE INFORMATION.
- M46 ROUTE GS/GR PIPING TO CIRCULATION PUMP P-2 FOR OFF-HOURS COOLING OPERATION. REFER TO CONTROLS ON M7.05.
- M55 THERMOSTATS AND HUMIDITY SENSORS SHALL BE INTERLOCKED WITH HP IN MEZZANINE ABOVE PLATFORM. REFER TO ENLARGED PLAN ON M2.02B.
- M56 ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
- M58 PIPING INSULATION ABOVE CLOUD CEILING SHALL BE PAINTED BLACK.
- M59 PROVIDE EXPANSION FITTING FOR PIPING THROUGH EXPANSION JOINT.
- M86 SWITCH SHALL BE INTERLOCKED WITH EF-4 ON ROOF. REFER TO CONTROLS ON M7.06.
- M94 INSTALL DEDICATED HUMIDITY SENSOR FOR DOAS DEHUMIDIFICATION CONTROL SEQUENCE. ATC SHALL FURNISH, INSTALL, AND WIRE SENSOR. REFER TO CONTROL DRAWING M7.04 FOR ADDITIONAL REQUIREMENTS.
- M98 INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M6.02 FOR INSTALLATION DETAILS.



1 MAIN LEVEL MECHANICAL PIPING PLAN - AREA B
1/8" = 1'-0"

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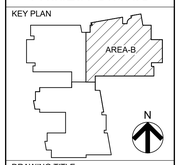
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL MECHANICAL PIPING - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M3.02B

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WATER SOURCE HEAT PUMP RUNOUT SCHEDULE

MARK	GS/GR HOSE KIT PIPING SIZE (Ø)
HHP-007	¾"
HHP-012	1"
HHP-019	1"
HHP-024	1"
HHP-036	1-1/4"
HHP-048	1-1/2"
VHP-012	1"
VHP-019	1"
VHP-024	1"
VHP-030	1-1/4"
VHP-036	1-1/4"
VHP-042	1-1/4"
VHP-048	1-1/2"
VHP-060	1-1/2"
VHP-072	1-1/2"
VHP-096	2"
VHP-240	2-1/2"
VHP-300	3"

REMARKS :

1. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE AS SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.

TAGGED NOTES

(##)

- M24 ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
- M25 REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
- M52 THERMOSTAT SHALL BE INTERLOCKED WITH HP IN GROUPED MECHANICAL ROOM ON MAIN LEVEL. REFER TO SHEET M2.02C FOR CONTINUATION.
- M56 ~~ATC INSTALL DDC FIELD PANEL ON WALL WITH~~ UNISTRUT RACKING. COORDINATE POWER WITH EC.
- M94 INSTALL DEDICATED HUMIDITY SENSOR FOR DOAS DEHUMIDIFICATION CONTROL SEQUENCE. ATC SHALL FURNISH, INSTALL, AND WIRE SENSOR. REFER TO CONTROL DRAWING M7.04 FOR ADDITIONAL REQUIREMENTS.
- M98 INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M6.02 FOR INSTALLATION DETAILS.
- M107 PROVIDE NORMALLY CLOSED VALVE FOR SYSTEM FLUSHING.

1 MAIN LEVEL MECHANICAL PIPING PLAN - AREA C
1/8" = 1'-0"

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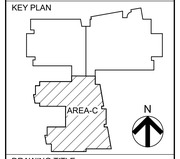
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL MECHANICAL PIPING - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M3.02C

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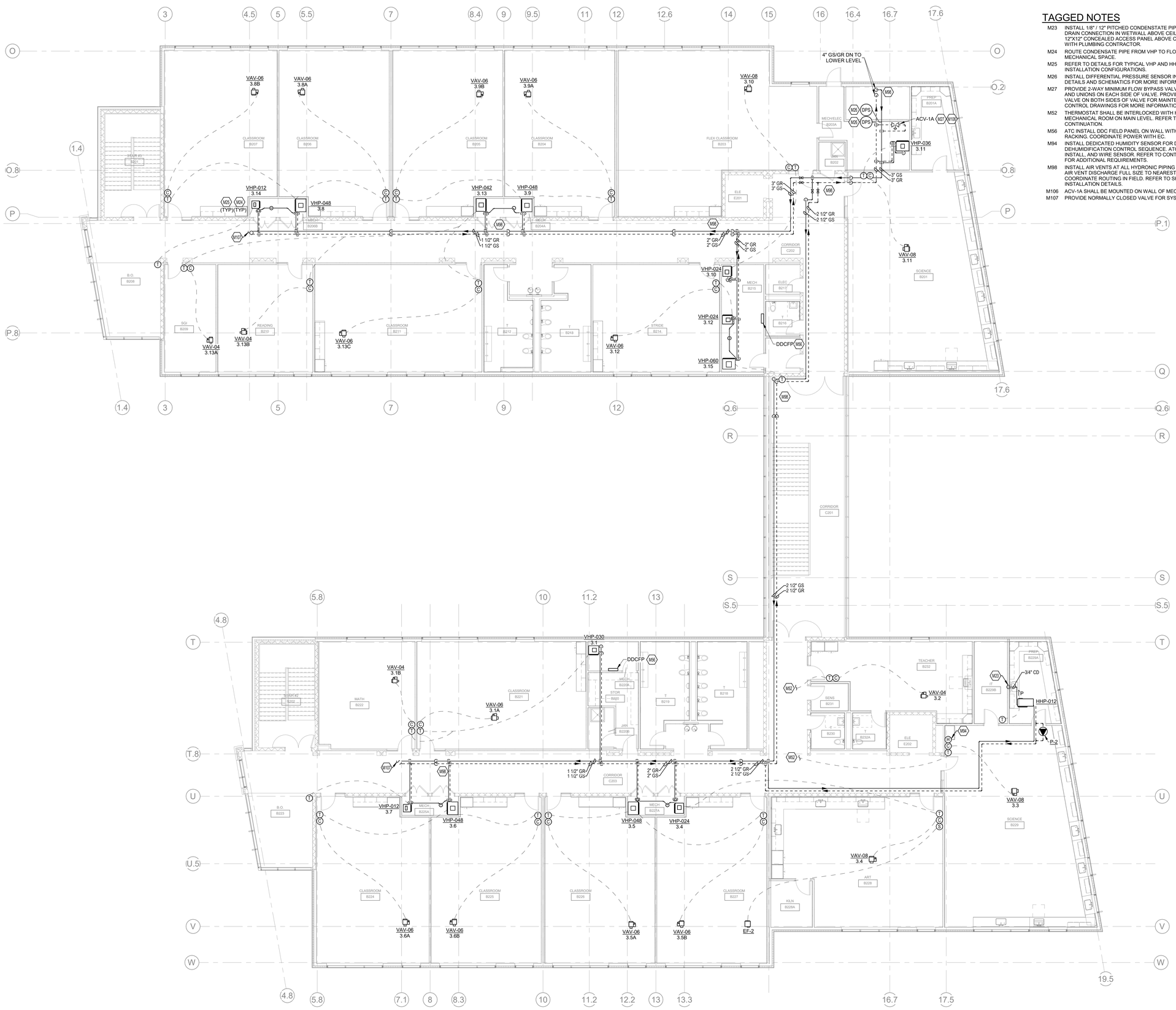
WATER SOURCE HEAT PUMP RUNOUT SCHEDULE

MARK	GS/GR HOSE KIT PIPING SIZE (Ø)
HHP-007	¾"
HHP-012	1"
HHP-019	1"
HHP-024	1"
HHP-036	1-1/4"
HHP-048	1-1/2"
VHP-012	1"
VHP-019	1"
VHP-024	1"
VHP-030	1-1/4"
VHP-036	1-1/4"
VHP-042	1-1/4"
VHP-048	1-1/2"
VHP-060	1-1/2"
VHP-072	1-1/2"
VHP-096	2"
VHP-240	2-1/2"
VHP-300	3"

REMARKS :

1. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE AS SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.



1 UPPER LEVEL MECHANICAL PIPING PLAN
1/8" = 1'-0"

TAGGED NOTES

M23	INSTALL 1/8" / 12" PITCHED CONDENSTATE PIPE TO INDIRECT DRAIN CONNECTION IN WETWALL ABOVE CEILING. PROVIDE WITH 12"X12" CONCEALED ACCESS PANEL ABOVE CEILING. COORDINATE WITH PLUMBING CONTRACTOR.
M24	ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
M25	REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
M26	INSTALL DIFFERENTIAL PRESSURE SENSOR IN PIPE. REFER TO DETAILS AND SCHEMATICS FOR MORE INFORMATION.
M27	PROVIDE 2-WAY MINIMUM FLOW BYPASS VALVE WITH FLANGES AND UNIONS ON EACH SIDE OF VALVE. PROVIDE WITH SHUT-OFF VALVE ON BOTH SIDES OF VALVE FOR MAINTENANCE. REFER TO CONTROL DRAWINGS FOR MORE INFORMATION.
M52	THERMOSTAT SHALL BE INTERLOCKED WITH HP IN GROUPED MECHANICAL ROOM ON MAIN LEVEL. REFER TO SHEET M2.02C FOR CONTINUATION.
M56	ATC INSTALL DDC FIELD PANEL ON WALL WITH UNISTRUT RACKING. COORDINATE POWER WITH EC.
M94	INSTALL DEDICATED HUMIDITY SENSOR FOR DOAS DEHUMIDIFICATION CONTROL SEQUENCE. ATC SHALL FURNISH, INSTALL, AND WIRE SENSOR. REFER TO CONTROL DRAWING M7.04 FOR ADDITIONAL REQUIREMENTS.
M98	INSTALL AIR VENTS AT ALL HYDRONIC PIPING HIGH POINTS. PIPE AIR VENT DISCHARGE FULL SIZE TO NEAREST FLOOR DRAIN. COORDINATE ROUTING IN FIELD. REFER TO SHEET M6.02 FOR INSTALLATION DETAILS.
M106	ACV-1A SHALL BE MOUNTED ON WALL OF MECHANICAL SPACE.
M107	PROVIDE NORMALLY CLOSED VALVE FOR SYSTEM FLUSHING.

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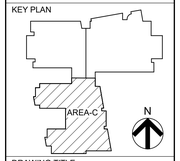
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL MECHANICAL PIPING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M3.03

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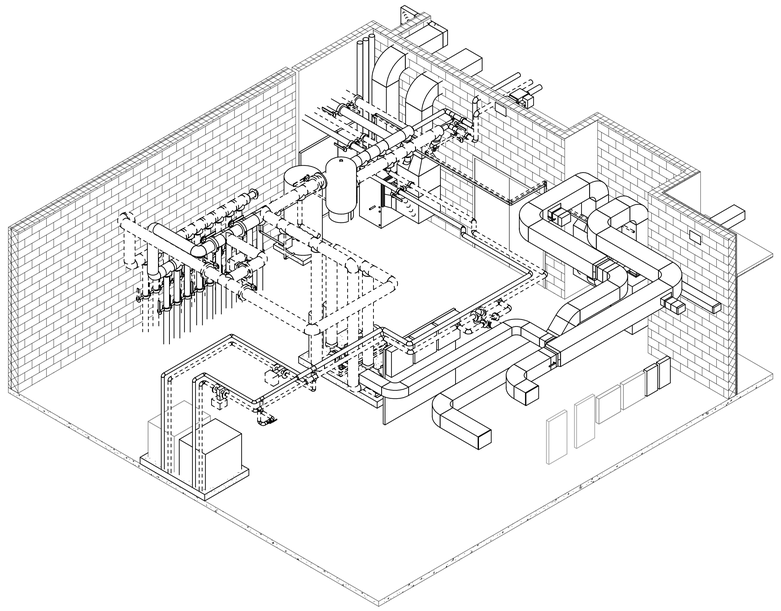
PURGING NOTES

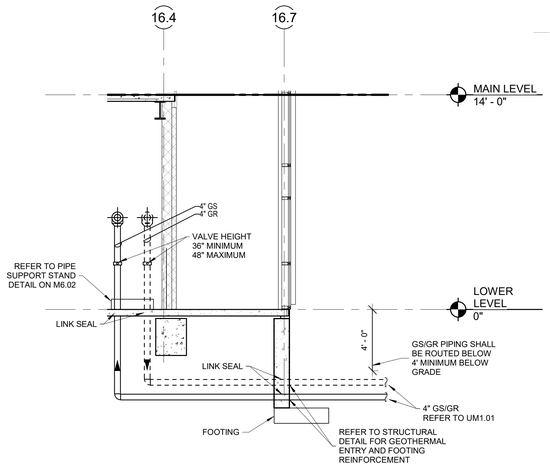
1. THE INTERIOR PIPING SYSTEM SHALL BE SUCCESSFULLY PURGED TO ENSURE PROPER REMOVAL OF AIR AND DEBRIS.
2. THE WELLFIELD PURGE IS REQUIRED AND SHALL OCCUR PRIOR TO THE INTERIOR PIPING PURGE. REFER TO DRAWING UM1.01 FOR WELLFIELD PURGE REQUIREMENTS.
3. THE ENTIRE INTERIOR GEOTHERMAL PIPING SYSTEM SHALL BE FLUSHED AS SPECIFIED TO REMOVE DEBRIS, INCLUDING DIRT, PIPING SHAVINGS, AND OTHER FOREIGN MATERIAL TRAPPED WITHIN THE PIPING.
4. DURING THE PURGE PROCESS, PRESSURE GAUGES SHALL BE MONITORED TO ENSURE THE SYSTEM IS NOT OVER-PRESSURIZED IN A MANNER THAT COULD CAUSE DAMAGE WITHIN THE BUILDING OR THE WELLFIELD. MAXIMUM PRESSURE IN THE BUILDING SHALL NOT EXCEED 75 PSI, MEASURED AT THE PUMP.
5. ALL VALVES ASSOCIATED WITH EACH HEAT PUMP UNIT SHALL BE CYCLED OPEN AND CLOSED TO FACILITATE BYPASS OPERATION.
6. THE SYSTEM PURGE SHALL BE WITNESSED AND VERIFIED BY THE TEST AND BALANCE (T&B) CONTRACTOR, OWNER'S REPRESENTATIVE (O.R.), AND/OR THE COMMISSIONING AGENT. THE T&B CONTRACTOR SHALL VERIFY THAT MINIMUM FLOW RATE AND VELOCITY ARE ACHIEVED. IN ADDITION, THE T&B CONTRACTOR SHALL MEASURE THE TOTAL HEAD REQUIRED TO ACHIEVE THE MINIMUM PURGE FLOW REQUIREMENTS.
7. PURGING FLOW RATES SHALL BE AS FOLLOWS TO MAINTAIN A MINIMUM VELOCITY OF 3 FPS:
   A. 2" PIPING: 35 GPM
   B. 2-1/2" PIPING: 50 GPM
   C. 3" PIPING: 70 GPM
   D. 4" PIPING: 125 GPM
   E. 6" PIPING: 275 GPM
8. AFTER FLUSHING AND PURGING ARE COMPLETE, BUT PRIOR TO SYSTEM STARTUP, THE CONTRACTOR SHALL TEST THE SYSTEM TO CONFIRM THAT NO FABRICATION OR INSTALLATION ERRORS ARE PRESENT. THIS SHALL BE ACCOMPLISHED BY MEASURING AND RECORDING CIRCUIT PRESSURE DIFFERENTIALS AT THE SUPPLY AND RETURN PIPING AT THE MAIN HEADER WHILE PURGING AT THE REQUIRED FLOW RATE. THE PRESSURE DROP THROUGH THE CIRCUITS, BASED ON THE ACTUAL INSTALLED CONFIGURATION, SHALL BE ESTIMATED BY THE CONTRACTOR AND REVIEWED BY THE ENGINEER. IF INCONSISTENCIES ARE IDENTIFIED, THE CONTRACTOR SHALL INVESTIGATE, CORRECT THE ISSUE, AND RETEST THE AFFECTED CIRCUIT(S) AT NO ADDITIONAL COST.
9. FLUSHING AND PURGING AT THE HEAT PUMP UNITS SHALL OCCUR AFTER THE BUILDING MAINS HAVE BEEN PURGED. USING THE ISOLATION VALVES AND HOSE CONNECTIONS, EACH UNIT SHALL BE FLUSHED AND FILLED.
10. INCLUDE IN THE BID AN ADDITIONAL COMPLETE PIPING NETWORK FLUSH AND PURGE AT PROJECT COMPLETION AND AGAIN AT 3, 6, 9, AND 12 MONTHS AFTER OCCUPANCY.



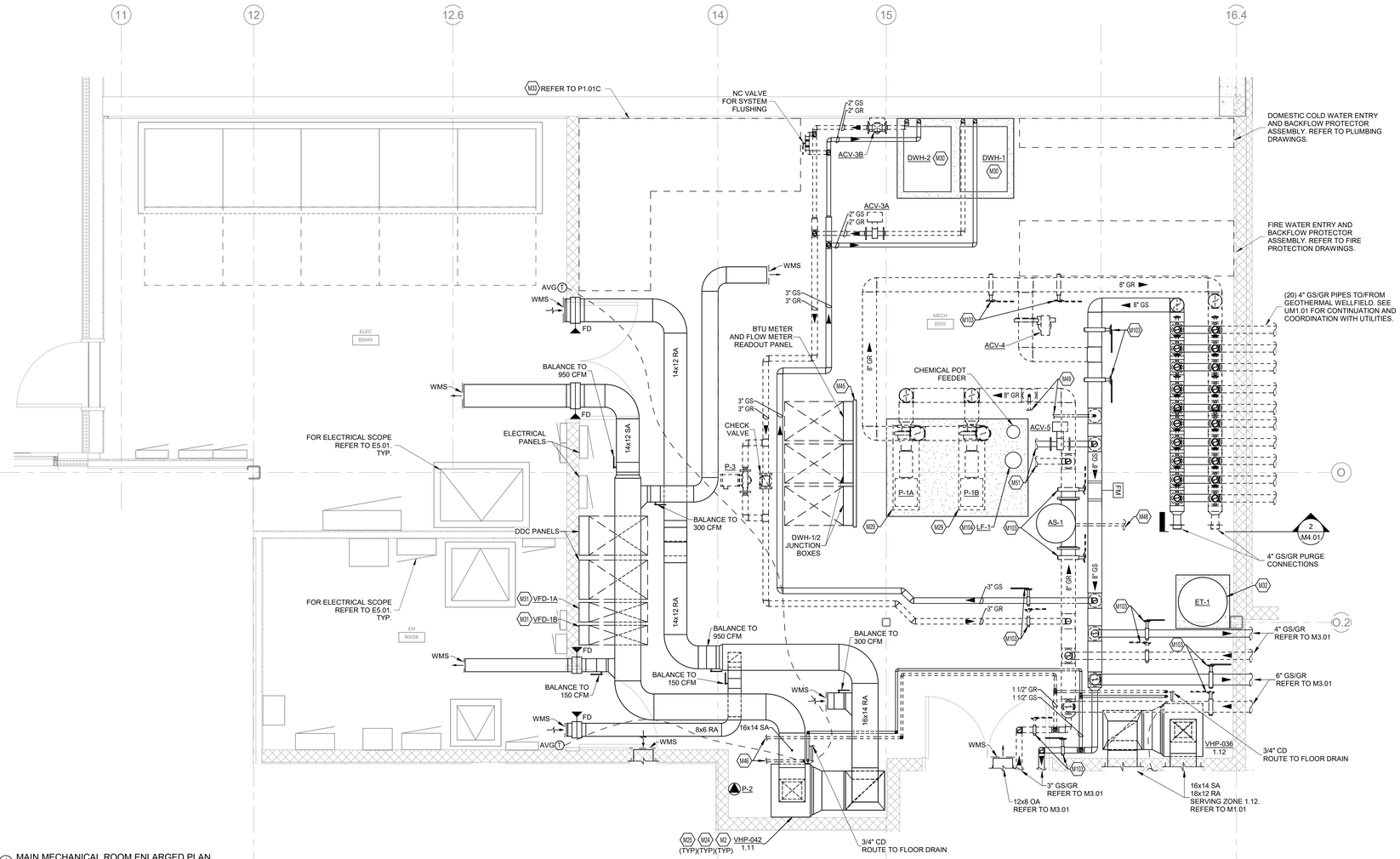
3 MAIN MECHANICAL ROOM ISOMETRIC

TAGGED NOTES

M2	REFER TO DETAILS FOR TYPICAL VHP DUCTWORK INSTALLATION INFORMATION.
M24	ROUTE CONDENSATE PIPE FROM VHP TO FLOOR DRAIN IN MECHANICAL SPACE.
M25	REFER TO DETAILS FOR TYPICAL VHP AND HHP PIPING INSTALLATION CONFIGURATIONS.
M29	INSTALL END SUCTION PUMPS ON CONCRETE PAD PER DETAIL ON M6.02.
M30	INSTALL DWH-1 ON 4" CONCRETE PAD. PROVIDE WITH MANUFACTURER'S RECOMMENDED CLEARANCES. SEE PLUMBING DRAWINGS AND MECHANICAL SCHEMATICS FOR MORE INFORMATION.
M31	VFDs SHALL BE INSTALLED ON UNISTRUT RACKS ON WALL. PROVIDE WITH NEC REQUIRED CLEARANCE.
M32	EXPANSION TANK SHALL BE INSTALLED ON CONCRETE PAD PER DETAIL ON M6.02.
M33	THIS AREA SHALL BE UTILIZED FOR DOMESTIC WATER STORAGE TANKS, DOMESTIC WATER EXPANSIONS TANKS, THERMOSTATIC MIXING VALVES, MIXING STATIONS, RECIRC PUMPS, AND ALL DOMESTIC WATER PIPING AS REQUIRED TO PIPE PER SCHEMATIC ON M7.02.
M45	CONSTRUCT AN UNISTRUT FRAME TO MOUNT (2) DWH-1 JUNCTION BOXES AND (1) FLOW METER READOUT PANEL. MC TO FURNISH PANELS, EC TO MOUNT PANELS AND PROVIDE POWER WIRING BEWTEEN PANELS AND EQUIPMENT. PIPING SHALL NOT BE ROUTED DIRECTLY OVER MOUNTED PANELS. PROVIDE PANELS WITH MANUFACTURER'S RECOMMENDED CLEARANCES.
M46	ROUTE GS/GR PIPING TO CIRCULATION PUMP P-2 FOR OFF-HOURS COOLING OPERATION. REFER TO CONTROLS ON M7.05.
M48	EXTEND 1" LINE TO EXPANSION TANK. REFER TO DETAIL ON M6.02.
M49	EXTEND (2) 1" LINES TO CHEMICAL POT FEEDER. REFER TO DETAIL ON M6.04.
M51	DROP FROM MAINS DOWN TO LINE FILTER. ADJUST INLINE VALVE TO INDUCE REQUIRED WATERFLOW THROUGH FILTER.
M103	CHAIN-OPERATED BUTTERFLY VALVES.
M104	INSTALL CLEAN LOOP FILTER AT SUBSTANTIAL COMPLETION.



2 GEOTHERMAL PIPING ENTRY SECTION
1/4" = 1'-0"



1 MAIN MECHANICAL ROOM ENLARGED PLAN
3/8" = 1'-0"

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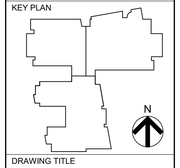
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN MECHANICAL ROOM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
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M4.01

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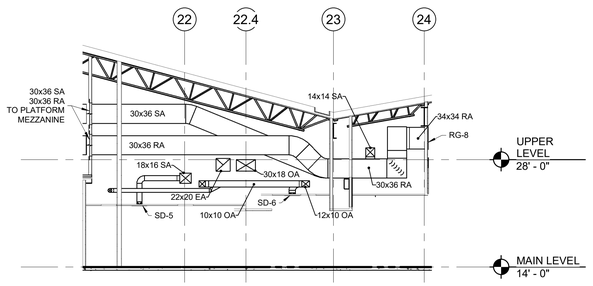
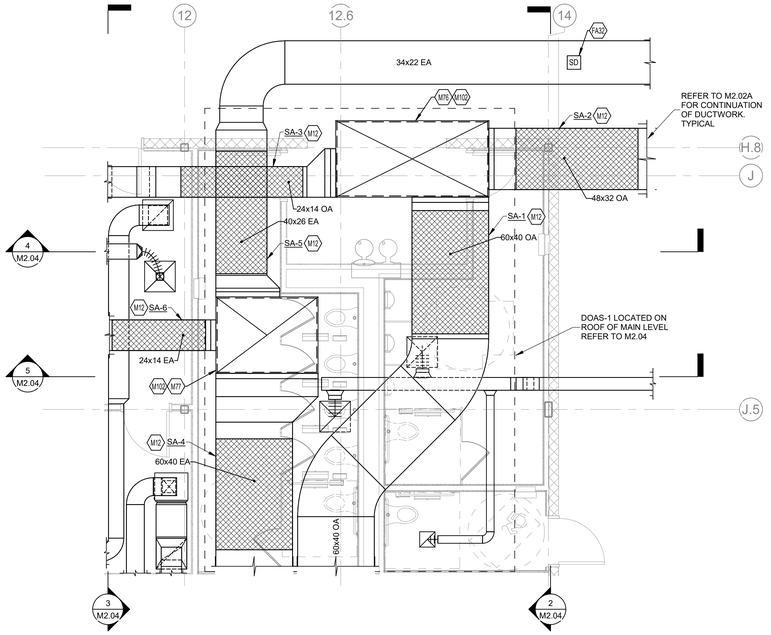
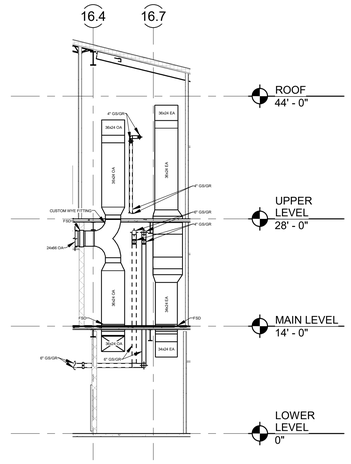


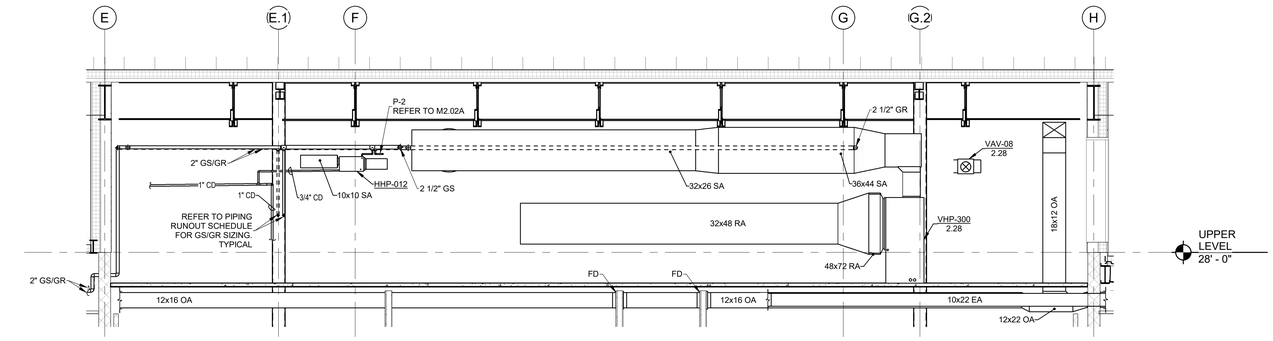
5 CAFETERIA DUCTWORK SECTION
1/8" = 1'-0"



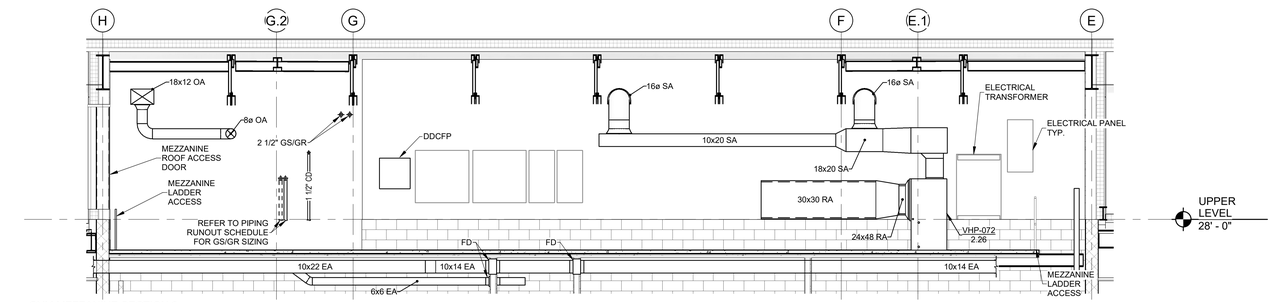
1 DOAS MAIN DUCTWORK ENLARGED PLAN
1/4" = 1'-0"



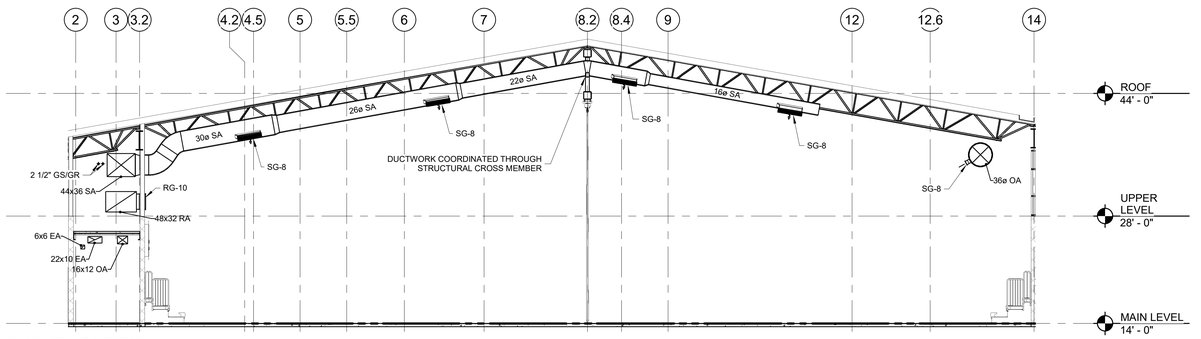
6 MECHANICAL SHAFT SECTION 1
1/8" = 1'-0"



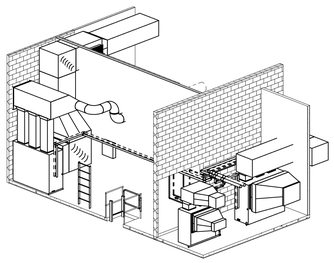
2 GYM MEZZANINE SECTION 1
1/4" = 1'-0"



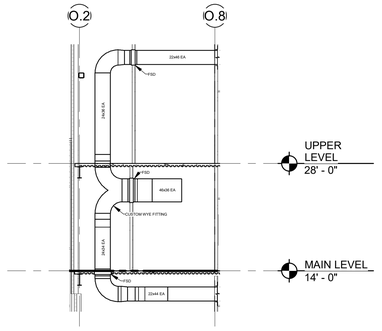
3 GYM MEZZANINE SECTION 2
1/4" = 1'-0"



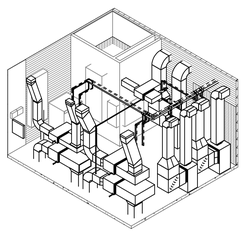
4 GYM DUCTWORK SECTION
1/4" = 1'-0"



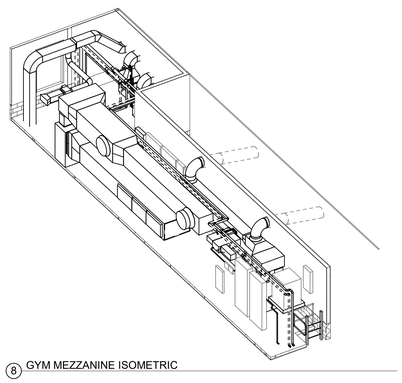
9 PLATFORM MEZZANINE ISOMETRIC



7 MECHANICAL SHAFT SECTION 2
1/8" = 1'-0"



10 MECH B123 ISOMETRIC



8 GYM MEZZANINE ISOMETRIC

TAGGED NOTES

##

FA32	DUCT SMOKE DETECTOR SHALL BE INSTALLED IN DUCTWORK WHERE INDICATED. FIRE ALARM CONTRACTOR SHALL PROVIDE, INSTALL, WIRE, AND INTEGRATE DETECTOR WITH BUILDING FIRE ALARM SYSTEM. COORDINATE FINAL LOCATION WITH DUCTWORK, ACCESS PANELS, AND EQUIPMENT MANUFACTURER REQUIREMENTS.
M12	PROVIDE AND INSTALL DUCT MOUNTED SOUND ATTENUATOR ABOVE CEILING PER MANUFACTUER'S REQUIREMENTS. INSTALL WITH STRAIGHT LENGTH REQUIREMENTS. SEE SILENCER SCHEDULE FOR MORE INFORMATION.
M76	120"x60" OA DUCT UP TO DOAS-1. INSTALL WITH 1-HOUR RATED FIRE DAMPER AT ROOF PENETRATION.
M77	80"x60" EA DUCT UP TO DOAS-1. INSTALL WITH 1-HOUR RATED FIRE DAMPER AT ROOF PENETRATION.
M102	FULLY LINE MAIN DUCTWORK FROM DOAS-1 BOTTOM CONNECTION. REFER TO SPECIFICATIONS FOR DUCT LINING REQUIREMENTS.

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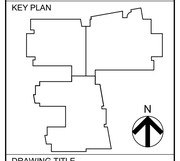
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL ENLARGED PLANS, SECTIONS, & ISOMETRICS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M5.01

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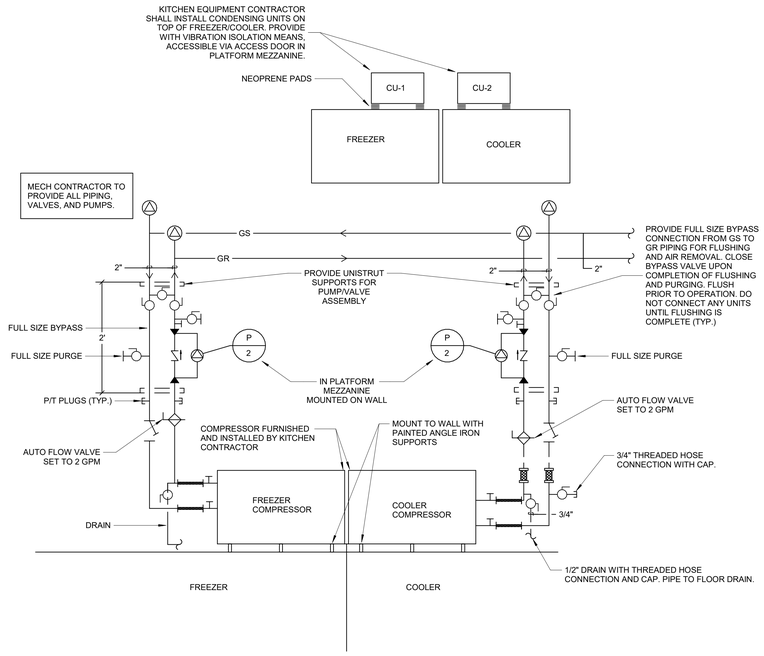
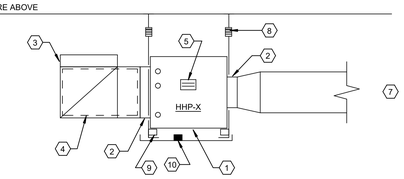


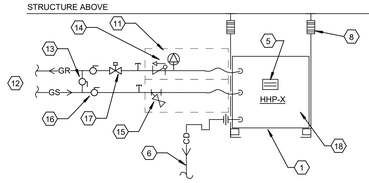
1 FREEZER/COOLER PIPING SCHEMATIC
NTS

STRUCTURE ABOVE



AIR-SIDE CONNECTIONS

STRUCTURE ABOVE



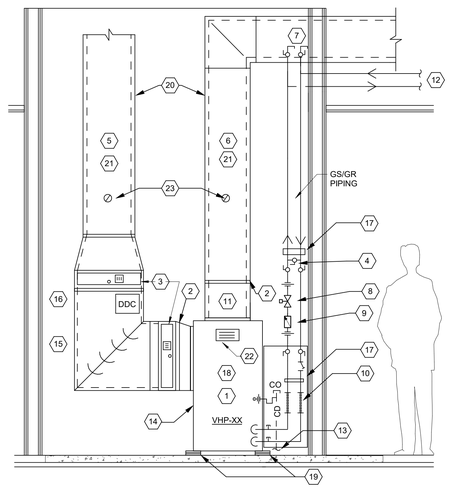
WATER-SIDE CONNECTIONS

GENERAL NOTES
-HEAT PUMP SHALL BE MOCKED UP AND APPROVED BY COMMISSIONING AGENT AND ENGINEER PRIOR TO RELEASE OF BUILDING-WIDE HP INSTALLATION.
-HOSE KITS SHALL INCLUDE FLEX HOSES, STRAINER, AUTOFLOW BALANCE VALVE, 2-POSITION CONTROL VALVE AND BALL VALVE. HOSE KIT TO BE FURNISHED BY EQUIPMENT MANUFACTURER AND INSTALLED BY MECHANICAL CONTRACTOR.

HORIZONTAL HEAT PUMP DETAIL KEY NOTES: (X)

1. DO NOT BLOCK ACCESS PANEL FOR HEAT PUMP UNIT WITH ANY OBJECT.
2. PROVIDE FLEXIBLE CANVAS CONNECTIONS AT UNIT CONNECTIONS.
3. RETURN DUCT WITH TWO 90° ELBOWS. SAME SIZE AS UNIT RETURN CONNECTION.
4. INSULATE THE FIRST 10' OF INTERIOR OF RETURN DUCTS WITH 1-1/2" THICK FLEXIBLE ELASTOMERIC ACOUSTIC INSULATION.
5. IDENTIFICATION PLACARD; REFER TO SPECIFICATIONS FOR MORE INFORMATION. THE PLACARD SHALL INCLUDE THE ELECTRIC PANEL NAME AND CIRCUIT NAME FEEDING THE EQUIPMENT.
6. ROUTE CONDENSATE DRAIN AS INDICATED ON THE FLOOR PLANS. REFER TO RUNOUT SCHEDULE FOR PROPER SIZING.
7. SUPPLY DUCTWORK. REFER TO FLOOR PLANS FOR DUCT SIZE. TRANSITION TO DUCTWORK SIZE INDICATED ON PLANS.
8. SUPPORT FROM OVERHEAD STRUCTURE WITH THREADED ROD AND ELASTOMERIC VIBRATION ISOLATORS.
9. PROVIDE RUBBER OR NEOPRENE PADS IN SHEAR VIBRATION ISOLATORS AT UNIT SUPPORT LOCATIONS.
10. PRIMARY DRAIN PAN TO BE PROVIDED WITH UL 508 CONDENSATE OVERFLOW SWITCH, INTERLOCK TO SHUT DOWN UNIT.
11. LINE SIZED-FLEXIBLE STAINLESS STEEL HOSE KITS, REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS.
12. REFER TO FLOOR PLANS FOR CONTINUATION OF GS/GR PIPING. REFER TO THE PIPING RUNOUT SCHEDULE FOR PROPER SIZING.
13. NORMALLY CLOSED FULL SIZE BYPASS VALVE. OPEN FOR SYSTEM FLUSHING. REFER TO START-UP SPECIFICATIONS.
14. PRESSURE INDEPENDENT AUTOFLOW VALVE
15. LINE SIZE STRAINER. STRAINER TO HAVE P/T PORT ON VALVE BODY.
16. LINE SIZED BALL VALVE (TYP.) NORMALLY OPEN, VALVE IS CLOSED FOR SYSTEM FLUSHING.
17. PROVIDE LINE SIZED TWO-POSITION TWO-WAY VALVE.
18. FACTORY MOUNTED INTEGRAL DISCONNECT.

2 HORIZONTAL WSHP INSTALLATION DETAIL
NTS



FILTER REQUIREMENTS:

- ALL VERTICAL HEAT PUMPS SHALL BE PROVIDED WITH FIELD PROVIDED FILTER RACKS. DISCARD MANUFACTURER PROVIDED FILTERS.
- FILTERS SHALL BE 2" MERV 13 PLEATED FILTERS THAT ARE A COMMON 24"X24" IN SIZE.
- PROVIDE ALL REQUIRED ACCESSORIES TO ENABLE FILTER PULL FROM ONE SIDE.

FILTER HOUSING/RACK SIZING:

- VHP-007 THROUGH VHP-60: PROVIDE FILTER HOUSING SIZED TO CONTAIN (X1) 24"X24" FILTER.
- FOR UNITS LARGER THAN VHP-60 - PROVIDE FILTER HOUSING SIZED TO ACCOMMODATE STANDARD 12" X 12" FILTER MODULES IN COMBINATIONS AS REQUIRED TO MATCH SCHEDULED FILTER AREA AND UNIT CONFIGURATION.

3 VERTICAL HEAT PUMP INSTALLATION DETAIL
NTS

HEAT PUMP DETAIL TAGGED NOTES: (X)

1. VERTICAL HEAT PUMP UNIT. DO NOT BLOCK ACCESS PANEL FOR HEAT PUMP UNIT WITH ANY OBJECT. MAINTAIN MANUFACTURER'S REQUIRED CLEARANCES.
2. PROVIDE FLEXIBLE CANVAS CONNECTIONS AT UNIT CONNECTION. TRANSITION DUCTWORK TO UNIT OPENING AS NEEDED.
3. PROVIDE FILTER HOUSING SEPARATE OF HEAT PUMP WITH 24"X24" MERV 13 2" PLEATED FILTERS. FILTER HOUSING SHALL HAVE CAM LOCKS AND SHALL BE AIR TIGHT. FILTERS MAY BE INSTALL IN HORIZONTAL OR IN VERTICAL BASED ON FIELD CONDITIONS.
4. BYPASS VALVE NC.
5. RETURN DUCTWORK. REFER TO DRAWINGS FOR DUCT SIZE.
6. SUPPLY DUCTWORK. REFER TO DRAWINGS FOR DUCT SIZE.
7. 1" MANUAL AIR VENTS SEE DETAIL ON SHEET M6.02
8. PROVIDE LINE SIZED TWO-POSITION TWO-WAY VALVE.
9. AUTOFLOW CONTROL VALVE.
10. PROVIDE STAINLESS STEEL FLEX CONNECTORS. HOSE KITS SIZE SHALL MATCH PIPE RUN OUT SIZE SCHEDULED, LINE SIZED. TRANSITION DOWN AT UNIT AS REQUIRED. REFER TO SPECIFICATIONS FOR ALL REQUIREMENTS. HOSE KITS SIZED TO UNIT CONNECTION DIMENSION IS UNACCEPTABLE.
11. TRANSITION FROM FULL SIZE OF UNIT OUTLET TO DUCT SIZE INDICATED ON THE DRAWINGS.
12. REFER TO DRAWINGS FOR CONTINUATION OF PIPING. REFER TO THE PIPING RUNOUT SCHEDULE FOR SIZING.
13. PROVIDE AND ROUTE CONDENSATE TO FLOOR DRAIN IN CLOSET OR MECH ROOM. PROVIDE LINE SIZED CONDENSATE CLEANOUT IMMEDIATELY DOWNSTREAM OF EACH CONDENSATE P-TRAP. REFER TO RUNOUT SCHEDULE FOR SIZING. ENSURE ALL CONDENSATE PIPING IS INSTALLED SO AS TO NOT CREATE A TRIP HAZARD. SECURE PIPING TO FLOOR/WALL AS REQUIRED. REFER TO PIPE RUNOUT SCHEDULE FOR SIZING. WHERE POSSIBLE, DO NOT ROUTE CONDENSATE PIPING OVER LEARNING SPACES.
14. MAINTAIN MANUFACTURER'S REQUIRED CLEARANCE ON SIDE OF HEAT PUMP TO ALLOW FOR MAINTENANCE ACCESS.
15. PROVIDE ELBOW WITH LONG TRAILING EDGE VANES FROM SIDE ACCESS FILTER TO RETURN DUCT DEPTH.
16. TRANSITION DUCT FROM ELBOW TO DUCT SIZE INDICATED ON PLANS.
17. PROVIDE VIBRATION DAMPING MOUNTS/CLAMPS TO ISOLATE PIPING FROM STRUCTURE.
18. FACTORY MOUNTED INTEGRAL DISCONNECT.
19. NEOPRENE PADS AT EACH CORNER OF STAND SHALL BE PROVIDED. PADS SHALL BE RATED FOR 0.38" DEFLECTION, TYPICAL.
20. PROVIDE ALL HEAT PUMPS WITH 1-1/2" INTERNAL SOUND LINEAR IN SA AND RA DUCT, FOR MINIMUM 10' DOWNSTREAM OF WSHP, TYPICAL.
21. PROVIDE SUPPLY DUCTWORK AND RETURN DUCTWORK WITH INTERNAL INSULATION IN ACCORDANCE WITH SPECIFICATION SECTION '232200 - INSULATION - MECHANICAL.'
22. ENGRAVED IDENTIFICATION PLACARD. COORDINATE WITH MANUFACTURER INSTRUCTIONS.
23. 4" FACE DIAL THERMOMETER (TYP.) DWYER SERIES BT ADJUSTABLE BIMETAL THERMOMETER WITH 0-100F RANGE AND 6" STEM LENGTH.

GENERAL NOTES
-HEAT PUMP SHALL BE MOCKED UP AND APPROVED BY COMMISSIONING AGENT AND ENGINEER PRIOR TO RELEASE OF BUILDING-WIDE HP INSTALLATION.
-HOSE KITS SHALL INCLUDE FLEX HOSES, STRAINER, AUTOFLOW BALANCE VALVE, 2-POSITION CONTROL VALVE AND BALL VALVE. HOSE KIT TO BE FURNISHED BY EQUIPMENT MANUFACTURER AND INSTALLED BY MECHANICAL CONTRACTOR.

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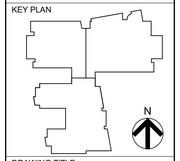
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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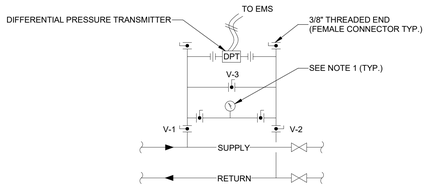
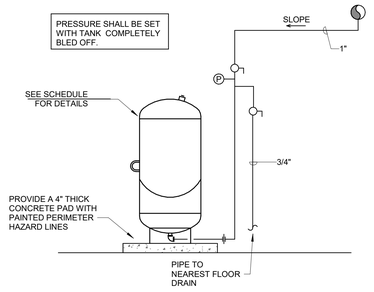


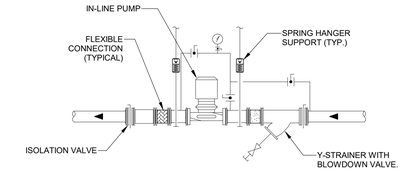
NOTES:

1. INSTALL NEW PRESSURE GAUGE (REFER TO SPECIFICATION).
2. ALL NEW PIPING SHALL BE 3/8" MIN. STEEL OR RIGID COPPER (95/5). ALL NEW VALVES ARE BALL VALVES. PRESSURE RATING= 150 PSIG.
3. DPTS SHALL BE RATED FOR 150 PSIG.
4. PROVIDE PERMANENT PLASTIC ENGRAVED SIGN ATTACHED TO DP WHICH STATES: "BYPASS VALVE V-3 MUST BE OPENED BEFORE VALVES V-1 OR V-2 ARE CLOSED TO AVOID DAMAGE OF TRANSMITTER."
5. PRESSURE TRANSMITTER SHALL BE MOUNTED TO NON-VIBRATING SURFACE IN ACCESSIBLE LOCATION APPROX. 5' ABOVE FLOOR.
6. MECHANICAL SUB-CONTRACTOR TO PROVIDE ALL PIPING. ATC/EMS SUB-CONTRACTOR TO FURNISH NEW DPT FOR INSTALLATION BY MECHANICAL SUB-CONTRACTOR.

1 DIFFERENTIAL PRESSURE TRANSMITTER PIPING DETAIL
NTS



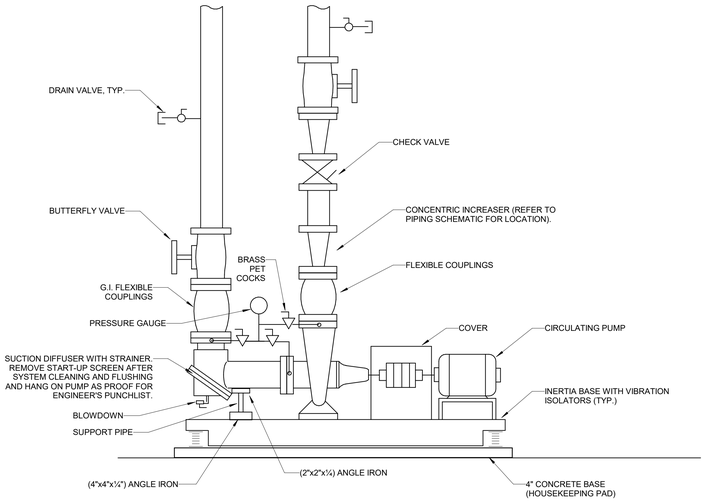
2 EXPANSION TANK PIPING DETAIL
NTS



NOTES:

1. PUMP CONNECTIONS AND PUMP SPECIALTIES ARE PER MC.

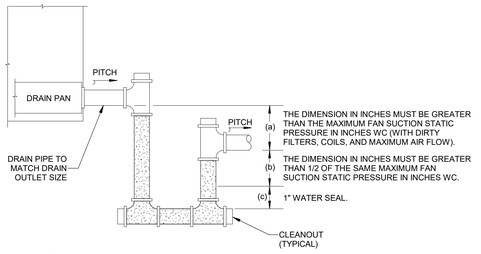
3 IN-LINE PUMP PIPING DETAIL
NTS



NOTES:

1. ALL PIPING ABOVE FLEXIBLE COUPLINGS SHALL BE SUPPORTED FROM STRUCTURE ABOVE. PIPING BELOW FLEXIBLE COUPLINGS SHALL BE SUPPORTED BY ELBOW BASE SUPPORTS. NO PIPING LOAD SHALL BE APPLIED TO PUMP FLANGES.
2. PROVIDE MINIMUM OF 3 PIPE DIAMETERS OF STRAIGHT PIPE UPSTREAM OF CHECK VALVE
3. GROUT PUMP BASE AS REQUIRED
4. FOR WELDED PIPE, FURNISH STAINLESS STEEL FLEXIBLE CONNECTORS AT THE PUMP INLET AND OUTLET.

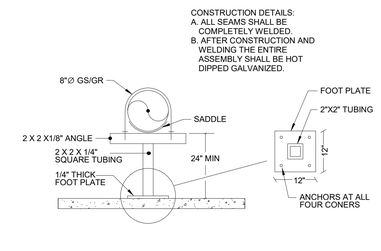
4 BASE-MOUNTED PUMP PIPING DETAIL
NTS



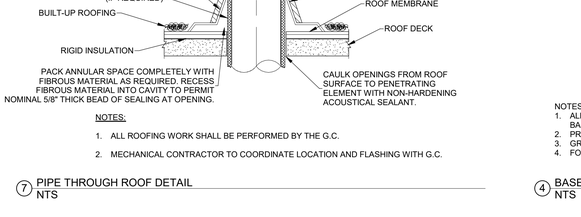
NOTES:

1. ALLOW SUFFICIENT SPACE BELOW DRAIN PAN FOR TRAP.
2. PITCH DRAIN FOR PROPER RUNOFF.
3. MANUALLY PRIME FILL TRAP BEFORE START-UP TO FORM INITIAL DRAIN SEAL.
4. SUPPORT LENGTHY DRAIN LINES TO PREVENT SAG AND CONDENSATE OVERFLOW.

5 DRAW THRU UNIT CONDENSATE TRAP DETAIL
NTS



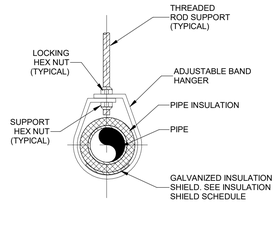
6 PIPING SUPPORT STAND DETAIL
NTS



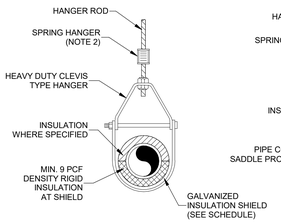
NOTES:

1. ALL ROOFING WORK SHALL BE PERFORMED BY THE G.C.
2. MECHANICAL CONTRACTOR TO COORDINATE LOCATION AND FLASHING WITH G.C.

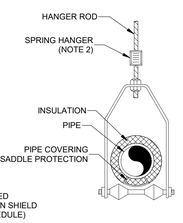
7 PIPE THROUGH ROOF DETAIL
NTS



FOR 1/2" & 3/4" PIPE

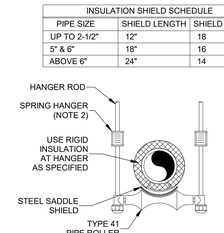


FOR PIPES 3" AND SMALLER



FOR PIPES 4" THRU 6"

INSULATION SHIELD SCHEDULE		
PIPE SIZE	SHIELD LENGTH	SHIELD GAUGE
UP TO 2-1/2"	12"	18
5" & 6"	18"	16
ABOVE 6"	24"	14

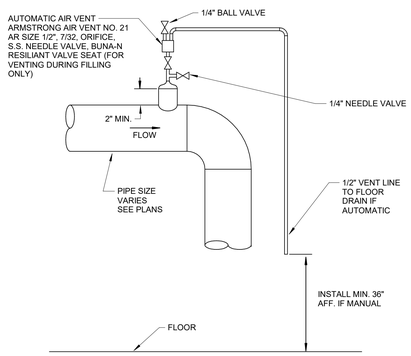


FOR PIPES 6" AND LARGER

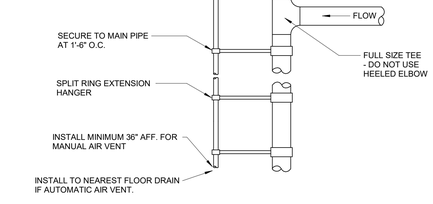
NOTES:

1. SEE SPECIFICATION FOR HANGER SIZES AND INSULATION THICKNESS PER CURRENT MASSACHUSETTS STATE ENERGY CODE.
2. REFER TO SPECIFICATIONS FOR REQUIREMENTS OF VIBRATION ISOLATION SPRING HANGERS AND FOR SEISMIC RESTRAINTS.
3. PROVIDE A SECTION OF HIGH COMPRESSION STRENGTH INSULATION AT EACH HANGER LOCATION FOR PIPE DIAMETERS GREATER THAN 2" INCHES. INSULATION MAY BE HALF OR FULL ROUND AND SHALL EXTEND 2 INCHES BEYOND INSULATION SHIELD IN EACH DIRECTION.

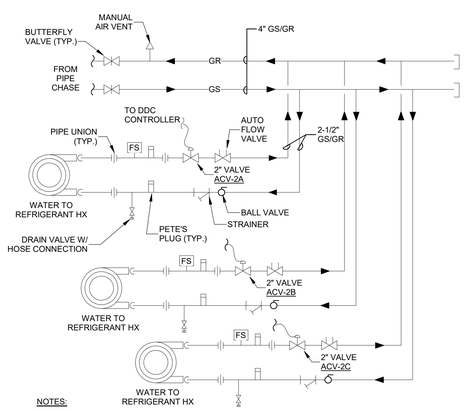
10 PIPE SUPPORT DETAILS
NTS



8 AIR VENT DETAIL - 4" AND LARGER
NTS



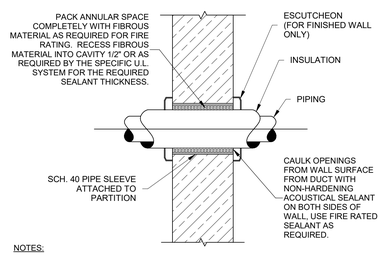
9 AIR VENT DETAIL - 3" & SMALLER
NTS



NOTES:

1. TYPICAL OF THREE CIRCUITS.
2. MANUFACTURER TO PROVIDE INLET STRAINER AND VALVE, FLOW SWITCH, AND P/T PORTS FOR EACH CIRCUIT.
3. MC TO PROVIDE FIELD PIPING FOR HEADER WITHIN DOAS INCLUDING ISOLATION VALVES, UNIONS, CIRCUIT SETTER, AND INSULATION FOR EACH CIRCUIT. TYPICAL OF THREE.
4. ATC SHALL PROVIDE AND WIRE CONTROL VALVE MC TO INSTALL IN PIPE. TYPICAL OF THREE
5. LOCATE PIPE UNIONS & ARRANGE PIPING TO FACILITATE COIL REMOVAL.
6. M.C. SHALL INSTALL HEADER AND SHIPPED LOOSE COMPONENTS WITHIN COMPRESSOR CAVITY INTERNAL TO DOAS-1.

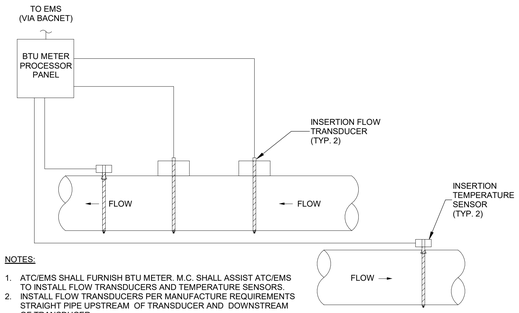
11 DOAS-1 HEAT PUMP COIL DETAIL
NTS



NOTES:

1. SIZE PENETRATION OPENING 1" TO 1-1/2" LARGER THAN OUTSIDE DIMENSIONS OF PENETRATING ELEMENT.

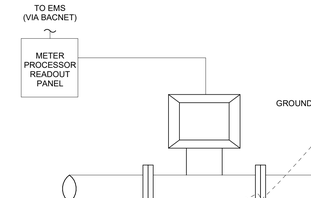
12 PIPE THROUGH PARTITION DETAIL
NTS



NOTES:

1. ATC/EMS SHALL FURNISH BTU METER. M.C. SHALL ASSIST ATC/EMS TO INSTALL FLOW TRANSDUCERS AND TEMPERATURE SENSORS.
2. INSTALL FLOW TRANSDUCERS PER MANUFACTURE REQUIREMENTS STRAIGHT PIPE UPSTREAM OF TRANSDUCER AND DOWNSTREAM OF TRANSDUCER.
3. ALL POWER/CONTROL WIRING BY ATC/EMS.
4. ATC/EMS TO REVIEW LOCATIONS OF METER PROCESSOR PANEL WITH OWNER/ENGINEER.

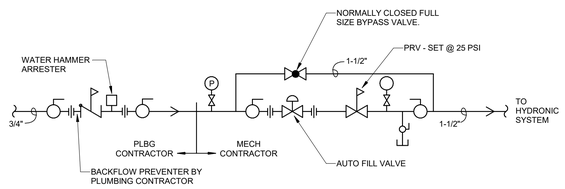
13 INSERTION TYPE BTU METER PIPING DETAIL
NTS



NOTES:

1. ATC/EMS SHALL FURNISH BTU METER. M.C. SHALL ASSIST ATC/EMS TO INSTALL FLOW METER.
2. INSTALL FLOW METER PER MANUFACTURE REQUIREMENTS 3 PIPE DIAMETERS STRAIGHT PIPE UPSTREAM AND 2 PIPE DIAMETERS STRAIGHT PIPE DOWNSTREAM OF TRANSDUCER.
3. ALL POWER/CONTROL WIRING BY ATC/EMS.
4. ATC/EMS TO REVIEW LOCATIONS OF METER PROCESSOR PANEL WITH OWNER/ENGINEER.

14 INLINE FLOW METER PIPING DETAIL
NTS



15 HVAC FILL SYSTEM PIPING SCHEMATIC
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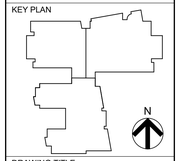
STATE OF CONNECTICUT · BRIAN K. KOPACZ · 34058 · REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M6.02

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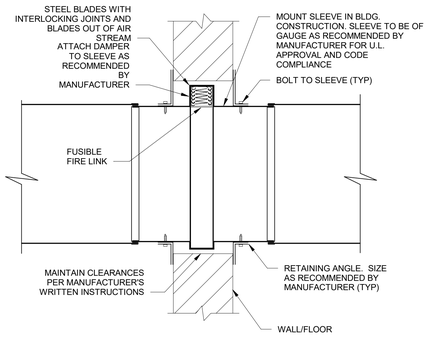
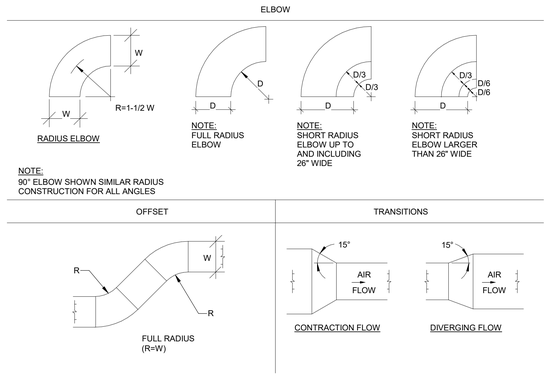
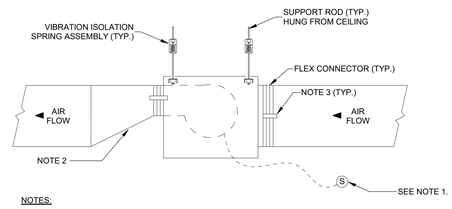


NOTES:
1. PROVIDE ACCESS DOOR IN ADJACENT DUCTWORK FOR RESETTING THE DAMPER.
2. SUPPORT DAMPER IN WALL/FLOOR BY SLEEVE AND RETAINING ANGLES. DAMPER MUST REMAIN IN PLACE IF DUCT COLLAPSES. SEAL BETWEEN WALL/FLOOR AND SLEEVE OF FIRE DAMPER WITH FIRESTOPPING.

1 FIRE DAMPER DETAIL
NTS

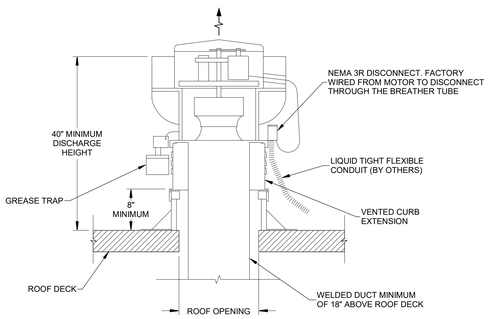


2 DUCT TRANSITIONS, OFFSETS, AND ELBOWS DETAIL
NTS

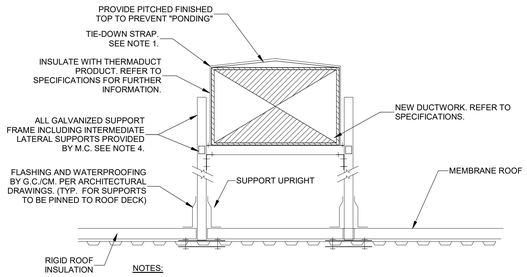


NOTES:
1. WIRE TO REMOTE SWITCH ON WALL SHOWN ON FLOOR PLANS.
2. TRANSITION DUCT AS REQUIRED TO INSTALL DUCT SIZE SHOWN ON FLOORPLANS
3. PROVIDE THRUST RESISTOR RESTRAINTS FOR FLEXIBLE CONNECTORS.
4. INSTALL WITH SPRING LOADED BACKDRAFT DAMPER.

3 IN-LINE EXHAUST FAN DETAIL
NTS

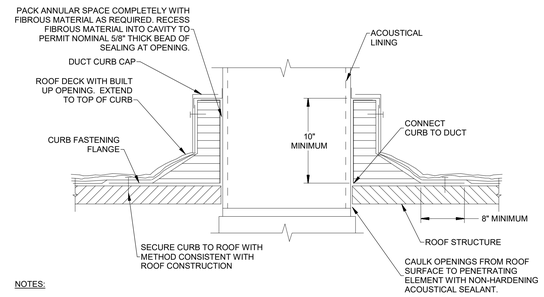


4 UPBLAST EXHAUST FAN DETAIL
NTS



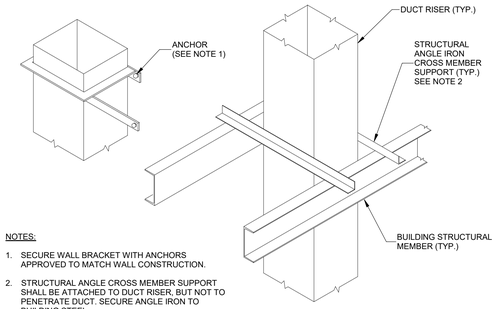
NOTES:
1. PROVIDE TIE DOWN STRAP ALL AROUND DUCT AT EACH SUPPORT. DO NOT PENETRATE DUCT OR COVERING WITH ANY ATTACHMENT HARDWARE.
2. SUPPORTS TO SPACED 6 FEET APART MAX.
3. DUCT SUPPORTS TO BE PINNED TO ROOF DECK EVERY OTHER SUPPORT.
4. M.C. TO PROVIDE ENGINEERED ROOF DUCT SUPPORT SYSTEM PER APPLICABLE MASS. STATE CODE REQUIREMENTS. REFER TO SPECIFICATIONS.
5. MEMBRANE COVERING OF NEW SUPPLY AIR DUCT.
6. BOTTOM OF ASSEMBLY SHALL BE MINIMUM 3'0" ABOVE FINISHED ROOF.

5 ROOF DUCT SUPPORT DETAIL
NTS



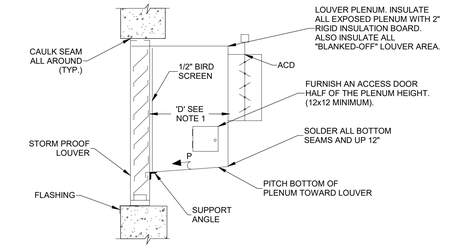
NOTES:
1. ALL DUCT ABOVE ROOF IS SEALED WATERTIGHT.
2. ROOF OPENING SIZE IS PER CURB MANUFACTURER'S REQUIREMENTS.
3. ALL PENETRATION WATER PROOFING SHALL MEET THE EXISTING ROOFING MATERIAL MANUFACTURER'S REQUIREMENTS.

6 DUCT PENETRATION THROUGH ROOF DETAIL
NTS



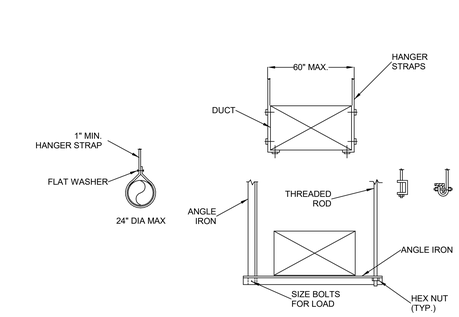
NOTES:
1. SECURE WALL BRACKET WITH ANCHORS APPROVED TO MATCH WALL CONSTRUCTION.
2. STRUCTURAL ANGLE CROSS MEMBER SUPPORT SHALL BE ATTACHED TO DUCT RISER, BUT NOT TO PENETRATE DUCT. SECURE ANGLE IRON TO BUILDING STEEL.

7 DUCT RISER SUPPORT DETAILS
NTS



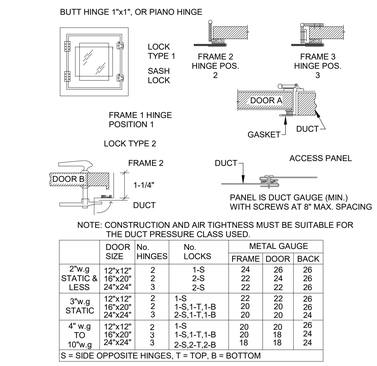
NOTES:
1. WHEN DIMENSION 'D' IS GREATER THAN 24", PROVIDE A 3/4" DRAIN AT 5'-0" CENTERS STARTING 6" FROM LOUVER.
2. PLENUM SHALL BE 18 GAUGE MINIMUM AND PROPERLY REINFORCED WITH GALVANIZED ANGLE IRON STEEL IN ACCORDANCE TO SMACNA REQUIREMENTS.
3. USE NEOPRENE GASKETS OR OTHER NON-CORROSIVE MATERIAL TO MAKE CONNECTIONS TO LOUVER WATERTIGHT.
4. BLOCK OFF UNUSED PORTIONS OF LOUVERS WITH SHEETMETAL AND SEAL AIR AND WATERTIGHT.

8 DUCT CONNECTION TO LOUVER DETAIL
NTS



NOTES:
1. REINFORCEMENT MAY BE USED FOR ATTACHMENT IF IT QUALIFIES FOR BOTH DUTIES
2. DO NOT EXCEED ALLOWABLE LOAD LIMITS

9 DUCT SUPPORT DETAIL
NTS

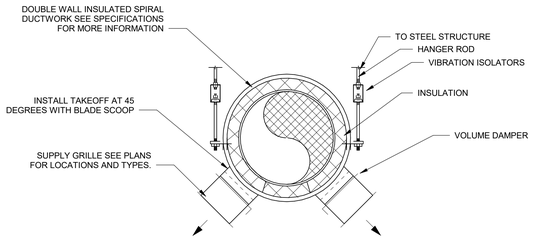


NOTE: CONSTRUCTION AND AIR TIGHTNESS MUST BE SUITABLE FOR THE DUCT PRESSURE CLASS USED.

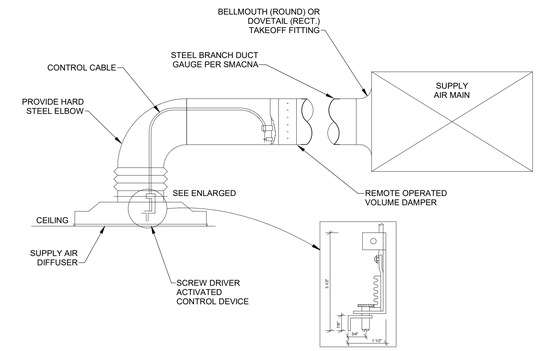
	DOOR SIZE	No. HINGES	No. LOCKS	METAL GAUGE FRAME	DOOR	BACK
2"w.g STATIC & LESS	12"x12" 16"x20" 24"x24"	2 2 3	1-S 2-S 2-S	24 22 22	26 24 22	26 26 26
3"w.g STATIC	12"x12" 16"x20" 24"x24"	2 2 3	1-S 1-S,1-T,1-B 2-S,1-T,1-B	22 20 20	22 20 20	26 26 24
4" w.g TO 10"w.g	12"x12" 16"x20" 24"x24"	2 3 3	1-S 1-S,1-T,1-B 2-S,2-T,2-B	20 20 18	20 18 18	26 24 24

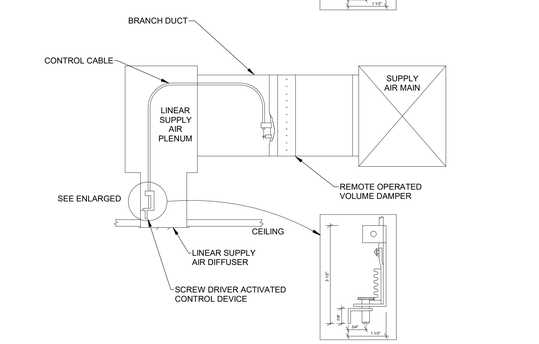
S = SIDE OPPOSITE HINGES, T = TOP, B = BOTTOM

10 DUCT ACCESS DOORS DETAIL
NTS

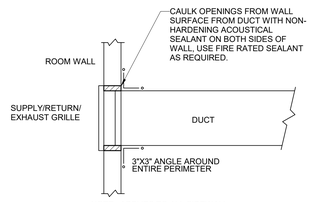


11 DOUBLE WALL DUCTWORK DETAIL
NTS

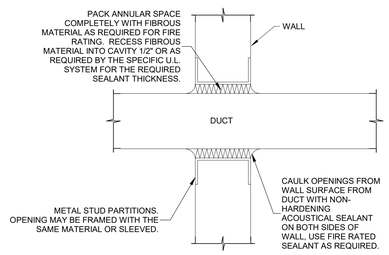




15 REMOTE CABLE OPERATED VOLUME DAMPER DETAIL
NTS

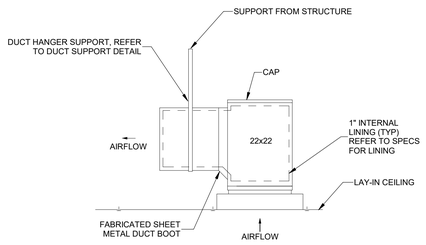


12 SIDE WALL GRILLE DETAIL
NTS



NOTES:
1. SIZE PENETRATION OPENING 1" TO 1-1/2" LARGER THAN OUTSIDE DIMENSIONS OF PENETRATING ELEMENT.

13 DUCT WALL PENETRATION DETAIL
NTS



14 1-WAY TRANSFER DUCT DETAIL
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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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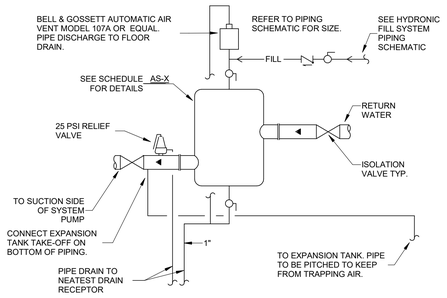
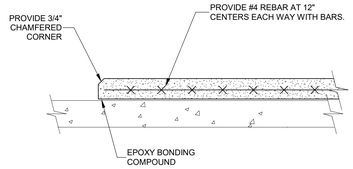


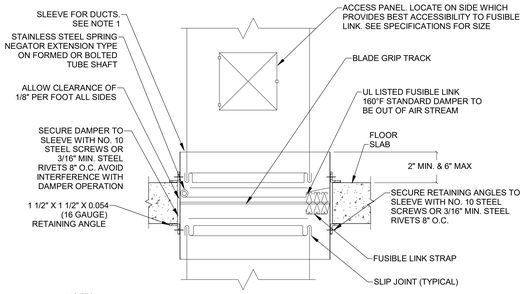
1 AIR SEPARATOR TANK DETAIL
NTS



NOTES:

1. NEW CONCRETE PAD - PROVIDE WHERE REQUIRED FOR NEW EQUIPMENT. DIMENSIONS OF NEW PAD SHALL ACCOMMODATE NEW EQUIPMENT BASE SUPPORT AND ANY PIPE DROPS TO/ FROM NEW EQUIPMENT.
2. M.C. TO COORDINATE INSTALLATION OF PADS TO ALLOW FOR PAINTING / EPOXY OF PAD PRIOR TO INSTALLATION OF EQUIPMENT.
3. ALL CONCRETE HOUSEKEEPING PADS SHALL BE 4"

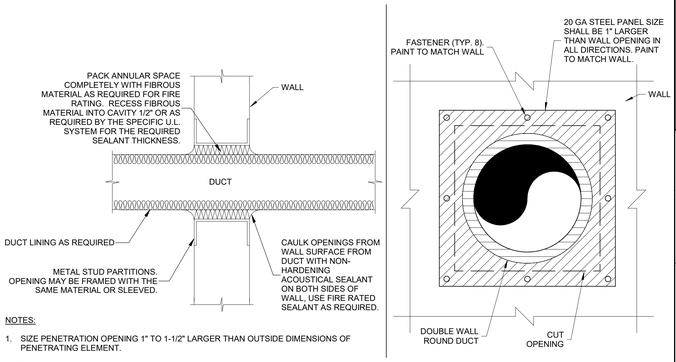
2 CONCRETE HOUSEKEEPING PAD DETAIL
NTS



NOTES:

1. 16 GAUGE STEEL SLEEVE FOR DUCTS W/ 24" MAX. HEIGHT AND 36" MAX. WIDTH. 14 GAUGE STEEL SLEEVE FOR DUCTS OVER 24" HEIGHT AND OVER 36" WIDTH.
2. RETAINING ANGLES MUST LAP STRUCTURAL OPENING 1" MIN. TO COVER CORNERS. DO NOT SECURE ANGLES TO FLOOR.

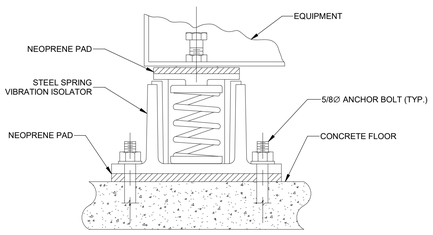
3 VERTICAL SPRING LOADED FIRE DAMPER DETAIL
NTS



NOTES:

1. SIZE PENETRATION OPENING 1" TO 1-1/2" LARGER THAN OUTSIDE DIMENSIONS OF PENETRATING ELEMENT.

4 EXPOSED DUCT WALL PENETRATION DETAIL
NTS

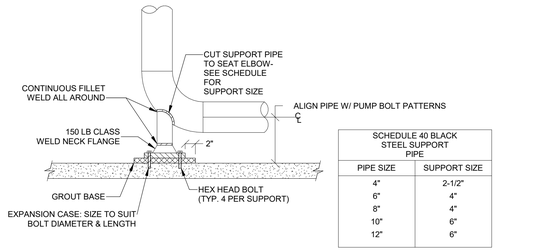


5 VIBRATION ISOLATOR DETAIL
NTS

Water @ 50°F

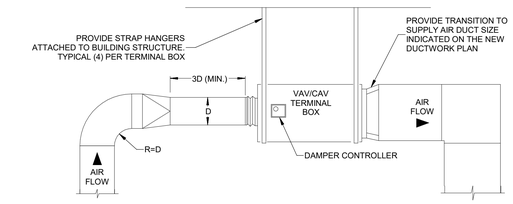
Material	Size	Max GPM	Pressure Drop (ft/100ft)	Velocity (FPS)
Copper	3/4"	3.1	3.09	2.03
Copper	1"	6.2	3.00	2.42
Copper	1-1/4"	11	3.01	2.82
Copper	1-1/2"	18	3.14	3.26
Copper	2"	37	3.03	3.87
Steel	2-1/2"	63	3.03	4.22
Steel	3"	112	3.01	4.86
Steel	4"	230	3.00	5.80
Steel	6"	680	3.00	7.55
Steel	8"	1240	2.37	7.96

6 PIPE SIZING GUIDE
NTS



SCHEDULE 40 BLACK STEEL SUPPORT PIPE	
PIPE SIZE	SUPPORT SIZE
4"	2-1/2"
6"	4"
8"	4"
10"	6"
12"	6"

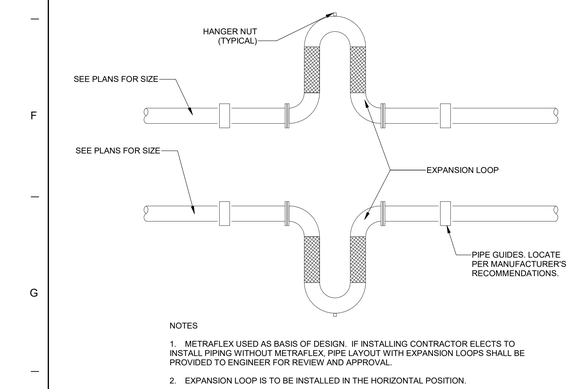
7 VERTICAL PIPE SUPPORT DETAIL
NTS



NOTES:

1. THE TERMINAL BOX AIR FLOW SENSOR SHALL BE ORIENTED IN SAME PLANE AS ELBOW ON INLET SIDE. THE FLOW SENSOR SHOULD BE WITHIN 10" OF HORIZONTAL RUN AND/OR PER MANUFACTURER'S RECOMMENDATION.
2. IF THE INDICATED STRAIGHT RUN OF DUCT CANNOT BE OBTAINED, THEN A FLOW STRAIGHTENER SHALL BE PROVIDED AT THE TERMINAL BOX INLET.
3. PROVIDE WITH AIRFLOW SUMMATION DEVICE.

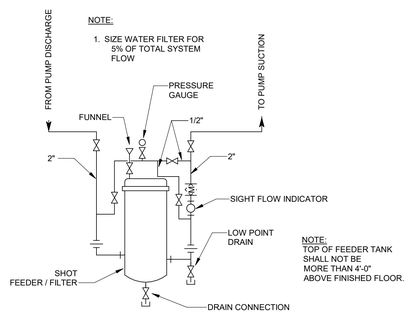
8 VAV/CAV BOX CONNECTION DETAIL
NTS



NOTES

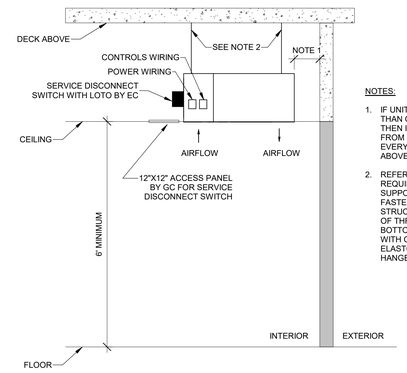
1. METRAFLEX USED AS BASIS OF DESIGN. IF INSTALLING CONTRACTOR ELECTS TO INSTALL PIPING WITHOUT METRAFLEX, PIPE LAYOUT WITH EXPANSION LOOPS SHALL BE PROVIDED TO ENGINEER FOR REVIEW AND APPROVAL.
2. EXPANSION LOOP IS TO BE INSTALLED IN THE HORIZONTAL POSITION.

9 EXPANSION LOOP DETAIL
NTS



NOTE:
TOP OF FEEDER TANK SHALL NOT BE MORE THAN 4'-0" ABOVE FINISHED FLOOR.

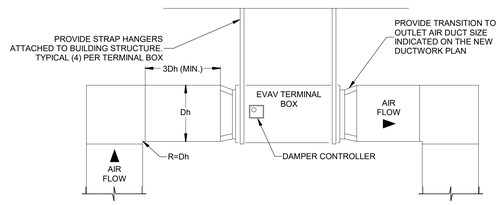
10 WATER TREATMENT FILTER DETAIL - CLOSED LOOP SYSTEMS
NTS



NOTES:

1. IF UNIT IS MOUNTED HIGHER THAN OPENING (I.E DOOR), THEN IT MUST BE SPACED FROM THE WALL 3/8" FOR EVERY INCH THE UNIT IS ABOVE THE OPENING.
2. REFER TO MANUFACTURER'S REQUIREMENTS FOR SUPPORTING HEATER. FASTEN TO SUPPORT STRUCTURE. ADJUST HEIGHT OF THREADED RODS SO BOTTOM OF UNIT IS FLUSH WITH CEILING. INSTALL WITH ELASTOMERIC VIBRATION HANGERS.

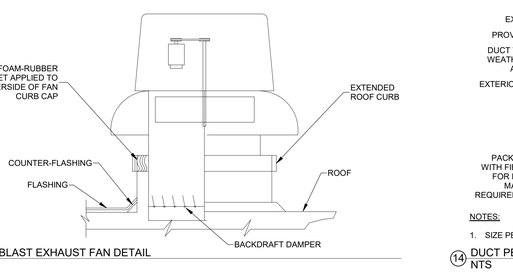
11 RECESSED ELECTRIC UNIT HEATER DETAIL
NTS



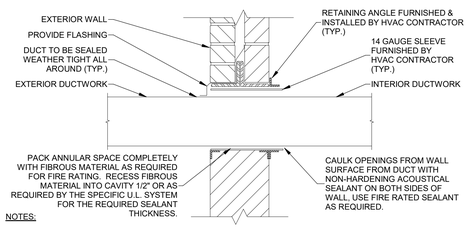
NOTES:

1. THE TERMINAL BOX AIR FLOW SENSOR SHALL BE ORIENTED IN SAME PLANE AS ELBOW ON INLET SIDE. THE FLOW SENSOR SHOULD BE WITHIN 10" OF HORIZONTAL RUN AND/OR PER MANUFACTURER'S RECOMMENDATION.
2. IF THE INDICATED STRAIGHT RUN OF DUCT CANNOT BE OBTAINED, THEN A FLOW STRAIGHTENER SHALL BE PROVIDED AT THE TERMINAL BOX INLET.
3. PROVIDE WITH AIRFLOW SUMMATION DEVICE.
4. Dh = HYDRAULIC DIAMETER

12 TERMINAL BOX CONNECTION DETAIL
NTS



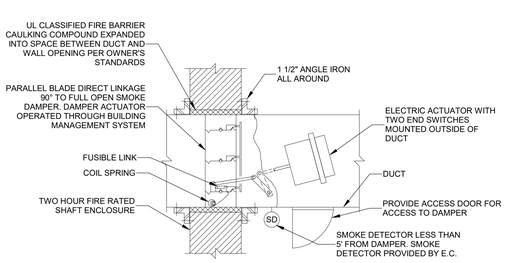
13 DOWNBLAST EXHAUST FAN DETAIL
NTS



NOTES:

1. SIZE PENETRATION OPENING 1" TO 1-1/2" LARGER THAN OUTSIDE DIMENSIONS OF PENETRATING ELEMENT.

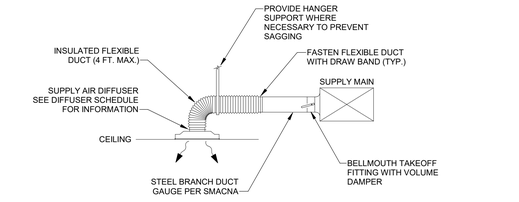
14 DUCT PENETRATION THROUGH EXTERIOR WALL DETAIL
NTS



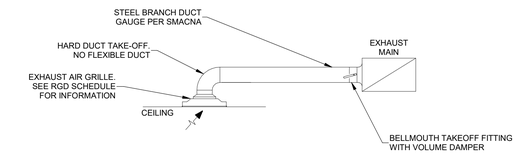
NOTES:

1. PROVIDE SEALING AROUND DUCTWORK AT ALL PENETRATIONS THROUGH SHAFT ENCLOSURE.
2. MAXIMUM PRESSURE DROP ACROSS SMOKE DAMPERS SHOULD NOT EXCEED 0.1 INCHES OF WATER. DAMPER MANUFACTURER SHALL SUBMIT PRESSURE DROP FOR MAXIMUM AIR FLOW REQUIRED FOR DAMPER AND SHALL RESIZE SMOKE DAMPER AS REQUIRED TO MEET MAXIMUM PRESSURE DROP AND SHALL WORK WITH HVAC CONTRACTOR TO COORDINATE INSTALLATION.
3. HVAC CONTRACTOR SHALL PROVIDE DUCT TRANSITIONS AT SMOKE DAMPERS AS REQUIRED TO ACCOMODATE REQUIRED SMOKE DAMPER SIZE.
4. SMOKE DAMPERS SHALL BE SQUARE OR RECTANGULAR WITH WIDTH AND HEIGHT IN ACCORDANCE WITH MANUFACTURER'S STANDARD SIZES, BUT IN NO CASE LESS THAN WIDTH AND HEIGHT ASSOCIATED DUCT SIZE OR SUCH THAT MAXIMUM ALLOWED PRESSURE DROP IS EXCEEDED.

15 COMBINATION FIRE-SMOKE DAMPER DETAIL
NTS



16 SUPPLY AIR DIFFUSER BRANCH DETAIL
NTS



17 RETURN AIR GRILLE/BRANCH DETAIL
NTS

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Hartford, CT 06106
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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M6.04

5/18/2026 11:07:47 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

A. GENERAL CONTROLS REQUIREMENTS
1. ALL EQUIPMENT IN THIS PACKAGE SHALL HAVE BACNET COMPATIBLE CONTROLLERS UNLESS OTHERWISE NOTED. ALL BACNET CONTROLLED EQUIPMENT SHALL BE CONNECTED WITH THE BAS FRONT END WITH REMOTE ACCESS FOR FACILITY OPERATORS.
2. ALL HARDWARE, EQUIPMENT, AND THE BAS FRONT END MUST FULLY COMPLY WITH THE SPECIFICATIONS INCLUDED IN THIS PACKAGE.
3. A VALVE EXERCISE PROGRAM SHALL BE INCLUDED AS PART OF THE DDC SYSTEM TO OPEN AND CLOSE AUTOMATIC CONTROL VALVES AND ACTUATORS (2) FULL STROKES DURING AN UNOCCUPIED PERIOD EVERY WEEK.
4. ALL POINT NAMES SHALL HAVE A STANDARDIZED NAMING CONVENTION APPROVED BY CMTA.
5. ALL EQUIPMENT TO HAVE UNIQUE TAG, COORDINATE NAMING WITH MECHANICAL PLANS AND EQUIPMENT LABELING.
6. GRAPHICS SHALL INCLUDE A SUMMARY TABLE FOR EACH EQUIPMENT TYPE WITH MORE THAN (1) PIECE OF EQUIPMENT. COORDINATE PERTINENT OPERATING PARAMETERS FOR EACH SYSTEM TYPE WITH CMTA.
7. PROVIDE ALL INSTALLATION, SUPERVISION, LABOR, AND MATERIAL (I.E. CONDUIT, WIRE, CABLE, ETC.) AS REQUIRED TO INSTALL THE ENTIRE UPGRADED CONTROLS SYSTEM PER DOCUMENT REQUIREMENTS.
8. PROVIDE ENGINEERING DRAWINGS, STARTUP, DATABASE PROGRAMMING, DYNAMIC COLOR GRAPHICS INCLUDING SITE PLAN, EQUIPMENT, FLOOR PLANS, ETC.
9. ALL EXPOSED WIRING, WIRING IN WALLS, HARD CEILINGS, AND MECHANICAL ROOMS SHALL BE IN CONDUIT. ALL CONCEALED WIRING SHALL BE PLENUM RATED WIRE NEATLY SUPPORTED UTILIZING BRIDAL RINGS.
10. ALL DEVICES THAT ARE ON THE BAS MUST HAVE A WARNING LABEL ON THE EQUIPMENT THAT IS CONTROLLED USING REMOTE PROGRAMMING AND CAN START AT ANY TIME.
11. MAIN NETWORK CONTROLLER SHALL HAVE STAND-ALONE UPS PROVIDED BY THE ATC THAT SHALL BE FIELD INSTALLED IN THE ASSOCIATED CONTROL CABINET(S) AND BE CONFIGURED FOR THE BAS TO MONITOR LOW BATTERY STATUS.

B. CONTROL GRAPHICS REQUIREMENTS
1. SETPOINTS & SOFT SETBACK: EACH UNIT USED FOR SPACE CONDITIONING SHALL, ON THE GRAPHIC, SHOW CURRENT HEATING AND COOLING SETPOINT. UNOCCUPIED AND OCCUPIED HEATING AND COOLING SETPOINT, AND TIME FOR WHICH SPACE SHALL CHANGE STATUS (I.E. FROM OCCUPIED TO UNOCCUPIED OR UNOCCUPIED TO OCCUPIED). THESE SETPOINTS SHALL BE ADJUSTABLE ON THE GRAPHIC PAGE. ALL TEMPERATURE ADJUSTMENT VALUES (TEMPERATURE RESETS, DEMAND LIMITING, OCCUPIED ADJUST, ETC.) SHALL BE SHOWN ON THE GRAPHIC.
2. TRENDS ON GRAPHICS: ALL TRENDED POINTS SHALL BE MADE AVAILABLE THROUGH THE GRAPHICAL INTERFACE.
3. SAMPLES FOR REVIEW: PROVIDE A SAMPLE OF EACH FOR REVIEW WITH SUBMITTALS OR UNDER SEPARATE COVER.
4. ANIMATION LINKED TO STATUS: ANY ANIMATION SUCH AS FLOWING PIPE ARROWS SHALL BE LINKED TO THE STATUS OF THE EQUIPMENT. FOR EXAMPLE, DO NOT SHOW MOVING PIPE ARROWS FOR PUMPS THAT ARE OFF.
5. ALARMS: EQUIPMENT GRAPHICS PAGE SHALL HAVE SECTION THAT CLEARLY DISPLAYS ANY SYSTEM RELATED ALARMS IN EFFECT.
6. GRAPHICS SHALL HAVE ROOM NAMES, ROOM NUMBERS, AND UNIT DESCRIPTIONS SHOWN. THE GRAPHICS SHALL SHOW OUTSIDE AIR TEMPERATURE, OUTSIDE AIR HUMIDITY, AND OUTSIDE AIR ENTHALPY. BOUNDARIES SHALL BE DEPICTED OF WHAT UNITS SERVE WHICH AREAS BY COLOR CODING OR BOUNDARY OUTLINE, OR OTHER APPROVED METHOD. CMTA SHALL BE PROVIDED WITH AN EXAMPLE AND APPROVE THE METHOD USED. GRAPHICS SHALL INCLUDE SECTION THAT CLEARLY DISPLAYS CURRENT FREEZER AND COOLER TEMPERATURES, IF MONITORED. GRAPHICS SHALL INCLUDE A SECTION THAT DISPLAYS CURRENT ALARMS WITH LINK TO THE ASSOCIATED SYSTEM.
7. ALL POINTS SHOWN ON THE POINTS LISTS INCLUDED HEREIN TO BE SHOWN ON THE EMS GRAPHICS, UNLESS OTHERWISE NOTED.

C. CONTROLS POINTS LIST CLARIFICATION
1. SERIAL INTERFACE: IF EQUIPMENT IS FURNISHED WITH A FACTORY BACNET OR OTHER SERIAL INTERFACE, CONTROLLER, ALL AVAILABLE POINTS SHALL BE BROUGHT IN THROUGH INTEGRATION BY CONTROLS CONTRACTOR. POINTS ALL FUNCTION AS SOFTWARE POINTS EVEN IF THE SENSOR REQUIRES TO BE FIELD INSTALLED AND WILL ALL BE DESIGNATED AS VIRTUAL POINTS. CONFIRM AVAILABLE POINTS AND CONFIGURATION WITH CMTA UPON EQUIPMENT SELECTION.
2. IF EQUIPMENT IS FURNISHED WITH TERMINAL STRIP FOR CONNECTION TO A THIRD PARTY CONTROLLER BY THE CONTROLS CONTRACTOR. THE INPUTS AND OUTPUTS FUNCTION AS HARDWIRE POINTS WHILE THE VIRTUAL POINTS FUNCTION AS SOFTWARE POINTS. CONFIRM AVAILABLE POINTS AND CONFIGURATION WITH CMTA UPON EQUIPMENT SELECTION.

D. EQUIPMENT SCHEDULING REQUIREMENTS
1. EQUIPMENT SCHEDULES
   a. EVERY SYSTEM SHALL OPERATE ACCORDING TO A USER DEFINABLE SCHEDULE. COORDINATE FINAL SCHEDULES AND GROUPS WITH CMTA PRIOR TO IMPLEMENTATION. COORDINATE FINAL SCHEDULING CAPABILITIES WITH OTHER BID REQUIREMENTS.
2. NORMAL SCHEDULE
   a. THESE ARE THE BASIC NORMAL WEEKLY SCHEDULES THAT ARE ENTERED AND RETAINED. THESE MAY BE PUT IN AT ANY LEVEL CHOSEN BY THE USER (EQUIPMENT, ZONE, SCHOOL, OR DISTRICT) AND MUST BE ADJUSTABLE. AN ADJUSTABLE STAGED OR OPTIMAL START ALGORITHM MUST BE INCLUDED TO ENABLE SPACES TO MEET THE NORMAL SCHEDULE OCCUPIED SETPOINT BY NORMAL SCHEDULE START TIME.
3. HOLIDAY SCHEDULE
   a. THESE SCHEDULES PUT EQUIPMENT, ZONES, SCHOOLS, OR THE DISTRICT IN UNOCCUPIED MODE WHILE "NORMAL" SCHEDULES REMAIN INTACT WHEN SCHOOL IS CANCELED OR OVER BREAKS. HOLIDAY TAKES PRIORITY OVER "NORMAL" SUCH THAT SCHOOLS/ZONES/EQUIPMENT SHALL BE IN UNOCCUPIED MODE.
4. OVERRIDE SCHEDULES
   a. THESE SCHEDULES TURN EQUIPMENT OR AREAS TO OCCUPIED MODE WHILE "HOLIDAY" OR "NORMAL" IS RETAINED. OVERRIDE TAKES PRIORITY OVER "HOLIDAY" AND "NORMAL".
   b. SYSTEMS SHALL HAVE ABILITY TO PUT A BUILDING, GROUP, OR PIECE OF EQUIPMENT INTO OVERRIDE. FOR EXAMPLE, THIS WOULD APPLY TO TYPICAL K-12 SUMMER OPERATION. ALL SCHOOLS ARE TYPICALLY TURNED TO UNOCCUPIED VIA A HOLIDAY THAT OVERRIDES THE NORMAL SCHEDULE. HOWEVER, SCHOOL EVENTS WILL REQUIRE CERTAIN AREAS OR PIECES OF EQUIPMENT TO BE TURNED ON AT ANY GIVEN SCHOOL. THE OVERRIDE FUNCTION ALLOWS THESE TO BE TURNED ON WHILE THE DISTRICT WIDE SUMMER HOLIDAY REMAINS IN FORCE FOR ALL SCHOOLS.
   c. BASE/DEFAULT TIME IN ALL SCHEDULES SHALL BE UNOCCUPIED. IF THERE IS NO EVENT, OR NO SCHEDULE, THE ITEM IS TO BE UNOCCUPIED. DO NOT REQUIRE THE USER TO PUT IN BOTH UNOCCUPIED TIME AND OCCUPIED TIME FOR SCHEDULES. ONLY OCCUPIED TIME IS TO BE PUT IN. IF A PIECE OF EQUIPMENT IS TO BE OCCUPIED/ENABLED 24 HOURS PER DAY, THE SCHEDULE SHALL BE PUT IN AS 24 HOURS PER DAY. DO NOT CHANGE DEFAULT TO OCCUPIED.
5. SCHEDULING GROUPS
   a. THE INITIAL OCCUPIED SCHEDULE WILL BE (PENDING OWNER/SUBMITTAL REVIEW):
      - FALL/SPRING: MONDAY THROUGH FRIDAY, 8AM TO 4PM (ADJ.)
      - SUMMER: MONDAY THROUGH FRIDAY, 9AM TO 2PM (ADJ.)
      - HOLIDAY: UNOCCUPIED (ADJ.)
      - ACADEMIC BREAKS: UNOCCUPIED (ADJ.)
   b. PROVIDE A SOFTWARE BASED HOA TOGGLE SWITCH FOR THE BUILDING AND ALL MAJOR HVAC EQUIPMENT WHICH ALLOWS THE USER TO CHOOSE BETWEEN THE FOLLOWING MODES OF OPERATION:
      - MANUALLY ON (HAND), BUILDING OR EQUIPMENT WILL OPERATE CONTINUOUSLY
      - MANUALLY OFF/OFF, BUILDING OR EQUIPMENT WILL NOT OPERATE
      - AUTOMATIC (AUTO), OPERATE PER SCHEDULE
      - THIS HOA SWITCH WILL NOT OVERRIDE ANY EQUIPMENT SCHEDULES
6. SUMMER MODE OPERATION
   a. DURING THE SUMMER MONTHS THE BUILDING SHALL OPERATE AT REDUCED OCCUPANCY LOAD. THIS MODE SHALL ONLY AFFECT SPECIFIED EQUIPMENT WITHIN THE BUILDING THAT HAS REGULAR SUMMARY OCCUPANCY. REMAINING EQUIPMENT WITHIN THE BUILDING SHALL OPERATE UNDER THEIR OWN SCHEDULE GROUPS IN THE UNOCCUPIED MODE TO CONTROL SPACE TEMPERATURE AND HUMIDITY WHILE IN SETBACK. COORDINATE FINAL SCHEDULE GROUPS WITH CMTA PRIOR TO IMPLEMENTATION.
7. SNOW DAY OPERATION
   a. FUNCTIONALITY SHALL BE BUILT INTO THE CONTROLS TO ALLOW FOR THE OVERRIDE OF ALL SCHEDULES INTO AN UNOCCUPIED STATE DUE TO THE SUDDEN CANCELLATION OF SCHOOL OR SIMILAR EVENT. SYSTEM OVERRIDE SWITCHES SHALL REMAIN IN PLACE AS STATE IN EACH SYSTEMS CONTROL SEQUENCES TO ALLOW FOR ISOLATED SPACES TO BE PLACED INTO OCCUPIED MODE DURING SCHEDULED UNOCCUPIED HOURS.

E. METERING
1. OVERALL INTENT
   a. THE ATC SHALL PROVIDE REQUIRED PROGRAMMING AND GRAPHICS TO DEVELOP A HILLCREST MIDDLE SCHOOL ENERGY DASHBOARD THAT DISPLAYS REAL TIME SYSTEM EFFICIENCY PARAMETERS OF NOTE BUILDING SYSTEMS USING DATA DERIVED FROM THE INSTALLED METERS AND MONITORING OF THE KW CONSUMPTION OF SPECIFIC HVAC EQUIPMENT (I.E. WSHP'S, DOAS, FANS, PUMPS, VFDS, AND PLUMBING EQUIPMENT). SEE CONTROLS DRAWINGS FOR MORE INFORMATION.
2. BTU METERING
   a. ALL BTU METERS SHALL BE FURNISHED AS SPECIFIED. METERS SHALL BE NICOM METERS WITH REQUIRED ELECTRONIC INSERTION FLOW METER AND IMMERSION TEMPERATURE SENSORS. ALL BTU METERS ARE TO BE FURNISHED BY THE ATC. METER MANUFACTURERS REP WILL PROVIDE FIELD SERVICES FOR ALL METERS (I.E. FIELD INSPECTION, SET UP AND ASSISTANCE TO THE ATC FOR INTERFACE, ETC.).
   b. ALL BTU METERS ARE TO BE FURNISHED AS DUAL CHANNEL WITH BACNET MS/TP OR IP SERIAL INTERFACE TO BE FINALIZED BY BIDDING ATC CONTRACTOR.
   c. THE ATC SHALL COORDINATE WITH THE APPROPRIATE SUBCONTRACTOR TO PROVIDE ALL DATA DROPS FOR ALL NEW BTU METERS. THE PATHWAY OF ROUTING THE COMMUNICATIONS (ANY REQUIRED EMT OR CONDUIT) FOR EACH REQUIRED DATA DROP SHALL BE PROVIDED BY THE ATC IF INSIDE THE BUILDING.
   d. ALL 120 VOLT POWER FOR ANY NEW BTU PROCESSOR SHALL BE BY THE PROJECT EC, BOTH CONDUIT AND POWER TO THE BTU METER PROCESSOR. FINAL TERMINATION TO THE BTU METER SHALL BE BY THE ATC.
   e. THE FOLLOWING BTU METERS WILL MONITOR THE FLOW, AND SUPPLY & RETURN WATER TEMPERATURES IN THE LISTED SYSTEMS.
      - GEOTHERMAL SYSTEM BTU METER
3. WATER METERING
   a. MAIN CITY WATER METER - THE TOWN SHALL PROVIDE AND THE PLUMBING CONTRACTOR SHALL INSTALL THE CLAMP ON PULSE METER. THE ATC SHALL PROVIDE ALL PROGRAMMING TO MAP VIA SERIAL INTERFACE THE NEW METER TO THE BAS GRAPHICS. FINAL MAPPED POINTS TO BE REVIEWED WITH OWNER AND ENGINEER. THE ATC WILL COORDINATE WITH THE WATER MANUFACTURER'S REP, WHO WILL PROVIDE FIELD SERVICES FOR METER (I.E. FIELD INSPECTION, SET UP AND ASSISTANCE TO THE ATC FOR INTERFACE, ETC.).
4. ELECTRIC METERING
   a. THE EC WILL FURNISH AN ELECTRIC METER TO BE INSTALLED BY THE EC ON THE NEW MAIN SWITCHBOARD. THE ATC SHALL PROVIDE ALL PROGRAMING TO MAP VIA SERIAL INTERFACE THE NEW METER TO THE BAS GRAPHICS. FINAL MAPPED POINTS TO BE REVIEWED WITH OWNER AND ENGINEER. THE EC WILL COORDINATE WITH THE METER MANUFACTURER'S REP WHO WILL PROVIDE FIELD SERVICES FOR METER (I.E. FIELD INSPECTION, SET UP AND ASSISTANCE TO THE ATC FOR INTERFACE, ETC.).
5. MONITORING OF HVAC EQUIPMENT
   a. THE FOLLOWING HVAC EQUIPMENT WILL HAVE CURRENT TRANSDUCERS THAT WILL MONITOR AMPS. THE BAS WILL RECORD THIS INFORMATION AND INTEGRATE THIS INTO THE SPECIFIED ENERGY REPORT. THE FOLLOWING EQUIPMENT SHALL BE INTEGRATED INTO THE ENERGY REPORTS:
      - DHW HEATER MODULES, COMPRESSOR MOTOR AMPS (KW) THAT WILL BE USED TO DEVELOP EFFICIENCY REPORTS.
      - DOAS-1 EC FAN MOTOR AMPS THAT WILL BE USED TO DEVELOP FAN ENERGY REPORTS.
      - ALL VFDS FOR PUMPS, FANS, AND EXHAUST FANS WILL HAVE BACNET MS/TP SERIAL INTERFACE AND THE KW FOR EACH VFD SHALL BE MAPPED AND RECORDED TO BE INTEGRATED INTO THE BUILDING ENERGY REPORT.
6. ELECTRICAL ENERGY USE SUBMETERING.
   a. THE PROJECT EC SHALL PROVIDE SUBMETERING FOR THE BUILDING WITH CTS AT PANELS/SWITCHGEAR DEFINED ON ELECTRICAL ONE-LINE DIAGRAM AND CONTROL DRAWING M7.07. THE EC SHALL PROVIDE 3-PHASE CTS AT EACH PANEL/SWITCHGEAR AND TOTAL LOADS PER CATEGORY OR FINAL READOUTS. THE ATC SHALL PROVIDE INTERFACE WITH THE SUBMETERS AS REQUIRED TO DISPLAY GRAPHICS FOR EACH ACCORDINGLY ON THE BAS.
      - TOTAL HVAC SYSTEM
      - INTERIOR LIGHTING
      - EXTERIOR LIGHTING
      - PLUG LOADS
      - KITCHEN LOADS
      - BUILDING OPERATIONS / MISCELLANEOUS LOADS
      - ELEVATOR LOAD
      - EV CHARGING LOADS
      - SOLAR PRODUCTION LOADS

F. ENERGY REPORTS, LOGS, GRAPHS, HISTORICAL LOGS, AND GRAPHICS
1. THE ATC SHALL DEVELOP THE FOLLOWING:
   a. ENERGY REPORT FOR DAILY, MONTHLY AND ANNUAL DATA.
   b. ENERGY GRAPHS FOR DAILY, MONTHLY AND ANNUAL DATA.
   c. HISTORICAL LOGS SHALL BE KEPT FOR 1 YEAR. CONFIRM WITH ENGINEER PRIOR TO PROGRAMMING.
   d. THE EMS GRAPHICS DISPLAY SHALL BE SUBMITTED FOR OWNER, ENGINEER, AND OWNER'S CX AGENT TO REVIEW AND REVISE.
   e. ALL GRAPHICS AND ENERGY REPORTS SHALL INCLUDE OUTSIDE AIR TEMPERATURE, DRY BULB AND WET BULB, AND CALCULATED OA RH.
2. WATER METER REPORTS
   a. PROVIDE WATER USAGE REPORTS FOR THE MAIN CITY WATER METER.
   b. WATER USAGE REPORTS SHALL BE IN DAILY, MONTH, AND YEARLY FORMAT.
   c. PROVIDE EMS GRAPHICS DISPLAY OF WATER METER DATA.
3. BTU METER REPORTS
   a. FOR EACH BTU METER, THE EMS SHALL RECORD
      - FLOW (GPM)
      - SYSTEM SUPPLY TEMPERATURE, °F
      - SYSTEM RETURN TEMPERATURE, °F
      - ANY OTHER SERIAL POINTS, REVIEW WITH ENGINEER.
   b. FOR EACH BTU METERS, TREND LOGS SHALL BE DEVELOPED TO GENERATE DAILY, MONTHLY AND ANNUAL REPORTS.
   c. FOR BTU METERS,
      - OBTAIN BTU DATA FROM EACH BTU PROCESSOR
      - RECORD BTU DATA FOR HOURLY DATA ALONG WITH FLOW, SYSTEM SUPPLY AND RETURN TEMPERATURE. FROM DATA, PROVIDE DAILY, MONTH AND ANNUAL REPORTS.
4. PUMP AND FAN ENERGY
   a. THE EMS SHALL RECORD HOURLY KW FOR
      - GEOTHERMAL PUMPS/VFDS
      - FOR EACH PUMP. THE EMS SHALL RECORD PUMP KW VIA THE SERIAL VFD INTERFACE
      - THE EMS SHALL PROVIDE HOURLY TREND TO GENERATE DAILY, MONTH AND ANNUAL PUMP ENERGY REPORTS.
   b. DOAS-1
      - FOR THE DOAS UNIT, THE EMS SHALL RECORD FAN KW/AMPS AND PROVIDE HOURLY TREND FOR FAN ENERGY TO GENERATE DAILY, MONTHLY AND ANNUAL FAN ENERGY REPORTS.
      - THE EMS SHALL HOURLY SUM THE BUILDING VAV BOX AIRFLOW AND WITH THE TEMPERATURE SENSORS INSTALLED IN THE DOAS UNIT'S AIRSTREAMS, THE ATC SHALL DEVELOP AN HOURLY REPORT TO GENERATE RECOVERED ENERGY FROM EACH DOAS UNIT. THE FINAL DERIVATION OF THE USE OF THE TEMPERATURE SENSORS AND CFM SHALL BE REVIEWED DURING THE SUBMITTAL PHASE, WITH THE OWNER, ENGINEER AND CX AGENT.
5. BUILDING ENERGY MONITORING AND TOTALIZATION
   a. THE EMS SHALL CONTINUOUSLY MONITOR THE BUILDING KW CONSUMPTION.
   b. THE ATC SHALL PROVIDE THE REQUIRED TOTALIZING ROUTINE FOR DAILY, MONTHLY AND ANNUAL KW DEMAND AND KWH USAGE.
   c. THE REPORT FORMAT AND EMS GRAPHICS SHALL BE REVIEWED DURING THE SUBMITTAL PHASE WITH THE OWNER, ENGINEER AND CX AGENT.
   d. THE OWNER SHALL BE ABLE TO ACCESS A GRAPHIC SCREEN TO DISPLAY BUILDING KW AND KWH DEMAND AND THE SCREEN, BY SELECTING AN EQUIPMENT BUCKET, THERE SHALL BE TABLES AND GRAPHS ILLUSTRATING 1/2 MONTHS OF KW DEMAND AND KWH ENERGY.
6. DEMAND RESPONSE
   a. INCORPORATE ELECTRICAL SYSTEM INTO A DEMAND RESPONSE PROGRAM. THE EMS SHALL INCLUDE AN ADJUSTABLE DEMAND SETPOINT FOR MMHS THAT CAN BE ACCESSED FROM THE EMS GRAPHICS TO ALLOW THE OPERATOR TO SET A DEMAND VALUE AT WHICH AN ALARM SHALL BE ANNUNCIATED IF REACHED.
   b. ANY DEMAND RESPONSE STRATEGY (I.E. LIMITING GEOTHERMAL WATER, CONTROLLING DOAS) SHALL BE DEVELOPED DURING THE SUBMITTAL PHASE WITH THE OWNER, ENGINEER, AND CX AGENT.
7. POWER DEMAND LIMITING
   a. THE GOAL OF DEMAND LIMITING IS TO SAVE OPERATING COSTS BY CONTROLLING & LIMITING PEAK ENERGY USAGE. THE SEQUENCE SELECTIVELY TURNS OFF EQUIPMENT AND/OR ADJUSTS SETPOINTS TO LIMIT ENERGY USE DURING PERIODS OF THE DAY THAT ARE TRADITIONALLY PEAK TIMES.
   b. THE UTILITY BILLING KW DEMAND SHALL BE MONITORED BY THE BAS. THE BUILDING KW TARGET SHALL INITIALLY BE SET TO 125 KW (ADJ.) AND SHALL BE VERIFIED WITH OWNER AND ENGINEER. THE KW TARGET IS THE MAXIMUM PERMITTED AVERAGE ENERGY FOR THE CURRENT DEMAND INTERVAL.
   c. THE CURRENT DEMAND INTERVAL IS THE DURATION IN MINUTES OVER WHICH ENERGY CONSUMPTION IS AVERAGED FOR BILLING PURPOSES. THE BAS SOFTWARE SHALL PREDICT DEMAND FOR THE DEMAND INTERVAL. IF THE PREDICTED DEMAND IS ABOVE THE CURRENTLY ACTIVE TARGET, DEMAND LIMITING SHALL BE LOADS AS SPECIFIED.
   d. PROVIDE A GRAPHIC RELEASE FEATURE. RELEASE THE EQUIPMENT AT THE BAS WITH A MANUAL COMMAND. COORDINATE WITH OWNER THE SHED TIME AND ADDITIONAL EQUIPMENT TO INCLUDE WITHIN DEMAND LIMITING.
   e. AT PERIODS OF PEAK USAGE, RESET THE SPACE TEMPERATURE SETPOINT BY 3F (ADJ.) IN HEATING OR COOLING MODE. THE SHED TIME SHALL BE 20 MINUTES (ADJ.) FOR EACH GROUP. EACH SUBSEQUENT GROUP SHALL FOLLOW IN 5-MINUTE (ADJ.) INCREMENTS. THIS ROUTINE SHALL START WHEN THE DEMAND REACHES 80% (ADJ.) OF SETPOINT AND SHALL OPERATE UNTIL ALL GROUPS COMPLETE AT LEAST ONE ROTATION. IF AT THE END OF THE ROTATION, THE DEMAND IS STILL WITHIN 80% (ADJ.) OF SETPOINT, THE SEQUENCE SHALL REPEAT AS NEEDED.
   f. INITIAL GROUPS SHALL BE:

GROUP 1 - DOAS-1
GROUP 2 - LOWER LEVEL HEAT PUMPS
GROUP 3 - UPPER LEVEL HEAT PUMPS
GROUP 4 - MAIN LEVEL AREA A AND B HEAT PUMPS
GROUP 5 - MAIN LEVEL AREA C HEAT PUMPS

TIME	GROUP # 1	2	3	4	5
11:59	ON	ON	ON	ON	ON
12:00	OFF	ON	ON	ON	ON
12:05	OFF	OFF	ON	ON	ON
12:10	OFF	OFF	OFF	ON	ON
12:15	OFF	OFF	OFF	OFF	ON
12:20	OFF	OFF	OFF	OFF	OFF
12:25	ON	OFF	OFF	OFF	OFF
12:30	ON	ON	OFF	OFF	OFF
12:35	ON	ON	ON	OFF	OFF
12:40	ON	ON	ON	ON	OFF
12:45	ON	ON	ON	ON	ON

ATC LEGEND

ALM	GENERAL ALARM / FAULT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
ATC	AUTOMATIC TEMPERATURE CONTROLS
BAS	BUILDING AUTOMATION SYSTEM
CT	CURRENT TRANSDUCER
DDC	DIRECT DIGITAL CONTROL SYSTEM
DDCP	DIRECT DIGITAL CONTROL PANEL
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
EF	EXHAUST FAN
HW	HARD WIRED CONNECTION
MCC	MOTOR CONTROL CENTER
MD-I	MODE SELECT INPUT
MD-O	MODE SELECT OUTPUT
MM	FIRE ALARM MONITOR MODULE
MR	MANUAL RESET
NET	NETWORK CONNECTION TO ATC SYSTEM
N.C	NORMALLY CLOSED
N.O	NORMALLY OPEN
PC	PROGRAMMABLE CONTROLLER
RES	SETPOINT RESET
RF	RETURN FAN
SPD-C	VFD SPEED COMMAND
ST / ST	START / STOP
STS	STATUS
SF	SUPPLY FAN
TEC	TERMINAL EQUIPMENT CONTROLLER
VD	VOLUME DAMPER

VAV / EVAV TERMINAL BOX
FAN
PUMP
2-WAY MODULATING CONTROL VALVE
2-WAY ISOLATION VALVE
MAUAL/BUTTERFLY ISOLATION VALVE
AIRFLOW MEASURING MOTORIZED CONTROL DAMPER
MOTORIZED DAMPER
BACKDRAFT DAMPER
DAMPER END SWITCH
UNION
ROOM TEMPERATURE
NAN — NETWORK APPLICATION NODES
UAC — UNITARY APPLICATION CONTROLLER
VFD — VARIABLE FREQUENCY DRIVE

DEVICE LEGEND - DUCTWORK

SYMBOL	DESCRIPTION	DESIGNATION	SERVICE
M	AUTOMATIC CONTROL DAMPER WITH ELECTRIC ACTUATOR	D-ACD	GENERAL
		D-BP	BY-PASS
		D-DA	DISCHARGE AIR
		D-EISO	EXHAUST FAN ISOLATION
		D-IN	INTAKE DAMPER
		D-ISO	ISOLATION
		D-MDOA	MIDDLE OUTSIDE AIR DAMPER
		D-MNOA	MINIMUM OUTSIDE AIR DAMPER
		D-MOA	MINIMUM OUTSIDE AIR
		D-MXOA	MAXIMUM OUTSIDE AIR DAMPER
M SR		D-OA	OUTSIDE AIR
		D-RA	RETURN AIR
		D-RISO	RETURN FAN ISOLATION
		D-RLF	RELIEF AIR
		D-SISO	SUPPLY FAN ISOLATION
		D-UISO	UNIT ISOLATION
		D-2P	2 POSITION / OPEN-CLOSED
		DSM-SA	SMOKE DAMPER / SUPPLY AIR
		DSM-RA	SMOKE DAMPER / RETURN AIR
		FSD-SA	FIRE SMOKE DAMPER / SUPPLY AIR
		FSD-RA	FIRE SMOKE DAMPER / RETURN AIR
		D-OA/RLF	OUTSIDE AIR RELIEF DAMPER
		D-VAV	VAV DAMPER
FE	FLOW ELEMENT	FE-SA	SUPPLY AIR FLOW
T	TEMPERATURE SENSOR (AVERAGING)	T-CC	COOLING COIL LEAVING AIR
		T-DA	DISCHARGE AIR
		T-EA	EXHAUST AIR
		T-ERW	ENTHALPY WHEEL LEAVING AIR
	TEMPERATURE SENSOR (DUCT)	T-HC	TEMPERATURE
		T-MA	HEATING COIL LEAVING AIR
		T-OA	MIXED AIR TEMPERATURE
		T-PHT	OUTSIDE AIR TEMPERATURE
		T-RA	PREHEAT COIL LEAVING AIR TEMPERATURE
		T-SA	RETURN AIR TEMPERATURE
			SUPPLY AIR TEMPERATURE
FZ	FREEZE-STAT	T-LTD	LOW TEMPERATURE DETECTOR (FREEZE-STAT)
SD	SMOKE DETECTOR (FURNISHED BY FA CONTRACTOR)	SD-RA	SMOKE DETECTOR - RETURN AIR
		SD-SA	SMOKE DETECTOR - SUPPLY AIR
SP	PRESSURE SENSOR PORT	D-DAHL	DISCHARGE AIR / HIGH LIMIT
		D-DALL	DISCHARGE AIR / LOW LIMIT
		D-DASP	DISCHARGE AIR / STATIC PRESSURE
		P-DP-A	DIFFERENTIAL PRESSURE - ANALOG
		P-DP-D	DIFFERENTIAL PRESSURE - DIGITAL
		P-EASP	EXHAUST AIR / STATIC PRESSURE
		P-EAHL	EXHAUST AIR / HIGH LIMIT
SP		P-EALL	EXHAUST AIR / LOW LIMIT
		P-RAHL	RETURN AIR / HIGH LIMIT
		P-RALL	RETURN AIR / LOW LIMIT
		P-SAHL	SUPPLY AIR / HIGH LIMIT
		P-SALL	SUPPLY AIR / LOW LIMIT
		P-RASP	RETURN AIR / STATIC PRESSURE
		P-RFSP	RELIEF AIR / STATIC PRESSURE
		P-SASP	SUPPLY AIR / STATIC PRESSURE
		P-VPS	VELOCITY PRESSURE SENSOR
AFS	AIR FLOW PROVING SWITCH	AFS	DUCTWORK AIR FLOW PROVING SWITCH
DPT	DIFFERENTIAL PRESSURE TRANSMITTER	P-DP-A	DIFFERENTIAL PRESSURE - ANALOG
		P-DP-D	DIFFERENTIAL PRESSURE - DIGITAL
DPS	DIFFERENTIAL PRESSURE SWITCH	P-DPS	DIFFERENTIAL PRESSURE SWITCH
H	DUCT MOUNTED RH SENSOR	H-SA	
		H-RA	RELATIVE HUMIDITY

DEVICE LEGEND - PIPING

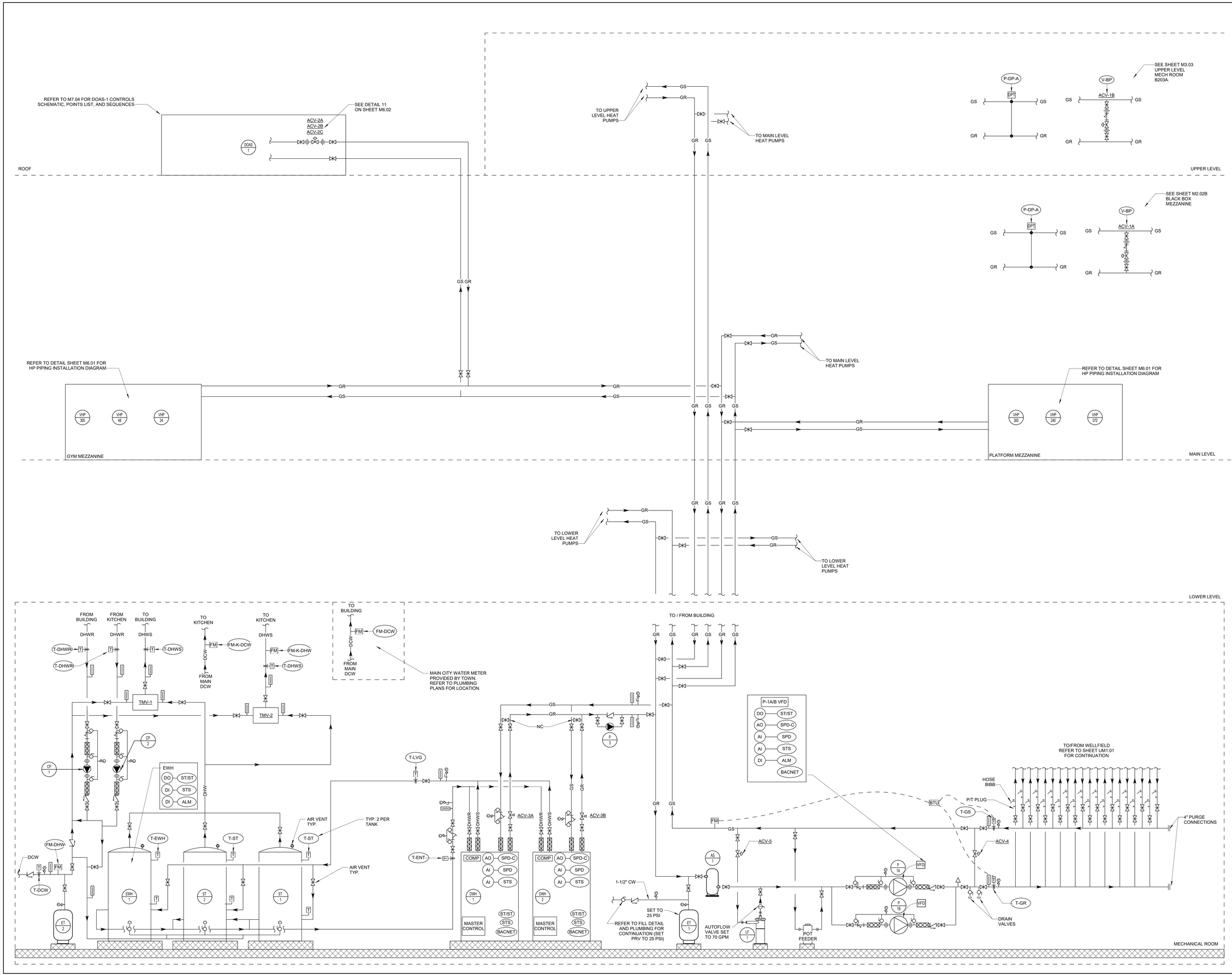
SYMBOL	DESCRIPTION	DESIGNATION	SERVICE
	2-WAY AND 3-WAY CONTROL VALVE WITH ELECTRIC ACTUATOR	V	GENERAL VALVE
		V-2P	2 POSITION VALVE
		V-BP	V-BP
		V-CHWD	CHILLED WATER DENY CONTROL VALVE
		V-CLG	COOLING COIL VALVE
		V-DIV	DIVERTING 3-WAY VALVE
		V-DP	DIFFERENTIAL PRESSURE CONTROL
		V-HRC	HEAT RECOVERY COIL VALVE
		V-HTG	HEATING COIL VALVE
		V-PH	PREHEAT COIL VALVE
		V-RH	REHEAT COIL VALVE
	ISOLATION VALVE	V-ISO	ISOLATION VALVE - OPEN/CLOSE
T	TEMPERATURE SENSOR AND WELL	T-GWS	GEOTHERMAL WATER SUPPLY
		T-GWR	GEOTHERMAL WATER RETURN
		T-SW	TEMPERATURE HIGH / LOW SWITCH
		T-HWS	HOT WATER SUPPLY
		T-HWS	HOT WATER RETURN
DPT	DIFFERENTIAL PRESSURE TRANSMITTER	P-DP-A	DIFFERENTIAL PRESSURE - ANALOG
		P-DP-D	DIFFERENTIAL PRESSURE - DIGITAL
PT	PRESSURE TRANSMITTER	PT	SYSTEM PRESSURE
FM	FLOW METER	FM	FLOW METER
BTU	BTU METER	BTU	BTU METER
FS	FLOW PROVING SWITCH	FS	FLOW PROVING SWITCH
LD	LEAK DETECTOR	LD	LEAK DETECTOR ALARM
LL	LOW LEVEL	LL	LOW LEVEL ALARM
OS	OVERFLOW SWITCH	OS	OVERFLOW SWITCH ALARM

DEVICE LEGEND - ROOM / SPACE SENSORS

SYMBOL	DESCRIPTION	DESIGNATION	SERVICE
ALM	ALARM	ALM	GENERAL ALARM
SMD	SMOKE DETECTOR ROOM / SPACE (FURNISHED BY FA CONTRACTOR)	SD-RM	ROOM / SPACE
T	TEMPERATURE ROOM / ZONE	T-RM	ROOM / ZONE
		T-OA	OUTSIDE AIR
		T-ZN	
SW	SWITCH	SW	SWITCH - DIGITAL INPUT
CO2	CARBON DIOXIDE SENSOR	CO2-RM	ROOM / ZONE
		CO2-ZN	
OCC	OCCUPANCY SENSOR	OCC-ZN	ROOM / ZONE

BUILDING OPTIMAL START SEQUENCE OF OPERATIONS:

A. MORNING WARM-UP - IN GENERAL THIS SEQUENCE IS INTENDED TO GRADUALLY RAMP UP BUILDING MECHANICAL SYSTEMS PRIOR TO THE OCCUPIED PERIOD IN ORDER TO REDUCE ELECTRICAL DEMAND SPIKES AND AVOID SIMULTANEOUS STARTUP OF ALL MAJOR EQUIPMENT.
   a. TO REDUCE BUILDING STARTUP DEMAND DURING STARTUP, THE BAS SHALL INITIATE THE MORNING PRESTART.
   b. 90 MINUTES (ADJ.) PRIOR TO THE SCHEDULED OCCUPIED MODE, THE BAS SHALL INITIATE MORNING WARM-UP BY ENABLING THE FOLLOWING EQUIPMENT IN STAGES AT 15-MINUTE (ADJ.) INTERVALS:
      1. START GEOTHERMAL PUMPS, DOMESTIC WATER HEATER, DOMESTIC WATER PUMPS.
      2. START ALL HEAT PUMPS SERVING MAIN LEVEL AREAS A AND B.
      3. START ALL HEAT PUMPS SERVING UPPER LEVEL AREA C.
      4. START ALL HEAT PUMPS SERVING LOWER LEVEL AREA C.
      5. START ALL HEAT P



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PROFESSIONAL SEAL

STATE OF CONNECTICUT — JOSEPH E. FALCIGNO — 34058 — LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL CONTROLS SCHEMATIC

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	12" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/25/2026	PHASE 1
5	5/19/2026	100% CD

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GEOTHERMAL SYSTEM SEQUENCE OF OPERATIONS:

1. GENERAL
   a. PROVIDE ALL I/O POINTS INDICATED ON THE CONTROL DIAGRAM AND AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATIONS.
   b. ALL WIRE TERMINALS, CABLES, GAUGES, AND WIRES SHALL BE IDENTIFIED WITHIN THE PANELS
   c. ALL POINTS SHALL BE ABLE TO INTEGRATE ALL TRENDS, TOTALIZATIONS, ETC. AS APPLICABLE
   d. ALL ALARMS SHALL BE SUPPRESSED DURING CONSTRUCTION.
   e. OWNER AND ENGINEER SHALL REVIEW ALL GRAPHIC SLIDES IN ATC SUBMITTAL PRIOR TO UPLOAD/USE.
   f. ALL ALARMS AS INDICATED ON THE DIAGRAMS IN THE SEQUENCE OF OPERATIONS SHALL BE GENERATED TO THE APPROPRIATE SERVER/WORKSTATIONS. ATC CONTRACTOR SHALL COORDINATE WITH THE OWNER FOR ALL CRITICAL ALARMS AND HOW THEY ARE TO BE RELAYED TO THE BUILDING PERSONNEL AS REQUIRED (VIA TEXT MESSAGE, EMAIL, OR OTHER).
2. OCCUPANCY SCHEDULE
   a. UNOCCUPIED MODE
      i. OCCUPIED MODE TIME SCHEDULE IS SET MANUALLY THROUGH THE BAS.
      ii. TIME OF DAY FOR OCCUPIED MODE IS ACTIVE.
      iii. THE SYSTEM SHALL MONITOR HEAT PUMPS WITHIN THE BUILDING SYSTEM. IF ANY HEAT PUMP IS ACTIVATED INTO OCCUPIED MODE, OVERALL SYSTEM SHALL BE PLACED IN OCCUPIED MODE TEMPORARILY.
      iv. IF THE TIME OF DAY OCCUPIED MODE IS OFF, AND THE SYSTEM IS IN TEMPORARY OCCUPIED MODE. THE BAS SHALL MONITOR EVERY 30 MINUTES (ADJ) THAT AT LEAST ONE HEAT PUMP IS OPERATING IN OCCUPIED MODE. THE BAS SHALL RETURN TO UNOCCUPIED MODE IF THE CONNECTED OCCUPANCY SENSORS FOR THE HEAT PUMP HAVE NOT DETECTED OCCUPANCY FOR 30 MINUTES (ADJ)
      v. P-1A & P-1B SHALL; BE OFF.
      vi. THE MINIMUM FLOW CONTROL VALVES SHALL BE OPEN.
   b. OCCUPIED MODE
      i. OCCUPANCY MODE SHALL BE SET WHEN ANY OF THE FOLLOWING APPLY
      ii. OCCUPIED MODE TIME SCHEDULE IS SET MANUALLY THROUGH THE BAS.
      iii. TIME OF DAY FOR OCCUPIED MODE IS ACTIVE.
      iv. THE SYSTEM SHALL MONITOR HEAT PUMPS WITHIN THE BUILDING SYSTEM. IF ANY HEAT PUMP IS ACTIVATED INTO OCCUPIED MODE, OVERALL SYSTEM SHALL BE PLACED IN OCCUPIED MODE.
   c. PUMP CONTROL
      i. UPON CALL FOR SYSTEM START, THE LEAD PUMP SHALL CONTROL THE PUMP VIA ASSOCIATED VFD RAMP UP TO MEET THE DIFFERENTIAL PRESSURE SETPOINT AS DETERMINED BY THE CURRENT SYSTEM SETPOINT. (LIKELY MINIMUM FLOW)
      ii. LEAD PUMP SHALL OPERATE CONTINUOUSLY DURING OCCUPIED MODE.
      iii. THE HEAT PUMP LOOP WATER FLOW RATE SHALL BE DETERMINED FROM AN ONICON F-3200 SERIES IN-LINE ELECTROMAGNETIC FLOW METER WITH 0.2% ACCURACY FROM 0-800 GPM. THIS METER SHALL ALSO BE USED IN CONJUNCTION WITH THE WELL FIELD SUPPLY AND RETURN TEMPERATURE SENSORS TO PROVIDE SYSTEM BTU CALCULATION. IT ALSO DISPLAYS GRAPHICALLY, THE WATERFLOW SUPPLIED TO THE BUILDING. THE BAS SHALL DISPLAY THE PEAK GPM AND CORRESPONDING DATE, TIME AND OUTSIDE AIR TEMPERATURE. REFER TO METERING POINTS LIST FOR MORE INFORMATION. REFER TO PLANS/DIAGRAMS FOR METER LOCATION.
      iv. THE DIFFERENTIAL PRESSURE SHALL INITIALLY BE SET LOW AT 7 PSI (ADJ.). THE BAS SHALL OPTIMIZE THE REQUIRED SETPOINT TO OBTAIN THE DESIGN WATER FLOW WITH ALL HEAT PUMPS AND IN CONJUNCTION WITH THE TAB CONTRACTOR AND THE MECHANICAL ENGINEER. NOTE THE FINAL SETPOINT IN THE BAS RECORD DOCUMENTS. MAXIMUM DP RESET LIMIT SHALL BE 15 PSI (ADJ.) AND MINIMUM DP RESET SHALL BE 3 PSI (ADJ.)
      v. THE MINIMUM FLOW RATE THROUGH THE SYSTEM IS 35% (ADJ.) BASED ON THE PUMP AND VFD. CONFIRM WITH VENDOR PRIOR TO PROGRAMMING AND THROUGH ON-SITE TESTING. THE PUMP IN CONJUNCTION WITH THE WATER FLOW METER AND MINIMUM FLOW CONTROL VALVES SHALL MODULATE IN TANDEM TO MAINTAIN ABOVE THIS WATER FLOW RATE.
      vi. IF THE PUMP CONTROLLER SENSES THAT THE DIFFERENTIAL PRESSURE IS BELOW THE PRESSURE SETPOINT, THE SPEED OF THE LEAD PUMP SHALL INCREASE. IF ONE PUMP RISES ABOVE 90% (ADJ.), THEN TWO PUMPS SHALL OPERATE. THE LAG PUMP SHALL RAMP-UP AND THE LEAD PUMP SHALL RAMP DOWN TO THE SAME SPEED TO MEET THE PRESSURE SETPOINT. THE PUMPS MUST OPERATE AT THE SAME SPEED AND THEIR SPEED SHALL BE INCREASED / DECREASED IN TANDEM TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT. IF BOTH PUMPS ARE OPERATING AT 35% (ADJ.) OR LESS AND DIFFERENTIAL PRESSURE SETPOINT IS SATISFIED, THEN THE LAG PUMP SHALL SHUT-OFF AND THE LEAD PUMP SHALL INCREASE SPEED TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.
      vii. FOR ALL PUMPS, IF PUMP FAILURE IS SENSED BY A CURRENT TRANSDUCER OCCURS, THEN AN ALARM SIGNAL SHALL BE GENERATED AND THE LAG PUMP SHALL BE ENGAGED. A THIRTY-SECOND-TIME DELAY RELAY SHALL BE PROVIDED FOR THE PUMP TO PREVENT FALSE ALARMS. AFTER THE CAUSE OF THE ALARM HAS BEEN ELIMINATED, THE SYSTEM SHALL BE CAPABLE OF RESETTING AND RE-ESTABLISHING THE LEAD PUMP. IF NO WATER FLOW IS SENSED AFTER THIRTY SECOND TIME-DELAY THEN THE RESPECTIVE SYSTEMS SHALL BE SHUT DOWN AND AN ADDITIONAL TAG PUMP ALARM SHALL BE SENT TO DESIGNATED MAINTENANCE STAFF
      ix. THE BAS SHALL AUTOMATICALLY ROTATE LEAD AND LAG PUMP DESIGNATION ON A SCHEDULED BASIS. UNLESS NOTED OTHERWISE, ROTATION SHALL OCCUR WEEKLY (ADJ) AT AN ADJUSTABLE DAY AND TIME DURING A PERIOD OF LOW LOAD. ROTATION SHALL ONLY OCCUR IF THE SCHEDULED LAG PUMP IS AVAILABLE, PROVEN READY, AND NOT IN ALARM. BAS SHALL RUNTIME-ACCUMULATE EACH PUMP AND DISPLAY CURRENT LEAD/LAG STATUS.
      x. BAS SHALL NOT ALLOW PUMP SPEED TO REDUCE BELOW THE MINIMUM PROGRAMMED SPEED UNLESS THE MINIMUM FLOW CONTROL VALVE IS PROVEN OPEN BY ANALOG POSITION FEEDBACK. IF VALVE PROOF IS NOT RECEIVED WITHIN AN ADJUSTABLE TIME DELAY, BAS SHALL MAINTAIN PUMP SPEED AT OR ABOVE MINIMUM SAFE SPEED AND GENERATE AN ALARM.
   d. WELLFIELD BYPASS AND DEW POINT CONTROL
      i. MODULATE GEOTHERMAL BYPASS VALVE ACV-4 TO MAINTAIN BUILDING GEOTHERMAL SUPPLY WATER TEMPERATURE ABOVE CALCULATED SPACE DEW POINT PLUS 3F OFFSET (ADJ). BAS SHALL CALCULATE SPACE DEW POINT USING MECHANICAL ROOM SPACE TEMPERATURE AND RELATIVE HUMIDITY SENSOR INPUTS. UPON LOW GEOTHERMAL SUPPLY WATER TEMPERATURE, BYPASS VALVE SHALL MODULATE OPEN TO RECIRCULATE BUILDING LOOP WATER AND REDUCE FLOW THROUGH THE WELLFIELD.
      ii. BYPASS VALVE SHALL MODULATE CLOSED AS BUILDING LOOP WATER TEMPERATURE RISES ABOVE SETPOINT. ALARM IF TEMPERATURE REMAINS BELOW SETPOINT FOR MORE THAN 10 MINUTES WITH BYPASS VALVE FULLY OPEN.
   g. LOOP FILTER CONTROL
      i. LOOP FILTER SHALL REMAIN DISABLED DURING NORMAL SYSTEM OPERATION. ENABLE LOOP FILTER WHEN OPERATING GEOTHERMAL LOOP PUMP HAS OPERATED AT 50% SPEED OR LESS FOR 15 MINUTES, ADJUSTABLE.
      ii. UPON ENABLE, MODULATE FILTER CONTROL VALVE ACV-5 100% OPEN TO MAINTAIN 70 GPM THROUGH THE LOOP FILTER.
      iii. DISABLE LOOP FILTER WHEN OPERATING GEOTHERMAL LOOP PUMPS EXCEED 60% SPEED FOR 5 MINUTES, ADJUSTABLE. UPON DISABLE, MODULATE FILTER CONTROL VALVE ACV-5 100% CLOSED.
   h. ALARMS
      i. PUMP FAILURE ALARM: GENERATE ALARM UPON FAILURE OF LEAD OR LAG PUMP TO START, RUN, OR PROVE STATUS WHEN COMMANDED.
      ii. DIFFERENTIAL PRESSURE ALARM: GENERATE ALARM UPON DIFFERENTIAL PRESSURE BELOW OR ABOVE ADJUSTABLE SETPOINT FOR ADJUSTABLE TIME DELAY.
      iii. FLOW METER ALARM: GENERATE ALARM UPON FLOW METER FAILURE, BAD SIGNAL, LOSS OF COMMUNICATION, OR LOSS OF VALID FLOW INPUT.
      iv. DP SENSOR ALARM: GENERATE ALARM UPON DIFFERENTIAL PRESSURE SENSOR FAILURE, BAD SIGNAL, LOSS OF COMMUNICATION, OR OUT-OF-RANGE INPUT.
      v. WELLFIELD SUPPLY TEMPERATURE ALARM: GENERATE ALARM UPON WELLFIELD SUPPLY TEMPERATURE ABOVE OR BELOW HIGH/LOW LIMIT. (100F/35F) (ADJ.)
      vii. VFD FAULT ALARM: GENERATE ALARM UPON VFD FAULT, TRIP, OR LOSS OF COMMUNICATION.
      viii. MINIMUM FLOW VALVE ALARM: GENERATE ALARM IF MINIMUM FLOW CONTROL VALVE FAILS TO ACHIEVE COMMANDED POSITION WITHIN ADJUSTABLE TIME DELAY.

GEOTHERMAL BUILDING LOOP SUPPLY TEMPERATURE BELOW DEW POINT PROTECTION SETPOINT. CONDENSATION RISK PRESENT, BYPASS VALVE COMMANDED FULL OPEN.

i. IMPORTANT NOTES
   i. DURING INITIAL SYSTEM STARTUP, WITH BUILDING AT MINIMAL INTERNAL LOAD AND WELL FIELD AT INITIAL USE, THE CAPACITY OF THE WELL FIELD CAN PRODUCE GEOTHERMAL SUPPLY TEMPERATURES LESS THAN THE BUILDING DEWPOINT. CAUTION SHOULD BE UTILIZED DURING INITIAL SYSTEM STARTUP.
   ii. LOOP FILTER SHALL BE OPERATED FROM INITIAL GEOTHERMAL LOOP STARTUP THROUGH OWNER OCCUPANCY, WITH A MINIMUM OPERATING PERIOD OF 45 DAYS. 1 LOOP FILTER SHALL OPERATE WHEN GEOTHERMAL LOOP PUMPS ARE AVAILABLE, OR PER THE AUTOMATIC LOOP FILTER SEQUENCE. CONTRACTOR SHALL CLEAN/REPLACE FILTER ELEMENTS AS REQUIRED AND DOCUMENT FILTER DIFFERENTIAL PRESSURE UNTIL FILTER DP HAS STABILIZED AND LOOP WATER QUALITY IS ACCEPTABLE.

GEOTHERMAL CENTRAL PLANT POINTS LIST

POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	BUILING GW DIFFERENTIAL PRESSURE (TYP. 2)	P-DP-A	AI	X	X		1
2	ACV-1A BYPASS VALVE COMMAND	V-BP-C	AO				3
3	ACV-1A BYPASS VALVE POSITION	V-BP	AI			X	3
4	ACV-1B BYPASS VALVE COMMAND	V-BP-C	AO				3
5	ACV-1B BYPASS VALVE POSITION	V-BP	AI			X	3
6	BUILDING GW BTU METER (FLOW, GWS/R, ENERGY)		SERIAL				9
7	GS TEMPERATURE	T-GS	AI	X	X		2
8	GR TEMPERATURE	T-GR	AI	X	X		2
9	P-1A START / STOP	ST/ST	DO				4
10	P-1A STATUS	STS	AI			X	5
11	P-1A VFD SPEED COMMAND	SPD-C	AO				6
12	P-1A VFD SPEED FEEDBACK	SPD	AI				6
13	P-1A VFD ALARM	ALM	DI			X	7
14	P-1A VFD BACNET SERIAL POINTS		SERIAL				8
15	P-1B START / STOP	ST/ST	DO				4
16	P-1B STATUS	STS	AI			X	5
17	P-1B VFD SPEED COMMAND	SPD-C	AO				6
18	P-1B VFD SPEED FEEDBACK	SPD	AI				6
19	P-1B VFD ALARM	ALM	DI			X	7
20	P-1B VFD BACNET SERIAL POINTS		SERIAL				8
21	DWH START / STOP (TYP. 2)	ST/ST	DO				4
22	DWH STATUS (TYP. 2)	STS	AI			X	5
23	DWH BACNET SERIAL INTERFACE (TYP. 2)		SERIAL				10
24	DWH GENERAL ALARM (TYP. 2)	ALM	DI			X	11
25	DWH COMPRESSOR STATUS (TYP. 2)	STS	DI			X	16
26	DWH COMPRESSOR SPEED FEEDBACK (TYP. 2)	SPD	AI				16
27	DWH COMPRESSOR SPEED COMMAND (TYP. 2)	SPD-C	AO				16
28	DHW ENTERING TEMP TO DWH	T-ENT	AI				2
29	DHW LEAVING TEMP TO DWH	T-LVG	AI				2
30	DHW SUPPLY TO BUILDING (TYP. 2)	T-DHWS	AI	X	X		2
31	DHW RETURN FROM BUILDING (TYP. 2)	T-DHWR	AI	X	X		2
32	STORAGE TANK TEMPERATURE (TYP. 4)	T-ST	AI	X			13
33	DHW RETURN PUMP START / STOP (CP-1)	ST/ST	DO				4
34	DHW RETURN PUMP STATUS (CP-1)	STS	DI			X	14
35	DHW KITCHEN RETURN PUMP START / STOP (CP-2)	ST/ST	DO				4
36	DHW KITCHEN PUMP STATUS (CP-2)	STS	DI			X	14
37	GW ISOLATION CONTROL VALVE COMMAND (TYP. OF 2)	V-ISO-C	AO				3
38	GW ISOLATION CONTROL VALVE POSITION (TYP. OF 2)	V-ISO	AI				3
39	EWH-1 TANK TEMPERATURE (TYP. 2)	T-EHW	AI				13
40	EWH-1 START/STOP	ST/ST	DO				4
41	EWH-1 STATUS	STS	DI			X	5
42	EWH-1 GENERAL ALARM	ALM	DI			X	11
43	EWH-1 HIGH TEMPERATURE CUTOUT	ALM	DI			X	14
45	DHW SYSTEM FLOW METER	FM	AI			X	15
46	KITCHEN DHW SYSTEM FLOW METER	FM	AI			X	15
47	KITCHEN DCW SYSTEM FLOW METER	FM	AI			X	15
48	DOMESTIC COLD WATER TEMPERATURE	T-DCW	AI				2

POINT NOTES:
1. ATC TO FURNISH DPT FOR MC TO INSTALL IN PIPE, TOTAL OF (2) DPTS TO BE FURNISHED AND INSTALLED. REFER TO PLANS FOR SYSTEM/LOAD SIDE DPT LOCATIONS. ATC TO PROVIDE ALL POWER / CONTROL WIRING AS REQUIRED TO MONITOR AT EMS.
2. ATC TO FURNISH WELL AND IMMERSION TEMPERATURE SENSOR. MC TO PROVIDE PIPE TAP AND INSTALL WELL. PROVIDE MATCHED SENSORS FOR SUPPLY/RETURN. ATC TO PROVIDE ALL CONTROL WIRING TO MONITOR SUPPLY/RETURN TEMPERATURE AT EMS.
3. ATC TO FURNISH 2-WAY MODULATING CONTROL VALVE WITH ELECTRIC ACTUATOR PER SPECS. MC SHALL INSTALL VALVE IN PIPE. ATC TO PROVIDE ALL POWER / CONTROL WIRING TO MONITOR VALVE COMMAND AND POSITION FEEDBACK AT EMS.
4. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL TO REMOTE START TERMINALS. PROVIDE RELAY AS REQUIRED.
5. ATC TO PROVIDE CURRENT TRANSDUCER TO SENSE AMPERAGE ON LINE SIDE OF POWER SERVICE TO MONITOR STATUS. PROVIDE NEW POINT WIRING FROM CURRENT TRANSDUCER. PROVIDE MINIMUM AMPERAGE LIMIT FOR ON / OFF STATUS INDICATION.
6. ATC TO PROVIDE WIRING FOR VFD SPEED COMMAND AND SPEED FEEDBACK. MONITOR AT EMS.
7. ATC TO HARD WIRE VFD ALARM TO EMS FOR MONITORING.
8. ATC TO MAP VIA SERIAL INTERFACE THE AVAILABLE BACNET POINTS TO THE BAS GRAPHICS. OBTAIN BACNET REGISTRY FROM VFD MANUFACTURER. REVIEW FINAL MAPPED POINTS WITH OWNER AND ENGINEER
9. ATC TO PROVIDE ONICON BTU METER, REQUIRED ELECTRO INSERTION FLOW METER, AND IMMERSION TEMPERATURE SENSORS ON SUPPLY/RETURN PER DETAIL AND SPEC. MC TO PROVIDE PIPE TAPS AND ASSIST WITH INSTALLATION OF FLOW METER AND TEMP SENSORS. ATC TO MAP FOR EACH BTU METER VIA SERIAL INTERFACE THE AVAILABLE BACNET MS/TP POINTS TO THE BAS GRAPHICS. REVIEW FINAL MAPPED POINTS WITH OWNER AND ENGINEER.
10. ATC TO MAP BACNET MS/TP SERIAL POINTS TO BAS GRAPHICS SCREEN. MAP ALL AVAILABLE FAULT/ALARM CODES PER MODULE. MAP REFRIGERANT MONITOR PER MODULE. ATC SHALL OBTAIN THE FULL BACNET REGISTRY FROM THE EQUIPMENT MANUFACTURER. REVIEW FINAL MAPPED LIST WITH OWNER AND ENGINEER.
11. ATC TO HARDWIRE EQUIPMENT GENERAL ALARM FOR BAS MONITORING.
12. ATC SHALL FURNISH DPT FOR MC TO INSTALL IN PIPE ON INLET AND OUTLETS OF HW AND GW FROM DWH-1. ATC TO PROVIDE ALL POWER / CONTROL WIRING AS REQUIRED TO MONITOR AT BAS. INTERLOCK WITH MASTER CONTROLLER AT DWH-1
13. ATC SHALL FURNISH AND INSTALL TEMPERATURE AQUASTAT FOR EACH STORAGE TANKS (TYP. 6) AND ELECTRIC WATER HEATER. STAT SHALL BE INSTALLED HIGH AND LOW IN EACH TANK. ATC SHALL INSTALL WITHIN WELLS PROVIDE CONTROL WIRING TO MONITOR TEMPERATURES AT BAS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATIONS.
14. ATC SHALL FURNISH AND INSTALL CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS AND ALARM MONITORING. WRAP PUMP POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
15. PROVIDE FLOW METER ON SYSTEM. MC SHALL FURNISH AND INSTALL METER IN PIPING. ATC SHALL PROVIDE ALL CONTROLS POINTS, WIRING, INTEGRATION, TRENDING, AND ALARM FUNCTIONS ASSOCIATED WITH THE METER. COORDINATE OUTPUT SIGNAL, POWER REQUIREMENTS, AND BAS COMPATIBILITY.
16. ATC SHALL PROVIDE CONTROL WIRING TO MAP COMPRESSOR POINTS FROM HEATERS AS NECESSARY FOR BAS FOR MONITORING AND STAGING.

DOMESTIC HOT WATER SEQUENCE OF OPERATIONS:

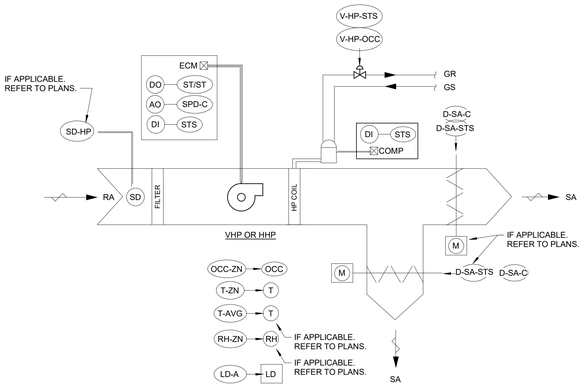
A. GENERAL
   1. DOMESTIC HOT WATER PLANT CONSISTS OF THE FOLLOWING EQUIPMENT:
      a. (2) WATER-TO-WATER DOMESTIC WATER HEAT PUMPS, SOURCED FROM A GEOTHERMAL WELLFIELD.
      b. (2) RECIRCULATION PUMPS AS REQUIRED FOR SYSTEM OPERATION.
      c. (1) DOMESTIC WATER RETURN PUMP FOR BUILDING
      d. (1) DOMESTIC WATER RETURN PUMP FOR KITCHEN
      e. (2) STORAGE TANKS
      f. (1) ELECTRIC RESISTANCE SWING TANK
      g. (2) THERMOSTATIC MIXING VALVES FOR BUILDING AND KTICHEN
   2. SYSTEM TO BE AUTOMATICALLY ENABLED THROUGH BMS CENTRAL HEAD END AND ABLE TO OPERATE 24/7 YEAR ROUND.
   3. (1) DOMESTIC WATER HEAT PUMPS SHALL BE ENABLED 24/7 TO MAINTAIN MINIMUM TANK TEMPERATURE AS REQUIRED FOR STANDBY DOMESTIC HOT WATER SERVICE.
   4. EQUIPMENT SHALL BE STAGED AND CYCLED TO MAINTAIN SUPPLY TEMPERATURE SETPOINT OF HYDRONIC LOOPS.
   5. BAS SHALL INTERFACE WITH PACKAGED CONTROLS ON PLANT EQUIPMENT AS FOLLOWS:
      a. BAS SHALL INTERFACE WITH EACH DWH-1/2 PACKAGED CONTROL PANELS THROUGH BACNET. COORDINATE NUMBER OF CONTROL PANEL RELAYS WITH EQUIPMENT VENDOR.
      b. BAS SHALL MONITOR AND TREND ELECTRIC RESISTANCE SWING TANK STATUS, ALARM, AND TANK TEMPERATURE.
      c. BAS SHALL MONITOR AND TREND DOMESTIC HOT WATER SUPPLY TEMPERATURE DOWNSTREAM OF BUILDING AND KITCHEN TMV
      d. BAS SHALL MONITOR AND TREND DOMESTIC HOT WATER RETURN TEMPERATURE FROM BUILDING AND KITCHEN LOOP.
      e. BAS SHALL START/STOP, TREND, AND MONITOR STATUS OF ALL CIRCULATION PUMPS (CP-1/2/3/4)
      f. BAS SHALL MONITOR DCW, DHW, KITCHEN DCW, AND KITCHEN DHW FLOWRATE INTO SYSTEM.

B. RUN CONDITIONS
   1. IN THE OCCUPIED MODE:
      a. THE MAIN BUILDING GEOTHERMAL PUMPS SHALL BE OPERATING AND BE PROVEN.
      b. UPON ACTIVATION FROM THE AUXILIARY INPUT FROM DWH-1/2 THE ISOLATION CONTROL VALVES ACV-3A AND ACV-3B SHALL OPEN AND BE PROVEN.
      c. CIRCULATOR PUMPS (CP-1 AND CP-2) SHALL BE OPERATING AND BE PROVEN. PUMPS SHALL OPERATE CONTINUOUSLY DURING OCCUPIED PERIODS. IF CURRENT SWITCH INDICATES PUMP ISSUE OR FAILURE, THEN AN ALARM SHALL BE GENERATED. A 30 SECOND (ADJ.) TIME DELAY RELAY SHALL BE PROVIDED TO PREVENT FALSE ALARMS. AFTER THE CAUSE OF THE ALARM HAS BEEN ELIMINATED, THE SYSTEM SHALL BE CAPABLE OF RESETTING AND RESTARTING THE PUMP.
      d. DWH-1 SHALL START AS REQUIRED AND OPERATION SHALL BE PROVED VIA LEAVING WATER TEMPERATURE.
      e. ELECTRIC RESISTANCE HEATER SHALL REMAIN ENABLED TO MAINTAIN MINIMUM TANK TEMPERATURE AS REQUIRED.
      f. P-3 SHALL BE DISABLED.
      g. THE SYSTEM SHALL NOT START IF ANY ONE COMPONENT DOES NOT PROVE OPERATION.
   2. IN THE UNOCCUPIED MODE:
      a. THE CIRCULATING PUMP P-3 SHALL BE OPERATING AND BE PROVEN.
      b. UPON ACTIVATION FROM THE AUXILIARY INPUT FROM DWH-1/2, THE ISOLATION CONTROL VALVES ACV-3A AND ACV-3B SHALL OPEN AND BE PROVEN.
      c. CIRCULATOR PUMPS (CP-1 AND CP-2) SHALL BE OPERATING AND BE PROVEN. PUMPS SHALL OPERATE CONTINUOUSLY DURING UNOCCUPIED PERIODS. IF CURRENT SWITCH INDICATES PUMP ISSUE OR FAILURE, THEN AN ALARM SHALL BE GENERATED. A 30 SECOND (ADJ.) TIME DELAY RELAY SHALL BE PROVIDED TO PREVENT FALSE ALARMS. AFTER THE CAUSE OF THE ALARM HAS BEEN ELIMINATED, THE SYSTEM SHALL BE CAPABLE OF RESETTING AND RESTARTING THE PUMP.
      d. DWH-1 SHALL START AS REQUIRED AND OPERATION SHALL BE PROVED VIA LEAVING WATER TEMPERATURE.
      e. THE ELECTRIC WATER HEATER SHALL BE OFF.
      f. MAIN GEOTHERMAL PUMPS SHALL BE DISABLED UNLESS CALL FOR UNOCCUPIED HEATING/COOLING VIA BAS.

C. TEMPERATURE CONTROL
   1. UNIT SHALL OPERATE TO PRODUCE DOMESTIC HOT WATER AS REQUIRED FOR SYSTEM OPERATION UNDER NORMAL CONDITIONS.
   2. DWH-1/2 SHALL DELIVER 140F (ADJ.) TO TANKS UNLESS OTHERWISE NOTED.
   3. TMV-1 HOT WATER SUPPLY TO BUILDING: 120F (ADJ.)
   4. TMV-2 HOT WATER SUPPLY TO KITCHEN: 140F (ADJ.)
   5. IF AFTER 15 MINUTES (ADJ.) THE SUPPLY WATER IS LESS THAN 5F (ADJ.) BELOW SETPOINT, THEN THE ADDITIONAL MODULE SHALL OPERATE TO ASSIST IN REACHING SUPPLY SETPOINT, ETC. ONCE SETPOINT IS REACHED, THE MODULE SHALL STAGE ON/OFF AS REQUIRED THERE SHALL BE A 10 MINUTE (ADJ.) TIME DELAY BEFORE AN ADDITIONAL MODULE CAN BE STAGED ON OR OFF.

D. MAKEUP WATER
   a. PROVIDE AND INSTALL FLOW METER, DDC PRESSURE SENSOR, AND PRESSURE GAUGE. FLOW METER SHALL BE NEPTUNE PULSE TYPE SCALED 0-10 GPM RANGE. THE DDC SYSTEM SHALL MONITOR TOTAL FLOW MAKE-UP VOLUME AND TREND MONTHLY. IF THE GEOTHERMAL LOOP MAKE-UP EXCEEDS 10 GPM OR CONSTANT WATER FLOW IS MEASURED, AN ALARM SHALL BE GENERATED LOCALLY AND THROUGH THE DDC SYSTEM

E. ALARMS
   a. ALARM IF THE DHW SUPPLY TEMPERATURE TO THE BUILDING OR KITCHEN IS +/- 5F (ADJ.) ABOVE OR BELOW SETPOINT FOR 15 MINUTES (ADJ.).
   b. ALARM ON FAILURE OF ANY DOMESTIC WATER PUMPS.
   c. ALARM ON DWH-1 COMMON FAULT
   d. ALARM ON EWH-1 COMMON FAULT
   e. ALARM ON EWH-1 HIGH TEMPERATURE CUT OUT TRIP
   f. ALARM IF ANY STORAGE TANK TEMPERATURE FALLS BELOW THE MINIMUM ALLOWABLE SETPOINT FOR 15 MINURES (ADJ.)



TWO STAGE WATER SOURCE HEAT PUMP CONTROL POINTS

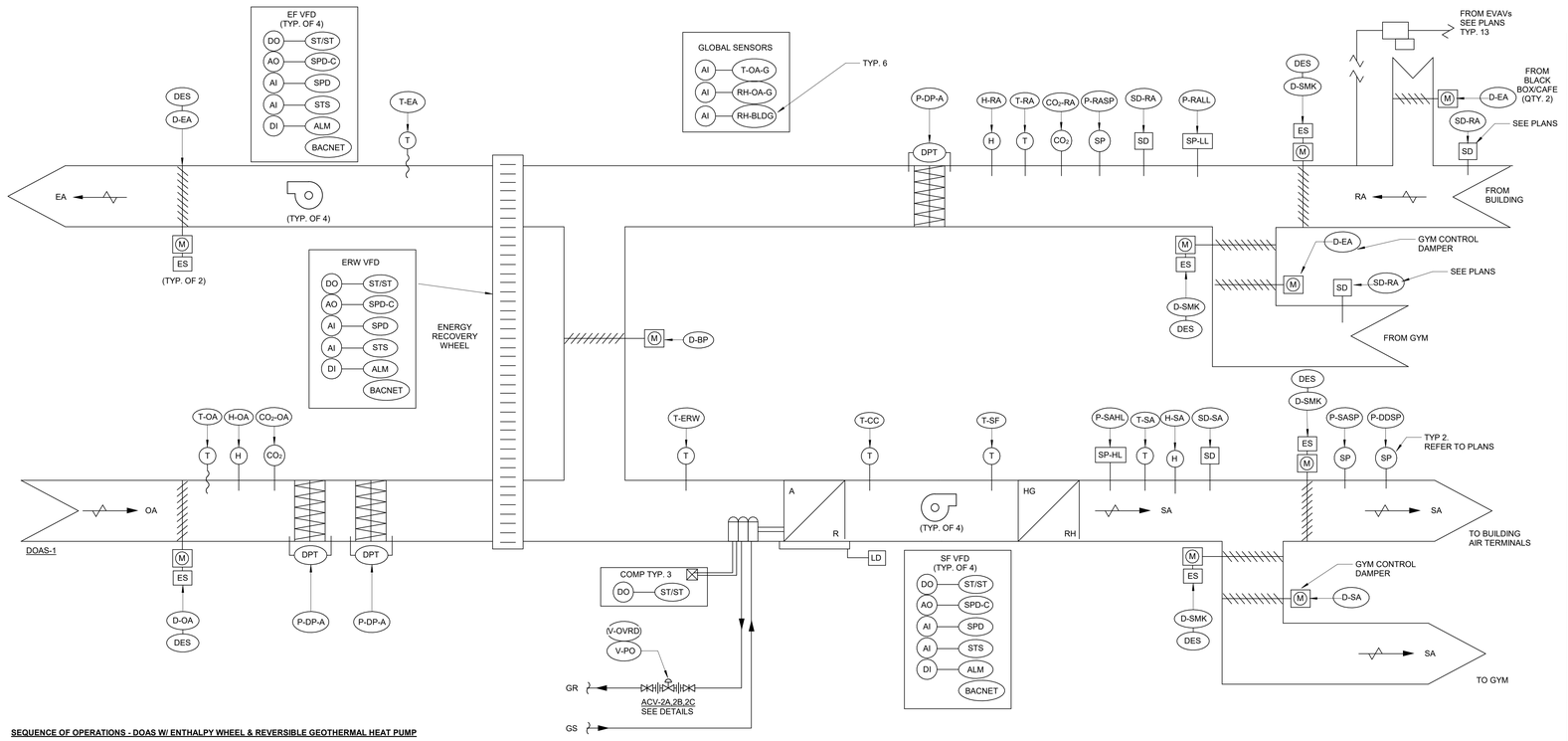
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	TWO-WAY CONTROL VALVE OPEN/CLOSE	V-HP-OC	AO				2
2	TWO-WAY CONTROL VALVE STATUS	V-HP-STS	AI				2
3	SPACE TEMPERATURE LOCAL #1	T-ZN	AI	X	X		1
4	SPACE TEMPERATURE LOCAL #2	T-AVG	AI	X	X		1
5	COMPRESSOR 1 STATUS	STS	DI			X	3
6	COMPRESSOR 2 STATUS	STS	DI			X	2
7	SUPPLY FAN(S) START / STOP	ST/ST	DO				4
8	SUPPLY FAN(S) STATUS	STS	DI			X	5
9	SUPPLY FAN(S) SPEED COMMAND	SPD-C	AO				13
10	OVERFLOW LEAK DETECTION	LD-A	DI			X	6
11	MOTORIZED CONTROL DAMPERS STATUS*	D-SA-STS	AI				7
12	MOTORIZED CONTROL DAMPERS COMMAND*	D-SA-C	AO				14
13	ZONE OCCUPANCY SENSOR	OCC-ZN	DI				8
14	GENERAL ALARM	ALARM	DI/DO			X	9
15	MAINTENANCE REQUIRED	ALARM	DI/DO			X	10

* REFER TO PLANS FOR SINGLE SPACES WITH MULTIPLE THERMOSTATS

POINT NOTES:
1. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS MONITORING. WRAP COMPRESSOR POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
2. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA FAN ECM. INSTALL NEW RELAY AS REQUIRED.
3. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS MONITORING. WRAP FAN POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING
4. ATC SHALL PROVIDE LEAK DETECTION IN ALL HORIZONTAL UNIT DRAIN PANS. ATC SHALL PROVIDE LEAK DETECTION IN ALL MECHANICAL ROOM CLOSETS CONTAINING VERTICAL HEAT PUMPS. PROVIDE CONTROL WIRING AND RELAY TO PRODUCE ALARM.
5. ATC SHALL PROVIDE WIRING AND RELAY FROM MOTORIZED CONTROL DAMPER TO BAS FOR DAMPER POSITION MONITORING.
6. DUAL CONTACT (FOR LIGHTING AND HVAC CONTROLS) OCCUPANCY SENSOR SHALL BE PROVIDED AND INSTALLED BY EC. SEE ELECTRICAL SPECS AND PLANS.
7. ATC SHALL MAP ALL APPLICABLE TROUBLESHOOTING ALARMS TO BAS, INCLUDING BUT NOT LIMITED TO A2L SIGNAL, COMPRESSOR TEMPERATURES AND PRESSURES, FREEZE FAULTS, LOW TEMP CUTOUTS AND ZONE SPACE CONDITIONS.
8. PROVIDE A GLOBAL RUNTIME CLOCK FOR ALL HEAT PUMPS. WHEN THE PRESET ACCUMULATED OPERATING HOURS ARE REACHED, THE BAS SHALL GENERATE A GLOBAL MAINTENANCE ALARM INDICATING THAT FILTER REPLACEMENT IS REQUIRED.
9. ATC SHALL PROVIDE STANDARD RELATIVE HUMIDITY SENSOR AND WIRE TO BAS FOR DEHUMIDIFICATION CONTROL.
10. PROJECT FA CONTRACTOR TO FURNISH SMOKE DETECTOR. PROJECT MC TO ASSIST IN FIELD MOUNTING OF SMOKE DETECTOR. PROJECT EC TO WIRE. ATC TO PROVIDE POINT WIRING FOR MONITORING.
11. ATC TO PROVIDE ANALOG SPEED COMMAND SIGNAL COMPATIBLE WITH ECM FAN TO MODUALATE SPEED. PROVIDE SIGNAL ISOLATION IF REQUIRED.
12. ATC TO PROVIDE MODULATING ACTUATORS AND FOR CONTROL DAMPER, PROVIDE ALL WIRING TO MONITOR DAMPER COMMAND AND POSITION FEEDBACK AT THE BAS.

SEQUENCE OF OPERATIONS:

A. GENERAL
   1. EACH UNIT SHALL OPERATE UNDER THE CONTROL OF A LOCAL, STAND-ALONE, MICROPROCESSOR-BASED DDC CONTROLLER FIELD INSTALLED WITHIN OR ADJACENT TO THE UNIT. THE UNIT'S DDC CONTROLLER SHALL BE PROGRAMMABLE AND INCLUDE ALL POINTS AND PROGRAMMING AS DESCRIBED HEREIN. THE ATC CONTRACTOR SHALL INSTALL AND HARD-WIRE AN L.E.D. PILOT LIGHT ON THE CONTROL PANEL FOR EACH HEAT PUMP. WHEN THE COMPRESSOR IS OPERATING, THE PILOT LIGHT SHALL BE ON.
   2. IF COMMUNICATION IS LOST BETWEEN THE NETWORK CONTROLLER AND THE HEAT PUMP CONTROLLER, THE HEAT PUMP CONTROLLER SHALL BE PLACED



SEQUENCE OF OPERATIONS - DOAS W/ ENTHALPY WHEEL & REVERSIBLE GEOTHERMAL HEAT PUMP

A. GENERAL
1. PROVIDE ALL I/O/V POINTS INDICATED ON THE CONTROL DIAGRAM AND AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATIONS.
2. ALL WIRE TERMINALS, DEVICES, GAUGES, AND WIRES SHALL BE IDENTIFIED WITHIN THE PANELS.
3. ALL POINTS SHALL BE ABLE TO INTEGRATE ALL TRENDS, TOTALIZATIONS, ETC. AS APPLICABLE.
4. ALL ALARMS SHALL BE SUPPRESSED DURING CONSTRUCTION.
5. OWNER AND ENGINEER SHALL REVIEW ALL GRAPHICS IN ATC SUBMITTAL PRIOR TO UPLOAD.
6. ALL ALARMS AS INDICATED ON THE DIAGRAMS AND IN THE SEQUENCE OF OPERATIONS SHALL BE GENERATED TO THE APPROPRIATE SERVER / WORKSTATIONS. ATC CONTRACTOR SHALL COORDINATE WITH OWNER FOR CRITICAL ALARMS THAT CAN BE RELAYED VIA TEXT MESSAGE OR EMAIL.
7. ALL SETPOINTS SHALL BE ADJUSTABLE AT THE OPERATOR BAS FRONT END WORKSTATIONS.
8. END SWITCHES SHALL BE HARDWIRED TO RELAYS FOR START/STOP COMMANDS. THE END SWITCH CIRCUIT MUST BE MET PRIOR TO ENABLING SA, EA, OR RA FANS.

B. EQUIPMENT SUMMARY
1. DOAS-1 IS A HEATING/COOLING OUTSIDE AIR HANDLING UNIT WITH ENERGY RECOVERY. KEY COMPONENTS INCLUDE: ENTHALPY WHEEL, (4) SUPPLY FANS, (4) EXHAUST FANS, AIR TO REFRIGERANT WATER SOURCE HEAT PUMP COIL WITH HOT GAS REHEAT.
2. DOAS-1 IS LOCATED ON THE ROOF OF THE MAIN LEVEL OF HILLCREST MIDDLE SCHOOL. THE UNIT DISTRIBUTES FRESH OUTSIDE AIR THROUGHOUT THE BUILDING WHILE RECOVERING HEAT FROM THE EXHAUST AIR STREAM.
3. DOAS UNIT SHALL BE PROVIDED WITH FACTORY PACKAGE CONTROLS, INCLUDING ALL REQUIRED UNIT MICROPROCESSORS, SAFETIES, SENSORS, ACTUATORS, AND INTERNAL CONTROL DEVICES. ATC CONTRACTOR SHALL PROVIDE DDC INTERFACE TO DOAS PACKAGE CONTROLLER ONLY.

C. OCCUPANCY SCHEDULE
1. THE DOAS SHALL BE PLACED INTO THE OCCUPIED/UNOCCUPIED MODE BASED UPON THE USER ADJUSTABLE SCHEDULE AT THE NETWORK CONTROLLER. THIS SYSTEM SHALL BE IN THE OCCUPIED MODE DURING REGULAR SCHOOL HOURS ONLY.
2. IF COMMUNICATION IS LOST BETWEEN THE NETWORK CONTROLLER AND THE DOAS CONTROLLER, THEN THE DOAS SHALL BE PLACED INTO THE UNOCCUPIED MODE UNTIL COMMUNCATION IS RESTORED.
3. THE SYSTEM WILL BE PLACED INTO A MODE OF OPERATION BASED UPON THE FOLLOWING ADJUSTABLE TEMPERATURE SCHEDULE:
   a. IF OAT IS 72F (ADJ.) OR GREATER, THE UNIT SHALL BE IN COOLING MODE.
   b. IF OAT IS BETWEEN 50F (ADJ.) AND 72F (ADJ.), THE UNIT SHALL BE IN ECONOMIZING MODE.
   c. IF OAT IS 50F (ADJ.) OR LESS, THE UNIT SHALL BE IN HEATING MODE.
4. IN THE UNOCCUPIED MODE OR FREEZESTAT (LOW LIMIT) MODE:
   a. THE SUPPLY AND EXHAUST FANS SHALL BE OFF.
   b. THE ENERGY RECOVERY WHEEL SHALL BE OFF, WITH WHEEL BYPASS DAMPERS CLOSED.
   c. THE OUTSIDE, SUPPLY, RETURN, AND EXHAUST AIR DEAMPERS SHALL BE FULLY CLOSED.
5. IN THE OCCUPIED MODE, THE FOLLOWING SHALL OCCUR IN SEQUENTIAL ORDER:
   a. THE OUTSIDE, SUPPLY, RETURN, AND EXHAUST AIR DAMPERS SHALL BE FULLY OPEN AND BE PROVED VIA END SWITCH.
   b. THE ENERGY RECOVERY WHEEL SHALL ACTIVATE AND PROVE OPERATION. WHEEL BYPASS DAMPERS SHALL REMAIN CLOSED.
   c. THE SUPPLY FAN/VFD AND EXHAUST FAN/VFD SHALL START AND OPERATION SHALL BE PROVED VIA CURRENT TRANSDUCERS.
   d. THE SYSTEM SHALL NOT START IF ANY ONE COMPONENT DOES NOT PROVE OPERATION.

D. DISCHARGE AIR TEMPERATURE CONTROL
1. IN THE OCCUPIED MODE, THE ONBOARD CONTROLS SHALL ENGAGE COMPRESSORS (TYP. 3) AND MODULATE GEOTHERMAL WATER VALVES (TYP. 3) AS REQUIRED TO ENABLE DX COIL TO COOL OR HEAT IN ORDER TO MAINTAIN A DISCHARGE AIR TEMPERATURE BASED ON FOLLOWING SCHEDULE:
   a. COOLING MODE: 65F (ADJ.)
   b. ECONOMIZING MODE: VARIES
   c. HEATING MODE: 60F (ADJ.)
2. WHEN THE OAT IS BETWEEN 55F (ADJ.) AND 72F (ADJ.), THE ENERGY RECOVERY WHEEL SHALL MODULATE TO MAINTAIN DAT WITHOUT OVER HEATING/COOLING. .

E. DEHUMIDIFICATION
1. WHEN THE AVERAGE SPACE RELATIVE HUMIDITY, AS CALCULATED FROM THE SIX (6) SPACE RH SENSORS, EXCEEDS 65% RH FOR MORE THAN 15 MINUTES, (ADJ), THE DOAS FACTORY PACKAGE CONTROLLER SHALL ENABLE DEHUMIDIFICATION MODE.
2. DURING DEHUMIDIFICATION MODE, THE DOAS FACTORY PACKAGE CONTROLLER SHALL ENABLE COMPRESSORS AS REQUIRED TO MAINTAIN A COOLING COIL LEAVING AIR TEMPERATURE OF 52°F, ADJUSTABLE. HOT GAS REHEAT SHALL MODULATE AS REQUIRED TO REHEAT SUPPLY AIR TO A FINAL DISCHARGE AIR TEMPERATURE OF 65F, ADJUSTABLE, WHILE DEHUMIDIFICATION MODE IS ACTIVE.
3. WHEN THE AVERAGE SPACE RELATIVE HUMIDITY IS BELOW 55% RH FOR MORE THAN 5 MINUTES, ADJUSTABLE, THE DOAS FACTORY PACKAGE CONTROLLER SHALL DISABLE DEHUMIDIFICATION MODE AND RETURN THE DOAS TO NORMAL OPERATION.

F. STATIC PRESSURE CONTROL & RESET
1. THE SUPPLY AIR STATIC PRESSURE SENSOR (LOCATED AT THE DISCHARGE OF DOAS-1) SHALL BE DETERMINED DURING THE TESTING AND BALACING PROCESS BASED ON THE STATIC PRESSURE THAT SUCCESSFULLY SATSIFIES THE DESIGN AIRFLOW OF DOWNSTREAM TERMINAL DEVICES. THE INITIAL SETPOINT SHALL BE 3" W.C. (ADJ.)
2. THERE SHALL BE (2) DOWN DUCT STATIC PRESSURE SENSORS INSTALLED: REFER TO THE MECHANICAL AIR DISTRIBUTION PLANS FOR LOCATIONS. REVIEW FINAL INSTALLED LOCATION WITH OWNER AND ENGINEER.
3. THE DOWN DUCT STATIC PRESSURE SENSOR SETPOINTS SHALL BE DETERMINED DURING THE TESTING AND BALANCING PROCESS. THE INITIAL SETPOINT SHALL BE 1.8" W.C. (ADJ.). THE DOAS-1 SUPPLY FANS SHALL WORK TO SATISFY THE WORST CASE DUCT STATIC SENSOR SUCH THAT ALL (3) STATIC PRESSURE SETPOINTS ARE SATSIFIED.
4. THE BAS SHALL CONTINUOUSLY MONITOR THE POSITION OF ALL TERMINAL DEVICE DAMPERS AND RESET THE SUPPLY AIR STATIC PRESSURE SETPOINT TO MINIMIZE FAN ENERGY USAGE. THE SUPPLY AIR STATIC PRESSURE SETPOINT SHALL BE RESET SO THAT THE MOST OPEN BOX HAS A DAMPER POSITION OF 95% OPEN (ADJ.). THE STATIC PRESSURE SETPOINT SHALL BE RESET BETWEEN ADJUSTABLE LIMINTS DETERMINED BY THE TAB CONTRACTOR. LIMITS SHALL BE REVIEWED AND APPROVED BY THE OWNER, ENGINEER, AND CX AGENT.
5. PROVIDE A GRAPHIC SCREEN THAT DISPLAYS ALL VAV BOX DAMPER POSITIONS AND AIRFLOW FOR OPERATOR REFERENCE.
6. BALANCING: THE DOAS IS DESIGNED WITH A HIGH LEVEL OF DIVERSITY. COORDINATE WITH THE TAB CONTRACTOR TO DETERMINE THE STATIC PRESSURE SETPOINTS TO OBTAIN OVERALL SYSTEM DESIGN AIRFLOWS.

G. SUPPLY AND EXHAUST FAN OPERATION
1. STATUS MONITORING
   a. THE BAS SHALL MONITOR THE STATUS OF THE SUPPLY AND EXHAUST FANS VIA THE RESPECTIVE CURRENT TRANSDUCERS. ANY TIME ONE FAN IS ENABLED AND AFTER A 20 SECOND (ADJ.) TIME DELAY THE CURRENT TRANSDUCER DOES NOT PROVE FAN OPERATION, AN ALARM SHALL BE INITIATED.
   b. WHEN THE AIRFLOW STATION ASSOCIATED WITH A FAN DOES NOT SENSE FLOW, AN ALARM SHALL BE INITIATED.
2. SUPPLY FAN CONTROL
   a. THE SUPPLY FAN VARIABLE SPEED SHALL MODULATE BASED ON THE STATIC PRESSURE RESET SEQUENCE DESCRIBED ABOVE.
3. EXHAUST FAN CONTROL
   a. THE EXHAUST FANS SHALL BE CONTROLLED BY THEIR VFDS BASED ON A FIELD DETERMINED SUPPLY FAN OFFSET OF +/-10% VIA PROGRAMMED CFM OFFSET FROM AFFINITY LAWS. EXHAUST VARIABLE AIR VOLUME BOXES SHALL OPERATE PER THE SEQUENCES.
   b. THE EXHAUST FANS SHALL TRACK THE OUTSIDE AIR FAN VIA THE OFFSET ABOVE, AND SHALL MAINTAIN A 3,000 CFM OFFSET TO MAINTAIN A POSITIVE BUILDING PRESSURIZATION.

H. EXHAUST VARIABLE AIR VOLUME TERMINAL BOXES
1. THERE SHALL BE EXHAUST VARIABLE AIR VOLUME TERMINAL BOXES (EVAV) COLLECTING EXHAUST THROUGHOUT THE BUILDING. REFERENCE PLANS AND SCHEDULES FOR THE LOCATION / QUANTITY OF ALL EVAVS AND DUCT ROUTING OF EXHAUST. THE EVAVS SHALL MAINTAIN MAX CFMS AS SHOWN ON THE SCHEDULES. THE EVAV SHALL MODULATE IN RESPONSE TO THE OUTSIDE AIR VAVS IN ORDER TO MAINTAIN A POSITIVE BUILDING PRESSURIZATION.
2. EACH EVAV SHALL INCLUDE DDC CONTROLLER AND PRESSURE PORT TO MAINTAIN MINIMUM CONSTANT TOILET EXHAUST REQUIREMENTS.

I. ENERGY RECOVERY WHEEL OPERATION
1. DURING NORMAL OPERATIONS THE ENERGY WHEEL SHALL RUN AT A CONSTANT SPEED (ADJ.).
2. THE ENERGY WHEEL SEQUENCE SHALL BE DISABLED IF THE OUTSIDE AIR DRY BULB TEMPERATURE IS BELOW 70F (ADJ.) AND THE OUTSIDE AIR ENTHALPY IS BELOW THE RETURN AIR ENTHALPY FOR MORE THAN 15 MINUTES (ADJ.). THE BAS SHALL DISABLE THE HEAT WHEEL WHILE OPENING THE BYPASS DAMPERS.
3. WHEN THE OUTSIDE AIR ENTHALPY IS GREATER THAN THE RETURN AIR ENTHALPY FOR MORE THAN 15 MINUTES (ADJ.), THE ENERGY WHEEL BYPASS SHALL CLOSE AND THE WHEEL ENABLED. ENERGY WHEEL CONTROL SHALL ALSO BE LOCKED OUT IF THE OUTSIDE AIR DRY BULB TEMPERATURE RISES ABOVE 70F (ADJ.)
4. WHEN THE OUTSIDE AIR TEMPERATURE FALLS BELOW 5F (ADJ.), THE WHEEL SHALL SLOW TO 25% OF DESIGN FOR A PERIOD OF 3 MINUTES TO PREVENT FREEZING OF AIR STREAM. IT SHALL DO THIS EVERY 60 MINUTES.

J. GYMNASIUM VENTILATION OPERATION
1. DURING NORMAL OPERATION THE GYM SHALL BE SERVED BY VAV-08 IN MECHANICAL MEZZANINE AT 655 CFM. THE EXHAUST CONTROL DAMPER SERVING THE GYM SHALL BE SET TO MINIMUM (580 CFM)
2. DURING EVENT MODE PUSH BUTTON OR ELEVATED CO2 LEVELS (1500PPM) THE VAV-08 SHALL CLOSE 100% AND THE OUTSIDE AIR DAMPER SERVING THE DEDICATED GYM BRANCH SHALL OPEN TO 100% (8000 CFM) AND THE EXHAUST CONTROL DAMPER SHALL OPEN TO 100% (7100 CFM).

K. BLACK BOX VENTILATION OPERATION
1. DURING NORMAL OPERATION THE BLACK BOX SHALL BE SERVED BY VAV-10-2.40C AT 485 CFM. THE EXHAUST CONTROL DAMPER SERVING THE BLACK BOX SHALL BE SET TO MINIMUM (435 CFM)
2. DURING EVENT MODE PUSH BUTTON OR ELEVATED CO2 LEVELS (1500PPM) THE VAV-12-2.40A, VAV-12-2.40B, AND VAV-10-2.40C SHALL OPEN TO MAXIMUM 100% (4500 CFM TOTAL) AND THE EXHAUST CONTROL DAMPER SHALL OPEN TO 100% (4000 CFM).

L. EMERGENCY POWER OPERATION
1. WHEN BUILDING IS OPERATING ON EMERGENCY POWER AND OUTDOOR AIR TEMPERATURE IS BELOW 35F. (ADJ), THE DOAS SHALL OPERATE IN EMERGENCY POWER HEATING MODE.
2. UPON ENABLE, THE ENERGY WHEEL BYPASS DAMPER SHALL OPEN 100% AND BE PROVEN OPEN. ONCE PROVEN THE EA AND OA DAMPER SHALL CLOSE AND END SWITCHES SHALL BE PROVEN SHUT.
3. ONCE DAMPER POSITIONS ARE PROVEN, THE DOAS SHALL START AND OPERATE SUPPLY AND RETURN/EXHAUST FANS AT MAXIMUM AVAILABLE SPEED, SUBJECT TO THE EMERGENCY POWER STAGING REFER TO EMERGENCY POWER STAGING SEQUENCE FOR EQUIPMENT START DELAYS.
4. THE DOAS SHALL ENABLE HEATING AND MAINTAIN A SUPPLY AIR TEMPERATURE SETPOINT OF 85°F, ADJUSTABLE, WHILE IN EMERGENCY POWER HEATING MODE.
5. UPON ENABLE OF EMERGENCY POWER HEATING MODE, ASSOCIATED AIR TERMINAL UNITS SHALL BE COMMANDED TO THE FOLLOWING MINIMUM DAMPER POSITIONS:
   a. TYPICAL VAV BOXES: 50% OPEN
   b. GYMNASIUM VAV BOX / DAMPER: 75% OPEN
   c. CAFETERIA VAV BOXES: 65% OPEN
   d. KITCHEN VAV BOXES: 65% OPEN
   e. BLACK BOX VAV BOXES: 65% OPEN
6. SPACE TEMPERATURE CONTROL SHALL BE TEMPORARILY OVERRIDDEN WHILE IN EMERGENCY POWER HEATING MODE. VAV TERMINAL UNITS SHALL MAINTAIN THE ABOVE MINIMUM DAMPER POSITIONS UNLESS OTHERWISE LIMITED BY LIFE SAFETY, SMOKE CONTROL, OR EQUIPMENT PROTECTION SEQUENCES.
7. EMERGENCY POWER HEATING MODE SHALL DISABLE WHEN NORMAL POWER IS RESTORED OR WHEN OUTDOOR AIR TEMPERATURE RISES ABOVE THE EMERGENCY HEATING DISABLE SETPOINT, ADJUSTABLE. UPON DISABLE, DOAS AND AIR TERMINAL UNITS SHALL RETURN TO NORMAL OCCUPIED OR UNOCCUPIED CONTROL, AS APPLICABLE.

M. SAFETIES
1. UPON ACTIVATION OF ANY DUCT MOUNTED SMOKE DETECTOR, THE SIGNAL SHALL BE SENT TO THE FIRE ALARM SYSTEM AND THE SUPPLY AND EXHAUST FANS SHALL SHUT DOWN, ALL VAVS SHALL CLOSE, AND HEAT PUMP SHALL BE DISABLED. UPON CORRECTION OF THE PROBLEM, THE SYSTEM SHALL BE RESET AND SHALL RETURN TO NORMAL OPERATION. COORDINATE WITH THE FIRE ALARM SYSTEM/CONTRACTOR. ANY ACTIVATION OF THE BUILDING'S FIRE ALARM SYSTEM SHALL SHUTDOWN THE DOAS COMPLETELY.
2. HIGH / LOW STATIC PRESSURE ALARMS
   a. DUCT STATIC PRESSURE SWITCHES SHALL SHUT DOWN THE UNIT WHEN HIGH STATIC PRESSURE EXCEEDS 5" W.C. (ADJ.) POSITIVE PRESSURE. DUCT STATIC PRESSURE SWITCHES SHALL SHUT DOWN THE UNIT WHEN LOW STATIC PRESSURE EXCEEDS -3.5" W.C. (ADJ.). SWITCHES SHALL HAVE MANUAL RESET.
   b. WHEN SUPPLY OR EXHAUST FANS ARE SHUT DOWN ON LOW OR HIGH STATIC PRESSURE SAFETIES, AN ALARM SHALL BE INITIATED AT THE BAS FRONT END COMPUTER AND THE LOCAL CONTROL PANEL.
3. HIGH / LOW SUPPLY TEMPERATURE ALARMS
   a. IF THE UNIT SUPPLY TEMPERATURE DROPS BELOW 35F (ADJ.), THE UNIT CONTROLLER SHALL SHUT DOWN THE UNIT AFTER AN ADJUSTABLE TIME DELAY, INITIALLY 5 MINUTES (ADJ.).
   b. IF THE UNIT SUPPLY TEMPERATURE RISES ABOVE 120F (ADJ.), THE UNIT CONTROLLER SHALL SHUT DOWN THE UNIT AFTER AN ADJUSTABLE TIME DELAY, INITIALLY 5 MINUTES (ADJ.).
4. UPON ACTIVATION OF THE CONDENSATE PAN OVERFLOW SWITCH THE UNIT CONTROLLER SHALL SHUT DOWN THE UNIT AFTER AN ADJUSTABLE TIME DELAY, INITIALLY 5 MINUTES (ADJ.)
5. FOLLOWING A SAFETY SHUT DOWN MODE OF OPERATION, A MANUALLY INITIATED RESTART COMMAND SHALL RESTART THE SYSTEM AS PREVIOUSLY OUTLINED.

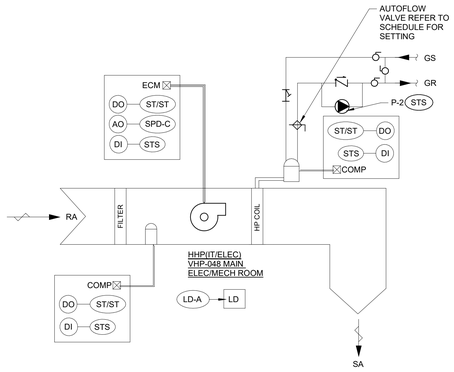
N. ALARMS
1. ALARM IF THE SUPPLY AIR STATIC PRESSURE DROPS 25% (ADJ.) BELOW SETPOINT FOR 15 MINUTES (ADJ.)
2. ALARM IF THE DAT DROPS OR RISES 5F (ADJ.) BELOW / ABOVE SETPOINT FOR 15 MINUTES (ADJ.)
3. ALARM IF THE DAMPER COMMAND DOES NOT MATCH DAMPER STATUS.
4. ALARM IF THE FAN COMMAND DOES NOT MATCH FAN STATUS.
5. ALARM IF DP ACROSS THE OA INTAKE OR RETURN FILTER IS ABOVE 1.25" W.C. (ADJ.) FOR 15 MINUTES (ADJ.)
6. ALARM IF THE CONDENSATE PAN OVERFLOW SWITCH IS ACTIVATED.
7. FOR ALL TEMPERATURE AND HUMIDITY SENSOR TRANSMITTERS, ALARM IF THE SENSOR IS REPORTING A VALUE INDICATING THE SENSOR HAS FAILED.
8. IF THE AVERAGE SPACE RELATIVE HUMIDITY, AS CALCULATED FROM THE SIX (6) SPACE RH SENSORS, EXCEEDS 70% RH FOR MORE THAN 30 MINUTES, ADJUSTABLE, THE BAS SHALL GENERATE A HIGH SPACE HUMIDITY ALARM.

OUTSIDE AIR SYSTEM (DOAS-1) POINTS LIST

POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	OUTSIDE AIR DAMPER COMMAND	D-OA-C	DO				1
2	OUTSIDE AIR DAMPER OPEN POSITION	DES	DI			X	1
3	OUTSIDE AIR DAMPER CLOSED POSITION	DES	DI			X	1
4	OUTSIDE AIR INLET TEMPERATURE	T-OA	AI				2
5	OUTSIDE AIR INLET HUMIDITY	H-OA	AI				3
6	OUTSIDE AIR INLET CO_2 PPM	CO_2-OA	AI				4
7	FILTER DIFFERENTIAL PRESSURE (TYP. OF 2)	P-DP-A	AI		X		5
8	ERW BYPASS DAMPER COMMAND	D-BP-C	AO				1
9	ERW BYPASS DAMPER POSITION	D-BP	AI			X	1
10	ERW LEAVING AIR TEMPERATURE	T-ERW	AI	X	X		2
11	BUILDING RELATIVE HUMIDITY (TYP. 6)	RH-BLDG	AI		X		7
12	COMPRESSOR STATUS (TYP. OF 3)	COMP-STS	DI			X	22
13	GEOTHERMAL WATER VALVE % OPEN (TYP. OF 3)	V-PO	AO				6
14	GEOTHERMAL WATER VALVE OVERRIDE (TYP. OF 3)	V-OVRD	AI				6
15	CONDENSATE PAN OVERFLOW SWITCH	OS	DI			X	8
16	COIL LEAVING AIR TEMPERATURE	T-CC	AI	X	X		2
17	SF (TYP. OF 4) VFD START / STOP	ST/ST	DO				9
18	SF (TYP. OF 4) VFD STATUS	STS	AI			X	10
19	SF (TYP. OF 4) VFD SPEED COMMAND	SPD-C	AO				11
20	SF (TYP. OF 4) VFD SPEED FEEDBACK	SPD	AI				12
21	SF (TYP. OF 4) VFD ALARM	ALM	DI			X	13
22	SF (TYP. OF 4) VFD BACNET SERIAL POINTS		SERIAL				14
23	SUPPLY AIR STATIC PRESSURE HIGH LIMIT	P-SAHL	DI		X		15
24	SUPPLY AIR TEMPERATURE	T-SA	AI	X	X		2
25	SUPPLY AIR RELATIVE HUMIDITY	H-SA	AI		X		3
26	SUPPLY AIR SMOKE DETECTOR	SD-SA	DI			X	16
27	SUPPLY AIR SUPPLY AIR STATIC PRESSURE	P-SASP	AI	X	X		17
28	DOWN DUCT STATIC PRESSURE (TYP. OF 2)	P-DDSP	AI	X	X		18
29	RETURN AIR STATIC PRESSURE LOW LIMIT	P-RALL	DI	X			15
30	RETURN AIR SMOKE DETECTOR	SD-RA	DI			X	16
31	RETURN AIR STATIC PRESSURE	P-RASP	AI	X	X		17
32	RETURN AIR INLET CO_2 PPM	CO_2-RA	AI		X		4
33	RETURN AIR TEMPERATURE	T-RA	AI				2
34	RETURN AIR HUMIDITY	H-RA	AI				3
35	RA FILTER DIFFERENTIAL PRESSURE	P-DP-A	AI		X		5
36	ERW VFD START / STOP	ST/ST	DO				9
37	ERW VFD STATUS	STS	AI			X	10
38	ERW VFD SPEED COMMAND	SPD-C	AO				11
39	ERW VFD SPEED FEEDBACK	SPD	AI				12
40	ERW VFD ALARM	ALM	DI			X	13
41	ERW VFD BACNET SERIAL POINTS		SERIAL				14
42	EXHAUST AIR TEMPERATURE	T-EA	AI	X	X		2
43	EF (TYP. OF 4) VFD START / STOP	ST/ST	DO				9
44	EF (TYP. OF 4) VFD STATUS	STS	AI			X	10
45	EF (TYP. OF 4) VFD SPEED COMMAND	SPD-C	AO				11
46	EF (TYP. OF 4) VFD SPEED FEEDBACK	SPD	AI				12
47	EF (TYP. OF 4) VFD ALARM	ALM	DI			X	13
48	EF (TYP. OF 4) VFD BACNET SERIAL POINTS		SERIAL				14
49	GYM EA CONTROL DAMPER COMMAND	D-EA-C	DO				14
50	GYM EA CONTROL DAMPER POSITION	D-EA-P	DI			X	25
51	GYM SA CONTROL DAMPER COMMAND	D-SA-C	DO				25
52	GYM SA CONTROL DAMPER POSITION	D-SA-P	DI			X	25
53	BLACK BOX EA CONTROL DAMPER COMMAND	D-EA-C	DO				25
54	BLACK BOX EA CONTROL DAMPER POSITION	D-EA-P	DI			X	25
55	EVAV COMMAND (TYP. OF 13)	D-EA-C	AO				19
56	EVAV POSITION (TYP. OF 13)	D-EA	AI			X	19
57	EVAV CFM (TYP. OF 13)	A-EA	AI				19
58	SUM OF CONNECTED SA VAV TERMINAL UNITS	A-SA	CALC				20
59	RA SMOKE DAMPER COMMAND (TYP. OF 2)	D-SMK-C	DO				21
60	RA SMOKE DAMPER OPEN POSITION (TYP. OF 2)	DES	DI			X	21
61	RA SMOKE DAMPER CLOSED POSITION (TYP. OF 2)	DES	DI			X	21
62	SA SMOKE DAMPER COMMAND (TYP. OF 2)	D-SMK-C	DO				21
63	SA SMOKE DAMPER OPEN POSITION (TYP. OF 2)	DES	DI			X	21
64	SA SMOKE DAMPER CLOSED POSITION (TYP. OF 2)	DES	DI			X	21
65	GLOBAL OUTSIDE AIR TEMPERATURE	T-OA-G	AI				23
66	GLOBAL OUTSIDE AIR RELATIVE HUMIDITY	RH-OA-G	AI				24

POINT NOTES:

1. OUTSIDE AIR, ENTHALPY WHEEL OA BYPASS, ENTHALPY WHEEL EA BYPASS, EXHAUST AIR DAMPERS, AND SMOKE DAMPERS SHALL BE FURNISHED WITH UNIT BY MANUFACTURER. ATC SHALL FURNISH AND INSTALL TWO-POSITION ACTUATOR AND (2) END SWITCHES FOR THE OUTSIDE AIR AND EXHAUST AIR SMOKE DAMPERS. THE ATC SHALL FURNISH AND INSTALL MODULATING ACTUATORS FOR THE ENTHALPY WHEEL BYPASS DAMPERS AND ATC TO PROVIDE ALL CONTROL WIRING TO MONITOR DAMPER COMMAND AND POSITION FEEDBACK AT THE BAS.
2. THE ATC SHALL FURNISH AND INSTALL ALL THE FOLLOWING TEMPERATURE SENSORS: OUTSIDE AIR TEMPERATURE, HOT GAS REHEAT, ERW LEAVING AIR TEMPERATURE, COIL LEAVING AIR TEMPERATURE, SUPPLY AIR TEMPERATURE, RETURN AIR TEMPERATURE, AND EXHAUST AIR TEMPERATURE. ATC SHALL PROVIDE ALL CONTROL WIRING TO MONITOR TEMPERATURES AT THE BAS.
3. ATC TO FURNISH AND INSTALL DUCT MOUNTED RELATIVE HUMIDITY SENSORS AND PROVIDE ALL POINTS WIRING. HUMIDITY POINTS SHALL BE WIRED TO THE BAS FOR MONITORING.
4. ATC TO FURNISH AND INSTALL DUCT MOUNTED CARBON DIOXIDE SENSORS AND PROVIDE ALL POINT WIRING. CO2 POINTS SHALL BE WIRED TO THE BAS FOR MONITORING.
5. THE ATC SHALL FURNISH (3) DIFFERENTIAL PRESSURE TRANSMITTERS AND INSTALL ACROSS (2) OA MERV-13 FILTERS AND RA MERV-8 FILTER. ATC SHALL PROVIDE ALL CONTROL WIRING TO MONITOR CLEANLINESS STATUS AT BAS. ALARM IF DP RISES ABOVE 1.25" W.C. (ADJ.)
6. ATC TO FURNISH AND INSTALL 2-WAY MODULATING CONTROL VALVES WITH ELECTRIC ACTUATOR FOR MC TO INSTALL IN PIPE. ATC TO PROVIDE ALL POWER AND CONTROL WIRING FOR VALVE. VALVES SHALL BE WIRED TO THE BAS. ATC TO PROVIDE ALL POINT WIRING FOR VALVE POSITION FEEDBACK. VALVES MUST ACCEPT 0-10 VDC CONTROL SIGNAL WITH 24 VAC POWER SUPPLY.
7. INSTALL SIX (6) SPACE RELATIVE HUMIDITY SENSORS AT LOCATIONS INDICATED ON FLOOR PLANS. ATC SHALL PROVIDE, INSTALL, AND WIRE RH SENSORS TO BAS HEAD-END CONTROLLER. ATC SHALL AVERAGE ALL SIX (6) RH SENSOR READINGS AND UTILIZE AVERAGED RH VALUE IN DOAS DEHUMIDIFICATION CONTROL SEQUENCE.
8. ATC SHALL FURNISH AND INSTALL CONDENSATE PAN OVERFLOW SWITCH. ATC SHALL INSTALL AND PROVIDE ALL CONTROL WIRING TO MONITOR OVERFLOW ALARM AT BAS.
9. ATC PROVIDE START / STOP CONTROL VIA FAN VFD. WIRE DOAS-1 SAFETIES (LOW/HIGH PRESSURE SWITCHES, SMOKE DETECTORS, FREEZESTAT, DAMPER END SWITCHES, SMOKE DAMPERS, ETC.) IN SERIES WITH START / STOP CONTROL CIRCUIT SO THEY CANNOT BE BYPASSED BY BAS CONTROL.
10. ATC TO FURNISH AND INSTALL CURRENT TRANSDUCER TO SENSE AMPERAGE AT LINE SIDE OF FAN STARTER. DETERMINE MINIMUM AMP VALUE FOR ALARMING AND STATUS MONITORING. FAN STATUS SHALL BE MONITORED BY THE BAS. PROVIDE SCOPE FOR EACH FAN.
11. ATC TO PROVIDE 4-20 mA OUTPUT SIGNAL TO VFD TO CONTROL / COMMAND SPEED OF THE DEVICE. PROVIDE SIGNAL ISOLATION IF REQUIRED.
12. ATC TO PROVIDE CONTROL WIRING FOR MONITORING VFD SPEED FEEDBACK AT THE BAS.
13. ATC TO HARDWIRE VFD ALARM TO BAS FOR MONITORING.
14. ATC TO MAP FOR EACH VFD VIA SERIAL INTERFACE THE AVAILABLE BACNET POINTS TO THE BAS GRAPHICS. REVIEW FINAL MAPPED POINTS WITH ENGINEER.
15. THE ATC SHALL FURNISH AND INSTALL HIGH SUPPLY DUCT STATIC SWITCH AND LOW RETURN DUCT STATIC SWITCH. ATC TO ADJUST SUPPLY HIGH STATIC SWITCH TO 5" W.C. (ADJ.) ATC TO ADJUST RETURN LOW STATIC SWITCH TO -3.5" W.C. (ADJ.) WIRE IN SERIES TO SHUTDOWN FANS AND FOR DDC MONITORING ON GRAPHICS.
16. PROJECT FA CONTRACTOR TO FURNISH SMOKE DETECTOR. PROJECT MC TO ASSIST IN FIELD MOUNTING OF SMOKE DETECTOR. PROJECT EC TO WIRE SMOKE DETECTOR. ATC TO PROVIDE POINT WIRING TO MONITOR.
17. THE ATC SHALL FURNISH AND INSTALL SUPPLY AIR (DISCHARGE) AND RETURN AIR STATIC PRESSURE SENSORS. ATC SHALL INSTALL AND PROVIDE ALL CONTROL WIRING TO MONITOR SUPPLY AIR STATIC PRESSURE AND RETURN AIR STATIC PRESSURE AT THE BAS.
18. ATC TO FURNISH AND INSTALL (2) ELECTRONIC AIR STATIC PRESSURE SENSORS (RANGE = 0-5" W.C.) IN THE SUPPLY AIR DUCT PER THE MECHANICAL PLANS. CONFIRM FINAL AIR SENSING LOCATIONS WITH ENGINEER. ATC SHALL PROVIDE ALL CONTROL WIRING TO MONITOR STATIC PRESSURES AT BAS.
19. MC SHALL FURNISH AND INSTALL EXHAUST AIR VARIABLE AIR VOLUME TERMINAL BOXES WITH INTEGRAL AIRFLOW MEASURING CONTROL DAMPER PACKAGE. PROVIDE FOR EACH LOCATION SHOWN ON PLAN. INSTALL WITH STRAIGHT DUCT LENGTH INLET/OUTLET PER MANUFACTURER'S RECOMMENDATION. ATC SHALL PROVIDE ALL CONTROL AND POWER WIRING TO MONITOR THE AIRFLOW AND DAMPER POSITION COMMAND, POSITION FEEDBACK, AND AIRFLOW CFM AT THE BAS. REFER TO PLANS AND CONTROL CHART FOR SIZE AND MIN/MAX AIRFL





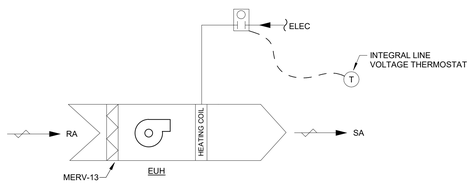
GEOTHERMAL HEAT PUMP POINTS LIST (IT/ELEC/MECH ROOMS)							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	SUPPLY FAN(S) START / STOP	ST/ST	DO				1
2	SUPPLY FAN(S) STATUS	STS	DI			X	2
3	SUPPLY FAN(S) SPEED COMMAND	SPD-C	AO				9
4	COMPRESSOR(S) START/STOP	ST/ST	DO			X	3
5	COMPRESSOR(S) STATUS	STS	DI				4
6	ZONE TEMPERATURE	T-ZN	AI	X	X		5
7	GENERAL ALARM	ALARM	DI/DO				10
8	LEAK DETECTION	LD-A	DI			X	6
9	P-2 RECIRC PUMP START/STOP	P-ST/ST	DO				7
10	P-2 RECIRC PUMP STATUS	P-STS	DI			X	8

POINT NOTES:

1. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA FAN ECM. INSTALL NEW RELAY AS REQUIRED.
2. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS MONITORING. WRAP FAN POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
3. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA COMPRESSOR. INSTALL NEW RELAY AS REQUIRED.
4. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS MONITORING. WRAP COMPRESSOR POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
6. ATC SHALL PROVIDE STANDARD TEMPERATURE SENSOR. PROVIDE SETPOINT CONTROL FOR USER ADJUSTABILITY WITHIN LIMITS.
7. ATC SHALL PROVIDE LEAK DETECTION IN ALL HORIZONTAL UNIT DRAIN PANS. ATC SHALL PROVIDE LEAK DETECTION IN ALL MECHANICAL ROOM CLOSETS CONTAINING VERTICAL HEAT PUMPS. PROVIDE CONTROL WIRING AND RELAY TO PRODUCE ALARM.
8. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL TO REMOTE START TERMINALS. PROVIDE RELAY AS REQUIRED.
9. ATC TO PROVIDE CURRENT SWITCH TO SENSE AMPERAGE ON LINE SIDE OF POWER SERVICE TO MONITOR STATUS. PROVIDE NEW POINT WIRING FROM CURRENT SWITCH. PROVIDE MINIMUM AMPERAGE LIMIT FOR ON / OFF STATUS.
10. ATC TO PROVIDE ANALOG SPEED COMMAND SIGNAL COMPATIBLE WITH ECM FAN TO MODULATE SPEED. PROVIDE SIGNAL ISOLATION IF REQUIRED.
11. ATC SHALL MAP ALL APPLICABLE TROUBLESHOOTING ALARMS TO BAS, INCLUDING BUT NOT LIMITED TO A2L SIGNAL, COMPRESSOR TEMPERATURES AND PRESSURES, FREEZE FAULTS, LOW TEMP CUTOUTS AND ZONE SPACE CONDITIONS.

SEQUENCE OF OPERATIONS:

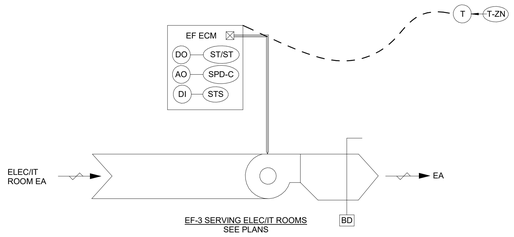
A. GENERAL
   1. SCOPE OF WORK IS APPLICABLE TO VHP-048 SERVING MAIN MECHANICAL ROOM AND HHP'S SERVING IT/ELECTRICAL ROOMS
   2. UNITS IN THIS CONTROL SEQUENCE SHALL BE ENABLED 24/7 AND MAINTAIN CONSTANT ZONE TEMP OF 75F (ADJ).
B. OPERATING MODE (COOLING ONLY)
   1. COOLING: IF THE ROOM TEMPERATURE RISES ABOVE THE ROOM TEMPERATURE SETPOINT, THE HEAT PUMP SHALL OPERATE AS REQUIRED TO SATISFY THE SPACE TEMPERATURE SETPOINT 75F (ADJ).
   2. HEATING MODE SHALL BE LOCKED OUT AT THE UNIT CONTROLLER PRIOR TO TURNOVER.
C. RECIRICULATING PUMPS SHALL BE ENABLED WHEN MAIN GEOTHERMAL PUMPS ARE DISABLED TO MAINTAIN MINIMUM FLOW THROUGH FREEZER/COOLER CONDENSERS. TAB BALANCER SHALL BALANCE VARI-SPEED MOTOR AS PART OF START UP. PUMPS SHALL OPERATE AT CONSTANT SPEED ONCE BALANCED.
D. ALARMS
   1. ALARM IF ZONE TEMPERATURE RISES / DROPS 5F (ADJ.) ABOVE OR BELOW ZONE TEMPERATURE SETPOINT.
   2. ALARM IF FAN COMMAND DOES NOT MATCH STATUS, AND VICE VERSA.
   3. ALARM IF THE LEAK DETECTOR IS PROVEN.
   4. RECIRCULATING PUMPS SHALL ALARM WHEN PUMP STATUS DOES NOT MATCH COMMAND AND MAIN GEOTHERMAL PUMPS SHALL BE ENABLED.



ELECTRIC UNIT HEATER:

SEQUENCE OF OPERATIONS:

A. GENERAL
   1. THE ATC SHALL PROVIDE ALL LOCAL CONTROL WIRING AS REQUIRED FOR THE UNIT TO OPERATE ON STANDALONE LOCAL CONTROLS. THE UNIT SHALL NOT BE MONITORED ON THE BAS.
B. RUN CONDITIONS
   1. THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
      a. OCCUPIED MODE: THE UNIT SHALL MAINTAIN A 70F (ADJ.) HEATING SETPOINT.
      b. UNOCCUPIED MODE: THE UNIT SHALL MAINTAIN A 60F (ADJ.) HEATING SETPOINT.
C. FAN
   1. THE FAN SHALL RUN ANYTIME THE ZONE TEMPERATURE IS BELOW THE HEATING SETPOINT, UNLESS SHUTDOWN ON SAFETIES.
D. ELECTRIC HEAT
   1. THE INTERNAL CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND ENABLE THE HEATING COIL TO MAINTAIN SPACE HEATING SETPOINT.
   2. HEATING SHALL BE ENABLED WHENEVER:
      a. OUTSIDE AIR TEMPERATURE IS LESS THAN 55F (ADJ.)
      b. AND THE ZONE TEMPERATURE IS BELOW HEATING SETPOINT
   3. SETPOINT SHALL BE ADJUSTABLE LOCALLY AT THE UNIT.
E. SAFETIES
   1. THE UNIT SHALL BE FURNISHED WITH AN INTEGRAL THERMAL CUTOVER FOR OVERHEAT PROTECTION. REFER TO SCHEDULES.



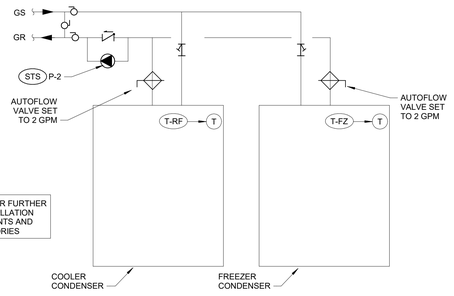
ELEC/IT ROOM EXHAUST FAN WITH EC MOTOR POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	FAN START / STOP	ST/ST	DO				1
2	FAN SPEED COMMAND	SPD-C	AO				2
3	FAN STATUS	STS	DI			X	3
4	ZONE TEMPERATURE SENSOR	T-ZN	AI	X	X		4

POINT NOTES:

1. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA FAN ECM. INSTALL NEW RELAY AS REQUIRED. ATC SHALL INTERLOCK FAN START / STOP CONTROL WITH THE ART ROOM WALL MOUNTED EXHAUST FAN WALL TIMER SWITCH/KNOB. TURNING SWITCH ON SHALL ENABLE EXHAUST FAN TO START. SWITCH/KNOB SHALL BE SEPARATE AND INDEPENDENT OF ANY LIGHTING OR TEMPERATURE CONTROLS FOR ROOM.
2. ATC TO PROVIDE ANALOG SIGNAL TO FAN EC MOTOR FOR FAN SPEED CONTROL.
3. ATC TO PROVIDE AND INSTALL CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS AND ALARM MONITORING. WRAP FAN POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
4. ATC SHALL PROVIDE TEMPERATURE SENSOR.

SEQUENCE OF OPERATIONS:

A. VARIOUS ELEC/IT ROOM SHALL BE SERVED BY A DEDICATED EXHAUST FAN INTERLOCKED WITH ZONE TEMPERATURE SENSOR.
B. EXHAUST FAN SHALL BE FURNISHED WITH BACKDRAFT DAMPER AND ECM MOTOR.
C. ATC SHALL INTERLOCK THE FAN START / TOP CONTROL SIGNAL WITH THE ZONE TEMPERATURE SENSOR. ONCE TEMPERATURE IS ABOVE SETPOINT 80F (ADJ) FOR 5 MINUTES (ADJ) THE BMS SHALL ENABLE EXHAUST FAN TO START. FAN SHALL AUTOMATICALLY DE-ENERGIZE TEMPERATURE REACHES SETPOINT FOR 10 MINUTES (ADJ).
D. REFER TO PLANS FOR DUCT ROUTING AND EXHAUST DISCHARGE LOCATION.
E. ALARMS
   1. BMS SHALL ALARM IF ZONE TEMPERATURE IS ABOVE SETPOINT FOR 20 MINUTES (ADJ)
   2. BMS SHALL ALARM IF FAN IS COMMANDED TO START, BUT STATUS IS OFF AND VICE VERSA.
   3. BMS SHALL ALARM IF THE EF HAS BEEN RUNNING FOR 6 HOURS (ADJ.) OR LONGER.



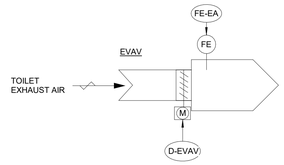
WATER COOLED REFRIGERATOR AND FREEZER POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	WALK IN COOLER TEMPERATURE	T-RF	AI				1
2	WALK IN COOLER LOW TEMP ALARM	ALM	DI	X			2
3	WALK IN COOLER HI TEMP ALARM	ALM	DI		X		2
4	WALK IN FREEZER TEMPERATURE	T-FZ	AI				1
5	WALK IN FREEZER LOW TEMP ALARM	ALM	DI	X			2
6	WALK IN FREEZER HI TEMP ALARM	ALM	DI		X		2
8	WALK IN COOLER RECIRC PUMP STATUS	STS	AI			X	3
9	WALK IN FREEZER RECIRC PUMP STATUS	STS	AI			X	3
10	WALK IN COOLER RECIRC PUMP START/STOP	P-ST/ST	DO				4
11	WALK IN FREEZER RECIRC PUMP START/STOP	P-ST/ST	DO				4

POINT NOTES:

1. ATC SHALL PROVIDE TEMPERATURE SENSOR FOR MONITORING AND ALARMING. TEMPERATURE SENSOR SHOULD BE CAPABLE OF RANGES APPROPRIATE FOR REFRIGERATORS AND FREEZERS.
2. ATC SHALL PROVIDE CONTROL WIRING TO ALARM IF REFRIGERATOR OR FREEZER TEMPERATURE EXCEEDS LOW OR HIGH OWNER ADJUSTABLE LIMITS. ALARM SHALL BE ANNUNCIATED AT THE FRONT END IF LIMITS ARE EXCEEDED.
4. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS AND ALARM MONITORING. WRAP PUMP POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
5. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL TO REMOTE START TERMINALS. PROVIDE RELAY AS REQUIRED.

SEQUENCE OF OPERATIONS:

A. GENERAL
   1. SCOPE OF WORK IS APPLICABLE TO (1) WALK IN COOLER AND (1) WALK IN FREEZER INSTALLED AS PART OF THIS PROJECT.
   2. ACCEPTABLE LIMITS CAN VARY BY SPECIFIC REFRIGERATOR OR FREEZER AND SHALL BE ADJUSTABLE.
C. RECIRCULATING PUMPS SHALL BE ENABLED WHEN MAIN GEOTHERMAL PUMPS ARE DISABLED TO MAINTAIN MINIMUM FLOW THROUGH FREEZER/COOLER CONDENSERS. TAB BALANCER SHALL BALANCE VARI-SPEED MOTOR AS PART OF START UP. PUMPS SHALL OPERATE AT CONSTANT SPEED ONCE BALANCED.
C. RECIRCULATING PUMPS SHALL ALARM WHEN PUMP STATUS DOES NOT MATCH COMMAND.



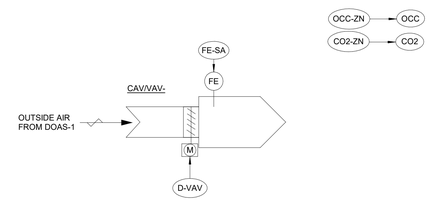
EVAV WITH DCV CONTROL (TYP.) POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	EXHAUST AIR FLOW ELEMENT	FE-EA	AI				1
2	EVAV DAMPER COMMAND	D-EVAV-C	AO				2
3	EVAV CFM OCCUPIED CONSTANT SETPOINT	EVAV-SP-OCC	AO				3

POINT NOTES:

1. EXTEND PRESSURE TUBING FROM TRANSDUCER AND PROVIDE SOFTWARE TO ESTABLISH K FACTOR.
2. ATC SHALL PROVIDE MODULATING ELECTRIC ACTUATOR AND MOUNT TO EVAV BOX. PROVIDE ALL CONTROL WIRING TO MONITOR EVAV DAMPER COMMAND AT EMS. TAB CONTRACTOR AND ATC SHALL WORK TOGETHER TO DETERMINE DAMPER POSITION TO ACHIEVE CONSTNANT DESIGN AIRFLOW RATE.
3. REFER TO EVAV BOX SCHEDULE FOR CFM SETPOINT. REFER TO PLANS. REFER TO SEQUENCE OF OPERATIONS. SETPOINT SHALL BE ADJUSTABLE.

SEQUENCE OF OPERATIONS:

A. GENERAL
   1. THE FOLLOWING SEQUENCE SHALL BE PROGRAMMED FOR EVAV BOXES THAT PROVIDE TOILET EXHAUST AIR FROM DOAS-1.
   2. THE EVAV BOXES WILL FOLLOW THE SCHEDULE OF DOAS-1.
   3. ATC SHALL BE RESPONSIBLE FOR PROVIDING FIELD MOUNTED EVAV BOX CONTROLLER TO ACCOMPLISH THE SEQUENCE OF OPERATIONS AND ACHIEVE ALL LISTED CONTROL POINTS.
B. OCCUPIED MODE: DOAS-1 ENABLED
   a. THE BAS SHALL MONITOR DAMPER COMMAND TO MAINTAIN CONSTANT AIRFLOW.
   b. THE ZONE EVAV SHALL BE BALANACED AT ITS MAXIMUM DAMPER POSITION WHEN EXHAUST FANS AT DOAS-1 ARE AT MINIMUM SPEED.
   c. UPON A SPEED AT THE DOAS EXHAUST FANS, THE EVAV SHALL MODULATE CLOSED TO AVOID OVER EXHAUSTING TO MAINTAIN CONSTANT AIR FLOW.
C. UNOCCUPIED MODE: DOAS-1 DISABLED
   a. THE ZONE EVAV BOX SHALL BE CLOSED (0 CFM) UNTIL DOAS-1 IS ENABLED
D. ALARMS
   1. THE BAS SHALL ALARM IF ZONE TEMPERATURE IS ABOVE SETPOINT BY 10% (ADJ) FOR 10 MINUTES (ADJ.)



CAV / VAV WITH DCV CONTROL (TYP.) POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	SUPPLY AIR FLOW ELEMENT	FE-SA	AI				1
2	VAV DAMPER COMMAND	D-VAV-C	AO				2
3	ZONE CARBON DIOXIDE LEVEL	CO2-ZN	AI		X		3
4	ZONE OCCUPANCY SENSOR	OCC-ZN	DI				4
5	VAV CFM OCCUPIED MINIMUM SETPOINT	VAV-SP-MIN-OCC	AO				5
6	VAV CFM OCCUPIED MAXIMUM SETPOINT	VAV-SP-MAX-OCC	AO				5
7	VAV CFM UNOCCUPIED SETPOINT	VAV-SP-UNOCC	AO				5
8	ZONE CARBON DIOXIDE SETPOINT	CO2-SP	AO				6

POINT NOTES:

1. EXTEND PRESSURE TUBING FROM TRANSDUCER AND PROVIDE SOFTWARE TO ESTABLISH K FACTOR.
2. ATC SHALL PROVIDE MODULATING ELECTRIC ACTUATOR AND MOUNT TO VAV BOX. PROVIDE ALL CONTROL WIRING TO MONITOR VAV DAMPER COMMAND AT EMS. TAB CONTRACTOR AND ATC SHALL WORK TOGETHER TO DETERMINE DAMPER POSITION TO ACHIEVE MIN/MAX DESIGN AIRFLOW RATE.
3. WHERE INDICATED ON PLANS, ATC TO PROVIDE COMBINATION TEMPERATURE AND CARBON DIOXIDE WALL THERMOSTAT. REFER TO SEQUENCES FOR INITIAL SETPOINTS. ALL SETPOINTS SHALL BE ADJUSTABLE. REFER TO PLANS FOR LOCATION. ZONE TEMPERATURE, CO2 LEVEL AND SETPOINTS SHALL BE DISPLAYED ON EACH ZONE GRAPHICS GRAPHICS SCREEN.
4. DUAL CONTACT (FOR LIGHTING AND HVAC CONTROLS) OCCUPANCY SENSOR SHALL BE PROVIDED AND INSTALLED BY EC. SEE ELECTRICAL SPECS AND PLANS.
5. REFER TO CAV/VAV BOX SCHEDULE FOR MIN/MAX CFM. REFER TO SEQUENCES.
6. REFER TO SEQUENCE OF OPERATIONS. SETPOINT SHALL BE ADJUSTABLE.

SEQUENCE OF OPERATIONS:

A. GENERAL
   1. THE FOLLOWING SEQUENCE SHALL BE PROGRAMMED FOR VAV/CAV BOXES THAT PROVIDE OUTSIDE VENTILATION AIR FROM DOAS-1.
   2. REFER TO PLANS FOR ZONES EQUIPPED WITH CO2 SENSOR.
   3. THE VAV/CAV BOXES WILL FOLLOW THE SCHEDULE OF DOAS-1.
   4. OCCUPANCY SHALL BE MONITORED VIA DUAL CONTACT OCCUPANCY SENSORS. REFER TO ELECTRICAL PLANS AND SPECS.
   5. TERMINAL BOXES LABELED 'CAV' SHALL BE THE SAME AS 'VAV' BUT WITH FIXED AIRFLOW AS INDICATED ON THE PLANS.
   6. ATC SHALL BE RESPONSIBLE FOR PROVIDING FIELD MOUNTED VAV BOX CONTROLLER TO ACCOMPLISH THE SEQUENCE OF OPERATIONS AND ACHIEVE ALL LISTED CONTROL POINTS.
   7. WHERE AVERAGING TEMPERATURE/CO2 WALL THERMOSTATS ARE INSTALLED, THE VAV SHALL CONTROL TO THE AVERAGE CO2 PPM LEVEL PER THE SEQUENCES BELOW.
   8. REFER TO M-7.06 FOR SEQUENCE OF OPERATIONS FOR VAV TERMINAL BOXES SERVING THE KITCHEN AND CAFETERIA.
B. OCCUPIED MODE: OCCUPANCY DETECTED VIA SENSOR
   1. ZONES EQUIPPED WITH CO2 SENSOR
      a. THE BAS SHALL MONITOR CO2 LEVEL IN EACH ZONE. THE INITIAL CO2 SETPOINT SHALL BE 900 PPM (ADJ.). THE VAV BOX WILL BE CONTROLLED TO KEEP THE ROOM CO2 LEVEL BELOW 700 PPM (ADJ.).
      b. THE ZONE VAV SHALL BEGIN AT ITS MINIMUM DAMPER POSITION.
      c. UPON A RISE IN CO2 ABOVE SETPOINT, THE VAV SHALL MODULATE OPEN TOWARDS ITS MAXIMUM DESIGN AIRFLOW.
      d. ONCE CO2 LEVEL FALLS 100 PPM (ADJ.) BELOW SETPOINT FOR 10 MINUTES (ADJ.), THE VAV SHALL MODULATE CLOSED TOWARDS ITS MINIMUM AIRFLOW.
   2. ZONES NOT EQUIPPED WITH CO2 SENSOR
      a. THE VAV BOX SHALL OPERATE AT ITS DESIGN MAXIMUM AIRFLOW WHILE OCCUPANCY IS DETECTED IN THE ZONE.
C. UNOCCUPIED MODE: OCCUPANCY NOT DETECTED VIA SENSOR
   1. ZONES EQUIPPED WITH CO2 SENSOR
      a. THE ZONE VAV BOX SHALL BE CLOSED (0 CFM) UNTIL OCCUPANCY IS DETECTED.
   2. ZONES NOT EQUIPPED WITH CO2 SENSOR
      a. THE ZONE VAV BOX SHALL BE CLOSED (0 CFM) UNTIL OCCUPANCY IS DETECTED.
D. ALARMS
   1. THE BAS SHALL ALARM IF ZONE CO2 LEVEL IS ABOVE 1,000 PPM (ADJ.) FOR 15 MINUTES (ADJ.).

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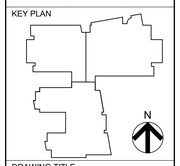
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL CONTROLS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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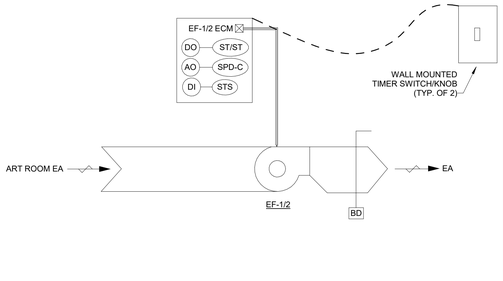
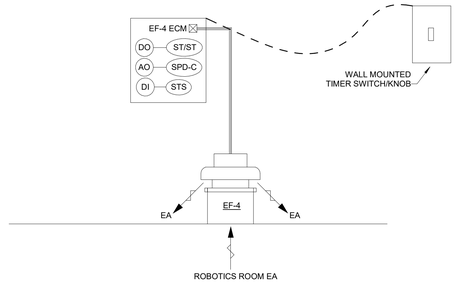




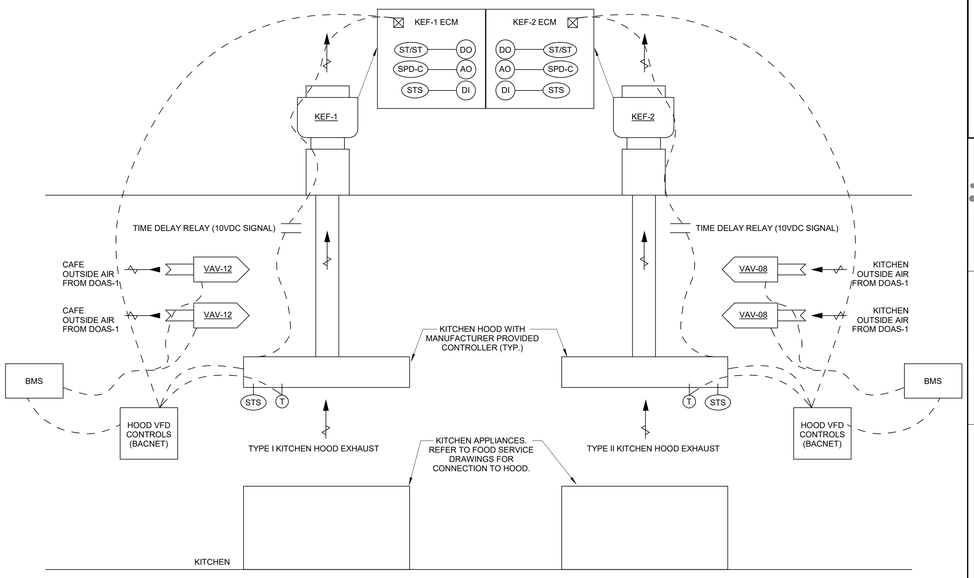
ART ROOM / 3D PRINTER EXHAUST FAN WITH EC MOTOR (EF-1, EF-2, AND EF-4) POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	FAN START / STOP	ST/ST	DO				1
2	FAN SPEED COMMAND	SPD-C	AO				2
3	FAN STATUS	STS	DI			X	3

POINT NOTES:

1. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA FAN ECM. INSTALL NEW RELAY AS REQUIRED. ATC SHALL INTERLOCK FAN START / STOP CONTROL WITH THE ART ROOM WALL MOUNTED EXHAUST FAN WALL TIMER SWITCH/KNOB. TURNING SWITCH ON SHALL ENABLE EXHAUST FAN TO START. SWITCH/KNOB SHALL BE SEPARATE AND INDEPENDENT OF ANY LIGHTING OR TEMPERATURE CONTROLS FOR ROOM.
2. ATC TO PROVIDE ANALOG SIGNAL TO FAN EC MOTOR FOR FAN SPEED CONTROL.
3. ATC TO PROVIDE AND INSTALL CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS AND ALARM MONITORING. WRAP FAN POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.

SEQUENCE OF OPERATIONS:

A. EACH ART ROOM AND ROBOTICS ROOM A141 SHALL BE SERVED BY A DEDICATED EXHAUST FAN INTERLOCKED WITH WALL TIMER SWITCH/KNOB.
B. EXHAUST FAN SHALL BE FURNISHED WITH BACKDRAFT DAMPER AND VARIGREEN ECM.
C. ATC SHALL INTERLOCK THE FAN START / TOP CONTROL SIGNAL WITH THE ART ROOM WALL MOUNTED TIMER SWITCH/KNOB. TURNING SWITCH ON SHALL ENABLE EXHAUST FAN TO START. THE TIMER SHALL BE FOR 1 HOUR (ADJ.), AND FAN SHALL AUTOMATICALLY DE-ENERGIZE AFTER TIME HAS EXPIRED.
D. REFER TO PLANS FOR DUCT ROUTING AND EXHAUST DISCHARGE LOCATION.
E. THERE SHALL BE (2) MODES THE ART ROOM B134 SHALL OPERATE UNDER:
   1. NORMAL CONDITIONS - EXHAUST FAN INACTIVE: ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE ROOMS SHALL BE SERVED FOR HEATING/COOLING PURPOSES BY THEIR RESPECTIVE HEAT PUMPS AND FOR FRESH AIR BY THE VAV.
      b. THE VAV SHALL MAINTAIN CO2 LEVELS PER THE SEQUENCE GIVEN ON M-7.04, AND MIN / MAX CFM AS GIVEN ON M-8.03.
      c. VAV SHALL OPERATE AT A MAX OF 425 CFM
      d. THE GENERAL RELIEF AIR SHALL MAINTAIN 385 CFM
   2. EXHAUST FAN ACTIVATED VIA WALL SWITCH/KNOB. ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE EXHAUST FAN SHALL BE MANUALLY ACTIVATED VIA THE WALL TIMER SWITCH/KNOB. EACH EF-1 SHALL OPERATE AT 240 CFM
      b. WHEN THE EXHAUST FANS IS ACTIVATED, THE ASSOCIATED VAV SHALL INCREASE TO 575 CFM.
      c. THE GENERAL RELIEF AIR SHALL MAINTAIN 385 CFM
   3. WHEN EXHAUST FAN TIMER EXPIRES, THE ASSOCIATED VAV SHALL RETURN TO NORMAL CONDITIONS.
F. THERE SHALL BE (2) MODES THE ART ROOM B228 AND KILN B228A SHALL OPERATE UNDER:
   1. NORMAL CONDITIONS - EXHAUST FAN INACTIVE: ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE ROOMS SHALL BE SERVED FOR HEATING/COOLING PURPOSES BY THEIR RESPECTIVE HEAT PUMPS AND FOR FRESH AIR BY THE VAV.
      b. THE VAV SHALL MAINTAIN CO2 LEVELS PER THE SEQUENCE GIVEN ON M-7.04, AND MIN / MAX CFM AS GIVEN ON M-8.03.
      c. VAV SHALL OPERATE AT A MAX OF 425 CFM
      d. THE GENERAL RELIEF AIR SHALL MAINTAIN 385 CFM
   2. EXHAUST FAN ACTIVATED VIA WALL SWITCH/KNOB. ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE EXHAUST FAN SHALL BE MANUALLY ACTIVATED VIA THE WALL TIMER SWITCH/KNOB. EACH EF-2 SHALL OPERATE AT 325 CFM.
      b. WHEN THE EXHAUST FANS IS ACTIVATED, THE ASSOCIATED VAV SHALL INCREASE TO 660 CFM.
      c. THE GENERAL RELIEF AIR SHALL MAINTAIN 385 CFM
   3. WHEN EXHAUST FAN TIMER EXPIRES, THE ASSOCIATED VAV SHALL RETURN TO NORMAL CONDITIONS.
G. THERE SHALL BE (2) MODES THE ROBOTICS ROOM A141 SHALL OPERATE UNDER:
   1. NORMAL CONDITIONS - EXHAUST FAN INACTIVE: ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE ROOMS SHALL BE SERVED FOR HEATING/COOLING PURPOSES BY THEIR RESPECTIVE HEAT PUMPS AND FOR FRESH AIR BY THE VAV.
      b. THE VAV SHALL MAINTAIN CO2 LEVELS PER THE SEQUENCE GIVEN ON M-7.04, AND MIN / MAX CFM AS GIVEN ON M-8.03.
      c. VAV SHALL OPERATE AT A MAX OF 385 CFM
      d. THE GENERAL RELIEF AIR SHALL MAINTAIN 345 CFM
   2. EXHAUST FAN ACTIVATED VIA WALL SWITCH/KNOB. ROOM CONDITIONS SHALL BE NEGATIVE. OFFSET SHALL BE -50 CFM.
      a. THE EXHAUST FAN SHALL BE MANUALLY ACTIVATED VIA THE WALL TIMER SWITCH/KNOB. EF-4 SHALL OPERATE AT 100 CFM.
      b. WHEN THE EXHAUST FANS IS ACTIVATED, THE ASSOCIATED VAV SHALL INCREASE TO 485 CFM.
      c. THE GENERAL RELIEF AIR SHALL MAINTAIN 345 CFM
H. ALARMS
   1. BMS SHALL ALARM IF FAN IS COMMANDED TO START, BUT STATUS IS OFF AND VICE VERSA.
   2. BMS SHALL ALARM IF THE EF HAS BEEN RUNNING FOR 6 HOURS (ADJ.) OR LONGER.



KITCHEN HOOD EXHAUST FAN (KEF-1 AND KEF-2) POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	TYPE I KITCHEN HOOD STATUS		SERIAL				1
2	KEF-1 START / STOP	ST/ST	DO				2
3	KEF-1 STATUS	STS	DI			X	3
4	KEF-1 SPEED COMMAND	SPD-C	AO				4
5	TYPE-I KITCHEN HOOD STATUS		SERIAL				1
6	KEF-2 START / STOP	ST/ST	DO				2
7	KEF-2 STATUS	STS	DI			X	3
8	KEF-2 SPEED COMMAND	SPD-C	AO				4
5	TYPE-II KITCHEN HOOD STATUS		SERIAL				1

POINT NOTES:

1. ATC TO INTEGRETE (BACNET) WITH KITCHEN HOOD CONTROLLER, PROVIDED BY HOOD MANUFACTURER, AND OBTAIN STATUS POINT. ANY LOCAL FIELD WIRING FOR CONTROLS FURNISHED WITH THE KITCHEN HOOD EQUIPMENT SHALL BE BY THE ATC UNDER SUPERVISION OF THE KITCHEN EQUIPMENT MANUFACTURER.
2. ATC TO PROVIDE HARD WIRED START / STOP CONTROL SIGNAL VIA FAN ECM. INSTALL NEW RELAY AS REQUIRED. ATC SHALL INTERLOCK FAN ECM MOTOR START / STOP CONTROL SIGNAL WITH THE KITCHEN HOOD OR DISHWASHER STATUS, SUCH THAT WHEN EQUIPMENT IS ON, THE ASSOCIATED EXHAUST FAN WILL ENABLE. FAN START / STOP CONTROL SIGNAL SHALL ALSO BE INTERLOCKED WITH THE OA VAV SERVING THE KITCHEN TO PROVIDE INCREASED OA CFM, PER THE SEQUENCES.
3. ATC TO PROVIDE AND INSTALL CURRENT SWITCH APPROPRIATELY SELECTEC FOR STATUS AND ALARM MONITORING. WRAP FAN POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
4. ATC TO PROVIDE 4-20mA OUTPUT SIGNAL TO FAN ECM TO CONTROL/COMMAND SPEED OF THE DEVICE. PROVIDE SIGNAL ISOLATION IF REQUIRED. TAB CONTRACTOR AND ATC CONTRACTOR SHALL WORK TOGETHER TO DETERMINE MINIMUM FAN SPEED TO ACHIEVE DESIGN AIRFLOW RATE.

SEQUENCE OF OPERATIONS:

A. KITCHEN EXHAUST FAN (KEF-1/2)
1. ATC AND TAB CONTRACTOR SHALL WORK TOGETHER TO DETERMINE MINIMUM FAN SPEED TO ACHIEVE DESIGN AIRFLOW.
2. ANY LOCAL FIELD WIRING FOR CONTROLS FURNISHED WITH THE KITCHEN HOOD EQUIPMENT SHALL BE BY THE ATC UNDER SUPERVISION OF THE KITCHEN EQUIPMENT MANUFACTURER.
3. EXHAUST AND MAKEUP AIR VAV TERMINALS ARE REQUIRED TO OPERATE PER CODE. WHEN HOOD IS IN USE OR INTERNAL SENSORS MEASURE HEAT, THE EXHAUST FAN SHALL START.
4. MAKEUP AIR VAV AIR TERMINALS SHALL OPERATE TO MAINTAIN 85% OF THE EXHAUST AIRFLOW. BASED ON VAV OPERATION BELOW.
5. THE KITCHEN EXHAUST SYSTEM IS A VARIABLE FLOW SYSTEM THAT SHALL OPERATE UNDER ITS OWN CONTROLS AND SHALL MODULATE THE EXHAUST FAN ECM ACCORDINGLY. TEMPERATURE SENSORS SHALL BE PROVIDED WITH THE SYSTEM AND INSTALLED BY THE ATC FOR EVERY 3 FEET OF HOOD. REFER TO THE FOOD SERVICE / KITCHEN EQUIPMENT DRAWINGS FOR MORE INFORMATION.
6. AS THE EXHAUST FAN ECM RAMPS UP AND DOWN SPEED/AIRFLOW WITH THE KITCHEN HOOD, THE MAKEUP VAV TERMINALS SHALL BE INTERCONNECTED AND RAMP UP AND DOWN SIMULTANEOUSLY TO MAINTAIN APPROPRIATE PRESSURIZATION.
7. THE KITCHEN HOOD SYSTEM SHALL BE INTERCONNECTED TO THE FIRE ALARM SYSTEM PROVIDED AT THE HOOD. UPON ACTIVATION OF FIRE OR SMOKE EVENT, THE MAKEUP AIR SHALL BE DEACTIVATED (100% CLOSED) AND THE EXHAUST FAN SHALL REMAIN IN OPERATION.
8. THE VARIABLE FLOW SYSTEM SHALL BE PROVIDED WITH A CONTROLLER THAT ACTIVATES HOOD EXHAUST AND LIGHTS UNDER THE HOOD. THE CONTROLLER SHALL HAVE BACNET INTERFACE CAPABILITIES. THE ATC SHALL PROVIDE FIELD CONNECTION AS REQUIRED TO THE BAS FOR BACNET MS/TP INTERFACE AND MONITORING. THE FOLLOWING POINTS ARE AVAILABLE TO MONITOR: ROOM TEMP, DUCT TEMP(S), MUA DISCHARGE TEMP, FAN SPEED, FAN AMPERAGE, FAN POWER, VFD FAULTS, CONTROLLER FAULTS, FAN FAULTS, FAN STATUS, PCU FAULTS, PCU FILTER CLOG PERCENTAGES, FIRE CONDITION, CORE FIRE SYSTEM, BUILDING PRESSURES, PREP TIME BUTTON, FANS BUTTON, LIGHTS BUTTON, WASH BUTTON. REFER TO THE FOOD SERVICE / KITCHEN EQUIPMENT DRAWINGS FOR MORE INFORMATION.
9. WHEN HOOD IS 'OFF', EXHAUST SHALL BE OFF (AFTER A PREDETERMINED TIME DELAY, INITIALLY 2 MINUTES (ADJ.) AND MAKEUP VAVS SHALL OPERATE PER THE SEQUENCES PROVIDED.
10. KEF-1 SHALL OPERATE AT 1,330 CFM
11. KEF-2 SHALL OPERATE AT 1,870 CFM
11. ALARMS
   a. ALARM IF THE FAN IS COMMANDED ON, BUT STATUS IS OFF AND VICE VERSA.
   b. ALARM IF THE KITCHEN HOOD STATUS IS ON, BUT FAN COMMAND AND/OR STATUS IS OFF.

B. VAV OPERATION
1. NORMAL OPERATION OF CAFETERIA (2) VAV-12 SHALL BE A MINIMUM CFM OF 510 EACH (1020 TOTAL) AND A MAXIMUM CFM OF 1450 EACH (2900 TOTAL). THEY SHALL OPERATE BASED ON KITCHEN HOOD EXHAUST OPERATION AND CO2 LEVELS WITHIN ZONE.
2. NORMAL OPERATION OF KITCHEN (1) VAV-08 SHALL BE A MINIMUM CFM OF 300 (ADDITIONAL VAV-08 REMAINS CLOSED IN NORMAL OPERATION) AND (2) VAV-08 SHALL OPERATE AT A MAXIMUM CFM OF 650 EACH (1300 TOTAL). THEY SHALL OPERATE BASED ON KITCHEN HOOD EXHAUST OPERATION.
3. UPON ACTIVATION OF KEF-1 BY HOOD STATUS, THE (2) VAV-12 SERVING CAFETERIA SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 775 CFM EACH (1550 TOTAL). AND THE (2) VAV-08 SERVING THE KITCHEN SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 340 CFM EACH (680 TOTAL).
4. UPON ACTIVATION OF KEF-2 BY HOOD STATUS, THE (2) VAV-12 SERVING CAFETERIA SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 940 CFM EACH (1880 TOTAL). AND THE (2) VAV-08 SERVING THE KITCHEN SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 405 CFM EACH (810 TOTAL).
5. UPON ACTIVATION OF KEF-1 AND KEF-2 BY HOOD STATUS. THE (2) VAV-12 SERVING CAFETERIA SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 1450 CFM EACH (2900 TOTAL). AND THE (2) VAV-08 SERVING THE KITCHEN SHALL BE SET TO MAINTAIN A CONSTANT AIR VOLUME OF 650 CFM EACH (1300 TOTAL).
6. DISABLING OF THE EXHAUST FANS AFTER THE APPLICABLE ADJUSTABLE TIME DELAYS DESCRIBED ABOVE SHALL ALLOW THE (2) VAV-12 AND (2) VAV-08 TO RETURN TO NORMAL OPERATION.

C. EAD-3 OPERATION
1. EAD-3 SHALL MODULATE TO MAINTAIN CONSTANT VOLUME OF 940 CFM OF GENERAL EXHAUST AIR AT ALL TIME IN ALL MODES OF OPERATION.

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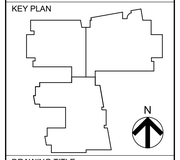
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL CONTROLS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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EMERGENCY POWER POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	GENERATOR STATUS	GEN-STS	DI			X	1
2	GENERATOR ALARM	GEN-ALM	DI			X	2
3	ATS NORMAL	ATS-NORM	DI			X	3
4	ATS STAND BY	ATS-STBY	DI			X	3

POINT NOTES:

1. ATC SHALL PROVIDE POINT WIRING FROM GENERATOR CONTROLLER TO BAS FOR MONITORING AND RUN STATUS.
2. ATC SHALL WIRE TO GENERATOR CONTROL PANEL ALARM CONTACTS. ALARM SHALL BE MONITORED AT THE BAS.
3. ATC SHALL MONITOR ATS NORMAL AND STAND-BY POSITION AT THE BAS.

GENERATOR MONITORING:

1. THE CONTROLLER SHALL MONITOR THE GENERATOR. GENERATOR STATUS AND GENERAL FAULT SHALL BE HARDWIRED POINTS, AND THE BAS SHALL MONITOR ALL OTHER POINTS VIA BACNET INTERFACE. THE ATC SHALL CARRY SCOPE TO MAP UP TO (25) SERIAL INTERFACE POINTS (BACNET MSTP OR IP OR MODBUS, TO BE FINALIZED WITH GENERATOR SELECTION) WITH THE ATC TO PROVIDE ANY NECESSARY GATEWAY. ATC SHALL COORDINATE WITH THE GENERATOR MANUFACTURER FOR FULL POINTS LIST REQUIRED AND MAPPED POINTS TO BE REVIEWED BY ENGINEER AND OWNER DURING SUBMITTAL PHASE.

ELECTRICAL INFRASTRUCTURE POINTS LIST				
POINT #	POINT DESCRIPTION	LOCATION	POINT TYPE	NOTES
1	MAIN SWITCHBOARD SWBD-1 METER	ELECTRICAL ROOM B004A	SERIAL	1
2	EGAUGE SUBMETER (DATA DROP) - SWBD-1	ELECTRICAL ROOM B004A	SERIAL	2
3	EGAUGE SUBMETER (DATA DROP) - SWBD-1	ELECTRICAL ROOM B004A	SERIAL	2
4	EGAUGE SUBMETER (DATA DROP) - DP-L1B	ELECTRICAL ROOM B004A	SERIAL	2
5	EGAUGE SUBMETER (DATA DROP) - DP-L1B	ELECTRICAL ROOM B004A	SERIAL	2
6	EGAUGE SUBMETER (DATA DROP) - EP-H1OSB	ELECTRICAL ROOM B004A	SERIAL	2
7	EGAUGE SUBMETER (DATA DROP) - M-H1B	ELECTRICAL ROOM B004A	SERIAL	2
8	EGAUGE SUBMETER (DATA DROP) - EP-H1LSB	EMERGENCY ELECTRICAL ROOM B005B	SERIAL	2
9	EGAUGE SUBMETER (DATA DROP) - EP-H1LSB	EMERGENCY ELECTRICAL ROOM B005B	SERIAL	2
10	EGAUGE SUBMETER (DATA DROP) - EP-H1LRB	EMERGENCY ELECTRICAL ROOM B005B	SERIAL	2
11	EGAUGE SUBMETER (DATA DROP) - EP-H2LSB	EMERGENCY ELECTRICAL ROOM A147C	SERIAL	2
12	EGAUGE SUBMETER (DATA DROP) - EP-H2LSB	EMERGENCY ELECTRICAL ROOM A147C	SERIAL	2
13	EGAUGE SUBMETER (DATA DROP) - L-H2B	ELECTRICAL ROOM A147D	SERIAL	2
14	EGAUGE SUBMETER (DATA DROP) - DP-H2B	ELECTRICAL ROOM A147D	SERIAL	2
15	EGAUGE SUBMETER (DATA DROP) - DP-H2B	ELECTRICAL ROOM A147D	SERIAL	2
16	EGAUGE SUBMETER (DATA DROP) - DP-H2B	ELECTRICAL ROOM A147D	SERIAL	2
17	EGAUGE SUBMETER (DATA DROP) - DP-L2B	ELECTRICAL ROOM A147D	SERIAL	2
18	EGAUGE SUBMETER (DATA DROP) - DP-L2B	ELECTRICAL ROOM A147D	SERIAL	2
19	EGAUGE SUBMETER (DATA DROP) - DP-L2B	ELECTRICAL ROOM A147D	SERIAL	2
20	EGAUGE SUBMETER (DATA DROP) - EP-H2LSA	EMERGENCY ELECTRICAL ROOM A122B	SERIAL	2
21	EGAUGE SUBMETER (DATA DROP) - EP-H2LSA	EMERGENCY ELECTRICAL ROOM A122B	SERIAL	2
22	EGAUGE SUBMETER (DATA DROP) - DP-H2C	MECHANICAL ROOM B123	SERIAL	2
23	EGAUGE SUBMETER (DATA DROP) - DP-H2C	MECHANICAL ROOM B123	SERIAL	2
24	EGAUGE SUBMETER (DATA DROP) - DP-L2C	MECHANICAL ROOM B123	SERIAL	2
25	EGAUGE SUBMETER (DATA DROP) - DP-H2A	GYM MECHANICAL MEZZANINE	SERIAL	2
26	EGAUGE SUBMETER (DATA DROP) - DP-H2A	GYM MECHANICAL MEZZANINE	SERIAL	2
27	EGAUGE SUBMETER (DATA DROP) - L-H2A	GYM MECHANICAL MEZZANINE	SERIAL	2
28	EGAUGE SUBMETER (DATA DROP) - DP-L2A	GYM MECHANICAL MEZZANINE	SERIAL	2
29	TOTAL PV SYSTEM (DATA DROP)	ROOF	SERIAL	2

POINT NOTES:

1. PROJECT EC TO FURNISH NEW ELECTRIC METER. ATC SHALL MAP VIA SERIAL INTERFACE THE AVAILABLE BACNET / MODBUS POINTS FROM NEW METER. FINAL MAPPED POINTS TO BE REVIEWED WITH OWNER AND ENGINEER. OBTAIN SERIAL REGISTRY FROM METER MANUFACTURER.
2. THE PROJECT EC SHALL PROVIDE SUBMETERING (BOD- EGAUGE ENERGY METERING SYSTEM) FOR THE BUILDING WITH CTS AT PANELS/SWITCHGEAR DEFINED ON E-400 - ELECTRICAL ONE-LINE DIAGRAM. THE EC SHALL PROVIDE 3-PHASE CTS AT EACH PANEL/SWITCHGEAR AND TOTAL LOADS PER CATEGORY FOR FINAL READOUTS. THE ATC SHALL PROVIDE INTERFACE WITH THE SUBMETERS AS REQUIRED TO DISPLAY GRAPHICS FOR EACH ACCORDINGLY ON THE BAS. EACH METER SHALL BE PROVIDED WITH FIELD CALIBRATION VERIFICATION SHEET.
   a. TOTAL HVAC SYSTEM
   b. INTERIOR LIGHTING
   c. EXTERIOR LIGHTING
   d. PLUG LOADS
   e. KITCHEN LOADS
   f. THEATER LOADS
   g. BUILDING OPERATIONS / MISCELLANEOUS LOADS
   h. ELEVATOR LOAD

PLUMBING EQUIPMENT POINTS LIST							
POINT #	POINT DESCRIPTION	POINT NAME	POINT TYPE	ALARM LO	ALARM HI	ALARM OFF / NORMAL	NOTES
1	ELEVATOR SUMP PUMP (ESP-1) STATUS	STS	DI				1
2	ELEVATOR SUMP PUMP (ESP-1) FLOAT SWITCH	FS	DI			X	2
3	MAIN CITY WATER METER SERIAL INTERFACE		SERIAL				3
4	ELEVATOR SUMP PUMP (ESP-2) STATUS	STS	DI				1
5	ELEVATOR SUMP PUMP (ESP-2) FLOAT SWITCH	FS	DI			X	2

POINT NOTES:

1. ATC TO PROVIDE CURRENT SWITCH APPROPRIATELY SELECTED FOR STATUS MONITORING. WRAP PUMP POWER WIRE THROUGH SWITCH SEVERAL TIMES FOR ACCURATE READING.
2. SUMP PUMP SHALL BE FURNISHED BY MANUFACTURER WITH INTEGRAL FLOAT OPERATED MECHANICAL SWITCH, NO EXTERNAL CONTROL REQUIRED. ATC SHALL PROVIDE ALL CONTROL WIRING TO MONITOR FLOAT SWITCH AT THE BAS.
3. THE TOWN SHALL PROVIDE CLAMP ON PULSE METER TO MEASURE MAIN CITY WATER COMING INTO THE BUILDING. PC SHALL INSTALL METER. THE ATC SHALL PROVIDE ALL PROGRAMMING TO MAP VIA SERIAL INTERFACE THE NEW METER CONSUMPTION / FLOW (GALLONS) TO THE BAS GRAPHICS.

ENERGY SUMMARY REPORT

1/1/2024 12:00AM TO 1/1/2025 12:00AM (MONTH)

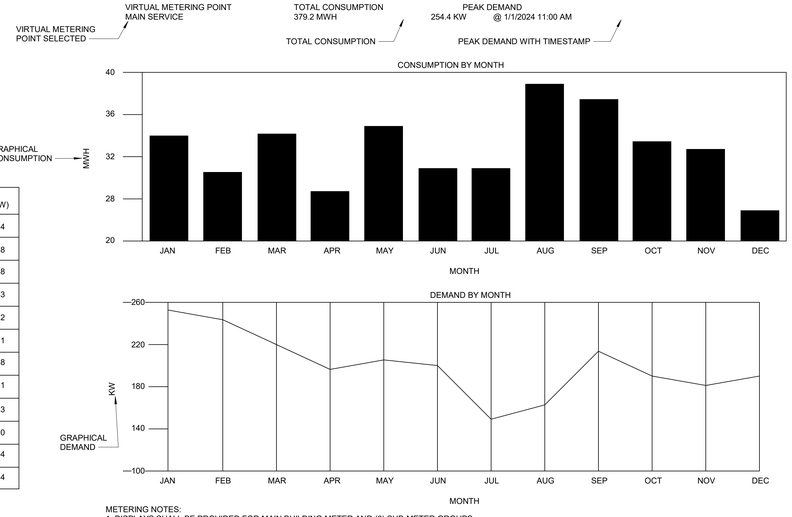
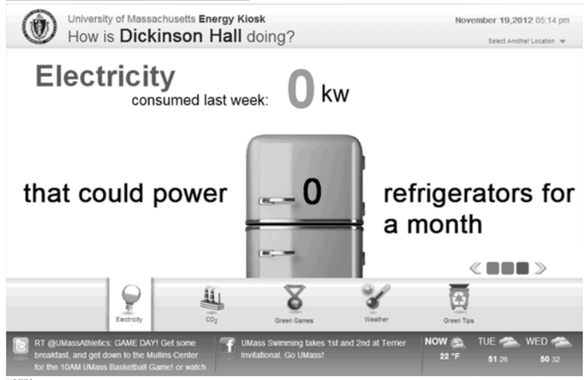


TABLE FORMAT →

DATE & TIME	CONSUMPTION (MWH)	DEMAND (KW)
1/1/2024 12:00AM	34.34	254.4
2/1/2024 12:00AM	30.04	250.8
3/1/2024 12:00AM	33.85	207.8
4/1/2024 12:00AM	27.72	198.3
5/1/2024 12:00AM	34.06	219.2
6/1/2024 12:00AM	28.14	213.1
7/1/2024 12:00AM	28.41	147.8
8/1/2024 12:00AM	38.71	172.1
9/1/2024 12:00AM	38.27	247.3
10/1/2024 12:00AM	30.37	206.0
11/1/2024 12:00AM	29.95	196.4
12/1/2024 12:00AM	25.09	207.4

METERING NOTES:
1. DISPLAYS SHALL BE PROVIDED FOR MAIN BUILDING METER AND (8) SUB-METER GROUPS.
2. BAS SHALL BE CAPABLE OF GENERATING CUSTOM "ENERGY SUMMARY REPORTS". THE ENERGY SUMMARY REPORT FUNCTION SHALL BE EASILY CONFIGURABLE AND HAVE THE FOLLOWING FEATURES:
   a. REPORT SHALL HAVE CUSTOMIZABLE TIME PERIOD BY DATE AND HOUR, FORMAT: MM / DD / YYYY / HH - MM / DD / YYYY / HH.
   b. REPORT SHALL HAVE CUSTOMIZABLE INTERVAL DISPLAY SETTING WITHIN TIME PERIOD SELECTED (I.E. HOURS, DAYS, MONTHS, YEARS)
   c. REPORT MAY BE GENERATED FOR ANY "VIRTUAL METERING POINT" OR COMBINATION OF "VIRTUAL METERING POINTS".
   d. REPORT SHALL DISPLAY KWH AND KW DATA IN GRAPHICAL CHARTS AS WELL AS TABLE FORMAT WITH NUMERICAL VALUES.
   e. REPORT SHALL FEATURE TOTAL CONSUMPTION AND PEAK DEMAND WITH TIME STAMP FOR TIME PERIOD SELECTED.
3. ATC SHALL COORDINATE/CLARIFY "ENERGY SUMMARY REPORT" REQUIREMENTS DIRECTLY WITH ENGINEER PRIOR TO OR DURING SHOP DRAWING PHASE. FAILURE TO DO SO MAY RESULT IN REVISIONS TO THE REPORTING SYSTEM AT THE CONTRACTOR'S EXPENSE.

GHG EMISSIONS CALCULATOR



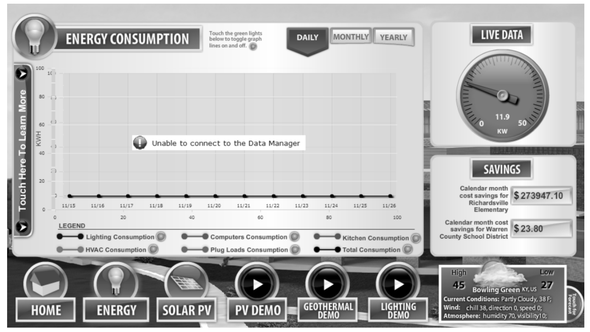
NOTES:
1. PROVIDE GHG CONVERSIONS CALCULATOR FOR DIFFERENT EXAMPLES OF ENERGY USAGE. TYPICAL FOR A MINIMUM OF (8) DIFFERENT EQUIVALENTS.

BUILDING ENERGY USAGE



NOTES:
1. PROVIDE BAR GRAPH FOR EACH OF THE (8) SUBMETERED BUILDING ELECTRICITY LOADS:
   a. TOTAL HVAC SYSTEM
   b. INTERIOR LIGHTING
   c. EXTERIOR LIGHTING
   d. PLUG LOADS
   e. KITCHEN LOADS
   f. THEATER LOADS
   g. BUILDING OPERATIONS / MISCELLANEOUS LOADS
   h. ELEVATOR LOAD

BUILDING ENERGY USAGE



NOTES:
1. GRAPHIC IS TYPICAL FOR BUILDING ELECTRICITY.
2. PROVIDE A BUILDING ELECTRIC ENERGY HOMEPAGE FOR INSTANTANEOUS KW USAGE, KWH CONSUMPTION / GENERATION TOTALS, AND LINKS TO THE DAILY, MONTHLY, AND SCHOOL TERM CONSUMPTION / GENERATION FOR THE FOLLOWING:
   a. TOTAL ENERGY CONSUMED (KWH) CHARTED AGAINST ENERGY GOAL
   b. SUBMETERED SYSTEMS CONSUMPTION
   c. MONTHLY AND YEARLY ACCUMULATIVE BAR GRAPH SHOWING UTILITY KWH
   d. GREEN CONVERSION CALCULATOR

BUILDING HOMEPAGE



NOTES:
1. PROVIDE A TOUCH SCREEN WITH LCD DISPLAY. MONITOR WILL DISPLAY THE SCHOOL'S "ENERGY DASHBOARD" AND CONTINUOUSLY SCROLL THROUGH THE HVAC METERS, ELECTRIC METERS, BUILDING TEMPERATURES, WATER USAGE, ETC. AS INDICATED.
2. THE FOLLOWING ENERGY DASHBOARD PAGES SHALL BE GENERATED / CREATED BY A COMPUTER GRAPHIC ARTIST SUBCONTRACTED BY THE ATC.
3. PROVIDE A HOMEPAGE WITH AN IMAGE OF THE SCHOOL, LOCAL WEATHER INFORMATION, AND LINKS TO THE FOLLOWING:
   a. BUILDING ENERGY ELECTRIC AND SUB-METERING
   b. GEOTHERMAL (IF ADD ALTERNATE IS SELECTED)
   c. GHG EMISSIONS CALCULATOR

DASHBOARD DESIGN PROCESS

STAGE 1 - INITIAL DESIGN: PROVIDE INITIAL DESIGN FOR REVIEW, WITH (2) ROUNDS OF REVIEW AND MODIFICATION.

STAGE 2 - SECONDARY DESIGN: PROVIDE THE SECONDARY REVIEW WITH (2) ROUNDS OF REVIEW AND MODIFICATION.

STAGE 3 - DEVELOPMENT: PROVIDE WORKING LINK TO A DEVELOPMENTAL SITE. SITE SHALL REPRESENT HOW THE APPLICATION WILL LOOK AND OPERATE ON OWNER'S COMPUTER, BUT WILL USE TEST DATA.

STAGE 4 - INSTALLATION: BEGIN INSTALLING THE APPLICATION ONCE THE ABOVE STAGES ARE APPROVED AND ALL ASSETS HAVE BEEN RECEIVED.

NOTES:
1. GRAPHICS PROVIDED IN THIS PACKAGE ARE NOT SPECIFIC TO THIS PROJECT. THEY ARE PROVIDED AS A SAMPLE OF CUSTOM ANIMATED GRAPHICS TYPICAL FOR THIS PROJECT. THE ATC SHALL DEVELOP CUSTOM ANIMATED GRAPHICS AND THE LINKS SPECIFIC FOR THIS PROJECT.
2. DESCRIPTIONS OF GRAPHICS CONTENT PROVIDED FOR REFERENCE.
3. GRAPHIC CONTENT SHALL BE PROVIDED TO THE ARCHITECT, ENGINEER, AND OWNER FOR REVIEW AND CONTENT APPROVAL DURING THE SHOP DRAWING SUBMITTAL PHASE.

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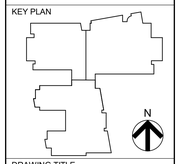
PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MECHANICAL CONTROLS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M7.07

5/18/2026 11:07:58 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

SYMBOLS LEGEND

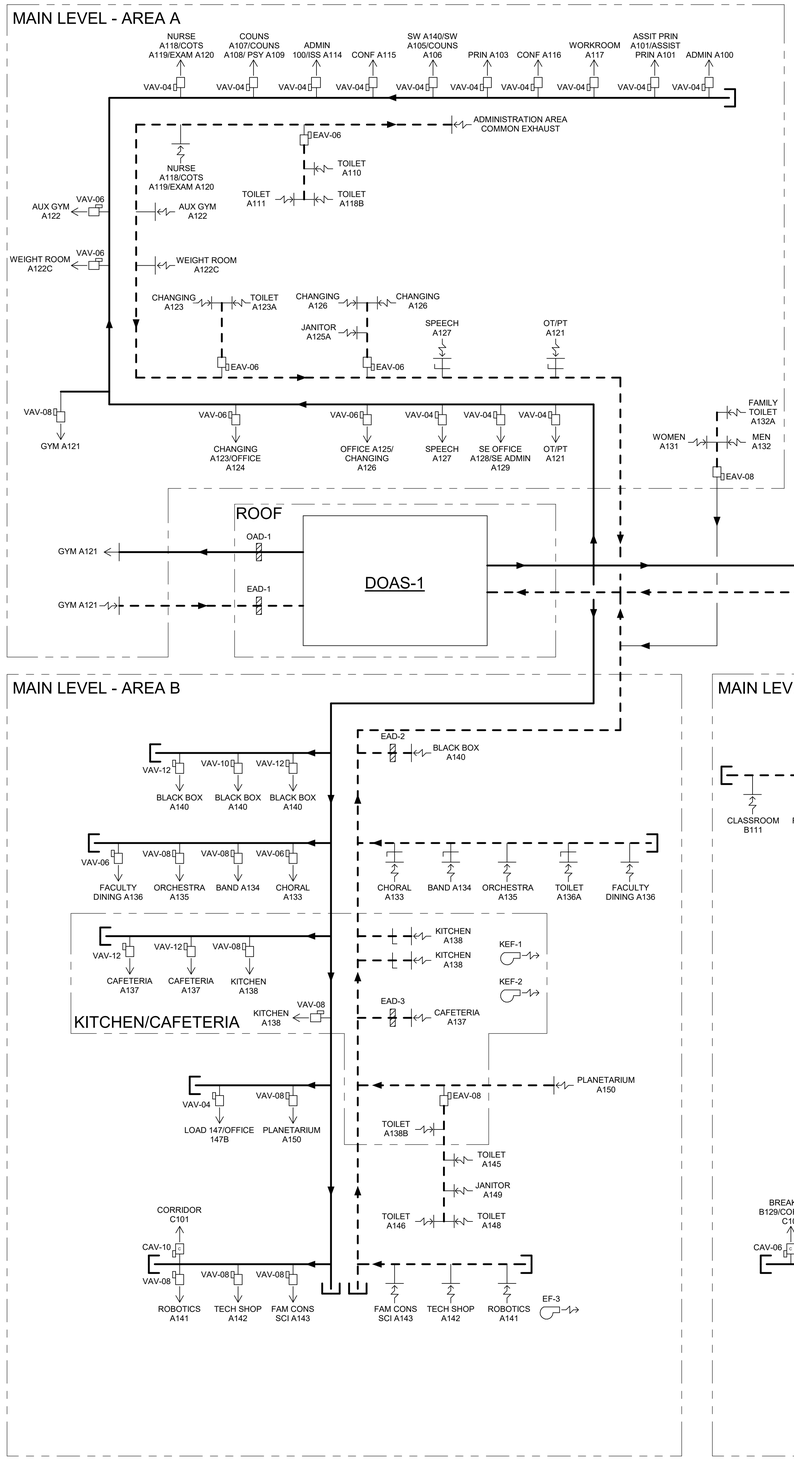
VAV BOX	EXHAUST FAN	EXHAUST DUCT	
EAV BOX	CAV BOX	OUTSIDE AIR DUCT	
GENERAL EXHAUST	EXHAUST WITH CAR DAMPER	DUCT END CAP	MODULATING DAMPER

VENTILATION AIR DIVERSITY CALCULATIONS

SPACES	OCCUPANCY MODE							
	Normal Operation (No Lunch)		Normal Operation (Lunch)		Black Box Event		Gymnasium Event	
	OCC.	CFM	OCC.	CFM	OCC.	CFM	OCC.	CFM
LOWER LEVEL	440	6,435	388	5,715	362	5,355	0	2702
MAIN LEVEL A	144	1,789	92	1,069	66	709	47	1,398
MAIN LEVEL B	230	6,054	178	5,334	152	4,974	0	2397
MAIN LEVEL C	447	7,557	395	6,837	369	6,477	0	2702
UPPER LEVEL	293	6,218	241	5,498	215	5,138	0	2078
GYMNASIUM	26	654	26	654	26	654	994	7,917
CAFETERIA	26	1,018	270	2,900	26	1,018	--	--
KITCHEN	5	303	5	1,300	5	303	--	--
BLACK BOX	26	485	26	485	425	4,486	--	--
EMPTY PROGRAM SPACE	-104	-1440	-52	-720	-52	-720	--	--
TOTAL	1,533	29,073	1,569	29,072	1,594	28,394	1,041	19,194

REMARKS:

1. ALL SPACES INCLUDED IN THE VENTILATION CALCULATIONS ON SHEET M8.02 ARE REPRESENTED IN THIS TABLE.



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PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL AIRFLOW DIAGRAM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M8.01

5/18/2026 11:08:01 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

VENTILATION CALCULATIONS

ROOM NUMBER	LEVEL	ROOM NAME	ROOM TYPE	Az FLOOR AREA (SF)	#/1000 SF	OCCUPANCY (Pz)	OA PER PERSON (Rp)	(Pz *Rp)	REQUIRED CFM/SF (Ra)	(Ra)*(Az)	Ez FOR SF ONLY	Ez ZONE AIR DISTRIBUTION EFFECTIVENESS	MINIMUM REQUIRED OA AIRFLOW (CFM)	MINIMUM CONSTANT EXHAUST (CFM)	MINIMUM INTERMITTENT EXHAUST (CFM)	# OF TOILET FIXTURES
B001	1C	SCIENCE	Classrooms (age 9 plus)	1,045	35	26	10	260	0.12	126	126	1	386	0	0	0
B001A	1C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B002	1C	JANITOR	Janitor	32	0	0	0	0	0	0	0	1	0	32	0	0
B005	1C	MAIN MECHANICAL ROOM	Electrical Equipment Room	1133	0	0	0	0	0.06	68	68	1	68	0	0	0
B006	1C	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
B007	1C	TOILET	Restroom	181	0	0	0	0	0	0	0	1	0	200	0	4
B008	1C	TOILET	Restroom	193	0	0	0	0	0	0	0	1	0	200	0	4
B009	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B010	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B011	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B012	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B013	1C	BREAKOUT	Classrooms (age 9 plus)	189	35	4	10	40	0.12	23	23	1	63	0	0	0
B014	1C	SGI	Conference/Meeting	232	50	5	5	25	0.06	14	14	1	39	0	0	0
B015	1C	READING	Classrooms (age 9 plus)	444	35	9	10	90	0.12	54	54	1	144	0	0	0
B016	1C	CLASSROOM	Classrooms (age 9 plus)	761	35	26	10	260	0.12	92	92	1	352	0	0	0
B017	1C	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
B019	1C	MAKER	Classrooms (age 9 plus)	761	35	15	10	150	0.12	92	92	1	242	0	0	0
B020	2C	MEDIA CENTER	Media Center	3123	25	50	10	500	0.12	375	375	1	875	0	0	0
B021	1C	BREAKOUT	Office space	137	5	4	5	20	0.06	9	11.25	.8	36	0	0	0
B022	1C	BREAKOUT	Office space	137	5	4	5	20	0.06	9	11.25	.8	36	0	0	0
B023	1C	BREAKOUT	Office space	157	5	8	5	40	0.06	10	12.5	.8	63	0	0	0
B024	1C	IT OFFICE	Office space	118	5	1	5	5	0.06	8	10	.8	16	0	0	0
B025	1C	OFFICE/WORKROOM	Office space	107	5	1	5	5	0.06	7	8.75	.8	15	0	0	0
B026	1C	MULTI-MEDIA PRODUCTION	Classrooms (age 9 plus)	771	35	12	10	120	0.12	93	93	1	213	0	0	0
B027	1C	CLASSROOM	Classrooms (age 9 plus)	779	35	26	10	260	0.12	94	94	1	354	0	0	0
B028	1C	MATH	Classrooms (age 9 plus)	449	35	9	10	90	0.12	54	54	1	144	0	0	0
B029	1C	BREAKOUT	Classrooms (age 9 plus)	196	35	4	10	40	0.12	24	24	1	64	0	0	0
B030	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B031	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B032	1C	CLASSROOM	Classrooms (age 9 plus)	772	35	26	10	260	0.12	93	93	1	353	0	0	0
B033	1C	CLASSROOM	Classrooms (age 9 plus)	773	35	26	10	260	0.12	93	93	1	353	0	0	0
B034	1C	TOILET	Restroom	191	0	0	0	0	0	0	0	1	0	150	0	0
B035	1C	TOILET	Restroom	168	0	0	0	0	0	0	0	1	0	150	0	0
B036	1C	STRIDE	Classrooms (age 9 plus)	425	35	13	10	130	0.12	51	51	1	181	0	0	0
B037	1C	SENSORY ROOM	Office space	48	5	1	5	5	0.06	3	3	1	8	0	0	0
B038	1C	SCIENCE	Classrooms (age 9 plus)	1062	35	26	10	260	0.12	128	128	1	388	0	0	0
B038A	1C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B039	1C	TOILET	Restroom	53	0	0	0	0	0	0	0	1	0	50	0	0
B040	1C	TEACHER	Break/Lounge	326	25	12	5	60	0.06	20	20	1	80	0	0	0
B041	1C	FLEX CLASSROOM	Classrooms (age 9 plus)	1215	35	26	10	260	0.12	146	146	1	406	0	0	0
C001	1C	CORRIDOR	Corridor	1589	0	0	0	0	0.06	96	96	1	96	0	0	0
C002	1C	CORRIDOR	Corridor	2012	0	0	0	0	0.06	121	121	1	121	0	0	0
C003	1C	CORRIDOR	Corridor	1535	0	0	0	0	0.06	93	93	1	93	0	0	0
A100	2A	ADMINISTRATION	Reception	1134	30	6	5	30	0.06	69	86.25	0.8	124	0	0	0
A101	2A	ASSISTANT PRINCIPAL	Office space	182	5	1	5	5	0.06	11	13.75	0.8	20	0	0	0
A102	2A	ASSISTANT PRINCIPAL	Office space	182	5	1	5	5	0.06	11	13.75	0.8	20	0	0	0
A103	2A	PRINCIPAL	Office space	209	5	1	5	5	0.06	13	16.25	0.8	23	0	0	0
A104	2A	SOCIAL WORKER	Office space	120	5	1	5	5	0.06	8	10	0.8	16	0	0	0
A105	2A	SOCIAL WORKER	Office space	120	5	1	5	5	0.06	8	10	0.8	16	0	0	0
A106	2A	COUNSELOR	Office space	120	5	1	5	5	0.06	8	10	0.8	16	0	0	0
A107	2A	COUNSELOR	Office space	120	5	1	5	5	0.06	8	10	0.8	16	0	0	0
A108	2A	COUNSELOR	Office space	120	5	1	5	5	0.06	8	10	0.8	16	0	0	0
A109	2A	PYSCHOLOGIST	Office space	152	5	1	5	5	0.06	10	12.5	0.8	19	0	0	0
A110	2A	TOILET	Restroom	51	0	0	0	0	0	0	0	0.8	0	50	0	1
A111	2A	TOILET	Restroom	51	0	0	0	0	0	0	0	0.8	0	50	0	1
A114	2A	ISS	Office space	77	5	1	5	5	0.06	5	6.25	0.8	13	0	0	0
A115	2A	CONFERENCE	Conference/Meeting	218	50	12	5	60	0.06	14	17.5	0.8	93	0	0	0
A116	2A	CONFERENCE	Conference/Meeting	191	50	10	5	50	0.06	12	15	0.8	78	0	0	0
A117	2A	WORKROOM	Office space	170	5	2	5	10	0.06	11	13.75	0.8	26	0	0	0
A118	2A	NURSE	Office space	220	5	2	5	10	0.06	14	17.5	0.8	30	0	0	0
A118B	2A	TOILET	Restroom	51	0	0	0	0	0	0	0	0.8	0	50	0	1
A119	2A	COTS	Office space	190	5	3	5	15	0.06	12	15	0.8	34	0	0	0
A120	2A	EXAM	Office space	150	5	2	5	10	0.06	9	11.25	0.8	24	0	0	0
A121	2A	GYM (CLASS)	Multiuse Assembly	7645	100	26	7.5	195	0.06	459	459	1	654	0	0	0
A121	2A	GYM (EVENT)	Multiuse Assembly	7685	100	994	7.5	7455	0.06	462	462	1	7917	0	0	0
A122	2A	AUX GYM	Health Club (Weight Room)	1517	10	26	20	520	0.06	92	92	1	612	0	0	0
A122C	2A	WEIGHT ROOM	Health Club (Weight Room)	380	10	20	20	200	0.06	23	23	1	223	0	0	0
A123	2A	CHANGING	Locker/Dressing Rooms	300	0	10	0	0	0	0	0	1	0	300	0	0
A123A	2A	TOILET	Restroom	52	0	0	0	0	0	0	0	1	0	50	0	1
A124	2A	OFFICE	Office space	113	5	1	5	5	0.06	7	8.75	.8	15	0	0	0
A125	2A	OFFICE	Office space	112	5	1	5	5	0.06	7	8.75	.8	15	0	0	0
A125A	2A	JANITOR	Janitor	18	0	0	0	0	0	0	0	1	0	20	0	0
A126	2A	CHANGING	Locker/Dressing Rooms	304	0	10	0	0	0	0	0	1	0	305	0	0
A126A	2A	TOILET	Restroom	52	0	0	0	0	0	0	0	1	0	50	0	1
A127	2A	SPEECH	Classrooms (age 9 plus)	204	35	6	10	60	0.12	25	25	1	85	0	0	0
A128	2A	SE OFFICE	Office space	166	5	1	5	5	0.06	10	10	1	15	0	0	0
A129	2A	SE ADMINISTRATION	Office space	136	5	1	5	5	0.06	9	9	1	14	0	0	0
A130	2A	OT/PT	Classrooms (age 9 plus)	375	35	5	10	50	0.12	45	45	1	95	0	0	0
A131	2A	MEN	Restroom	247	0	0	0	0	0	0	0	1	0	250	0	5
A132	2A	WOMEN	Restroom	259	0	0	0	0	0	0	0	1	0	200	0	4
A132A	2A	FAMILY TOILET	Restroom	54	0	0	0	0	0	0	0	1	0	50	0	1
C101/C102/C103	2A	CORRIDOR	Corridor	4242	0	0	0	0	0.06	255	255	1	255	0	0	0
A133	2B	CHORAL	Classrooms (age 9 plus)	996	35	26	10	260	0.12	120	120	1	380	0	0	0
A134	2B	BAND	Classrooms (age 9 plus)	1041	35	26	10	260	0.12	125	125	1	385	0	0	0
A135	2B	ORCHESTRA	Classrooms (age 9 plus)	1023	35	26	10	260	0.12	123	123	1	383	0	0	0
A136	2B	FACULTY DINING	Dining Rooms	539	70	16	7.5	120	0.18	98	98	1	218	0	0	0
A136A	2B	TOILET	Restroom	52	0	0	0	0	0	0	0	1	0	50	0	1
A137	2B	CAFETERIA (CLASS)	Cafeteria	4569	100	26	7.5	195	0.18	823	823	1	1018	0	0	0
A137	2B	CAFETERIA (EVENT)	Cafeteria	4637	100	275	7.5	2062.5	0.18	835	835	1	2898	0	0	0
A138	2B	KITCHEN	Kitchen (Cooking)	2208	0	5	7.5	37.5	0.12	265	265	1	303	1546	0	0
A138A	2B	OFFICE	Office space	54	5	1	5	5	0.06	4	4	1	9	0	0	0
A138B	2B	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
A139	2B	PLATFORM (CLASS)	Stages, studios	1455	70	13	10	130	0.06	88	88	1	218	0	0	0
A140	2B	BLACK BOX (CLASS)	Stages, studios	2209	70	13	10	130	0.06	133	133	1	263	0	0	0
A139/A140	2B	BLACK BOX/PLATFORM (EVENT)	Stages, studios	3919	70	425	10	4250	0.06	236	236	1	4486	0	0	0
A141	2B	ROBOTIC TECH ENG	Classrooms (age 9 plus)	945	35	26	10	260	0.12	114	114	1	374	0	0	0
A142	2B	TECH SHOP	Classrooms (age 9 plus)	1041	35	26	10	260	0.12	125	125	1	385	0	0	0
A143	2B	FAM CONS SCI	Classrooms (age 9 plus)	1007	35	26	10	260	0.12	121	121	1	381	0	0	0
A144	2B	SEC OFFICE	Office space	114	5	1	5	5	0.06	7	7	1	12	0	0	0
A145	2B	TOILET	Restroom	162	0	0	0	0	0	0	0	1	0	150	0	3
A146	2B	TOILET	Restroom	162	0	0	0	0	0	0	0	1	0	150	0	3
A147A	2B	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
A147B	2B	OFFICE	Office space	101	5	1	5	5	0.06	7	7	1	12	0	0	0
A150	2B	PLANETARIUM	Multiuse Assembly	752	100	50	7.5	375	0.06	46	46	1	421	0	0	0
C104/C105/C106	2B	CORRIDOR	Corridor	3280	0	0	0	0	0.06	197	197	1	197	0	0	0
B101	2C	SCIENCE	Classrooms (age 9 plus)	1055	35	26	10	260	0.12	127	127	1	387	0	0	0
B101A	2C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B103	2C	WORKROOM	Conference/Meeting	140	50	4	5	20	0.06	9	9	1	29	0	0	0
B104	2C	SKILLS	Classrooms (age 9 plus)	539	35	9	10	90	0.12	65	65	1	155	0	0	0
B105	2C	SPECIAL EDUCATION	Classrooms (age 9 plus)	795	35	10	10	100	0.12	96	96	1	196	0	0	0
B105B	2C	TOILET	Restroom	52	0	0	0	0	0	0	0	1	0	50	0	1
B105C	2C	BED PREP	Office space	82	5	1	5	5	0.06	5	5	1	10	0	0	0
B106	2C	SENSORY ROOM	Office space	56	5	1	5	5	0.06	4	4	1	9	0	0	0
B108	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B109	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B110	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B111	2C	CLASSROOM	Classrooms (age 9 plus)	795	35	26	10	260	0.12	96	96	1	356	0	0	0
B112	2C	BREAKOUT	Classrooms (age 9 plus)	192	35	4	10	40	0.12	24	24	1	64	0	0	0
B113	2C	SGI	Conference/Meeting	245	50	5	5	25	0.06	15	15	1	40	0	0	0
B114	2C	READING	Classrooms (age 9 plus)	451	35	9	10	90	0.12	55	55	1	145	0	0	0
B115	2C	CLASSROOM	Classrooms (age 9 plus)	773	35	26	10	260	0.12	93	93	1	353	0	0	0
B116	2C	TOILET	Restroom	206	0	0	0	0	0	0	0	1	0	250	0	5
B117	2C	TOILET	Restroom	221	0	0	0	0	0	0	0	1	0	250	0	5
B118	2C	STRIDE	Classrooms (age 9 plus)	575	35	15	10	150	0.12	69	69	1	219	0	0	0
B119	2C	TOILET	Restroom	56	0	0	0	0	0	0	0	1	0	50	0	1
B121A	2C	JANITOR	Janitor	15	0	0	0	0	0	0	0	1	0	15	0	0
B122	2C	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
B124	2C	TOILET	Restroom	221	0	0	0	0	0	0	0	1	0	250	0	5
B125	2C	TOILET	Restroom	206	0	0	0	0	0	0	0	1	0	250	0	5
B126A	2C	JANITOR	Janitor	32	0	0	0	0	0	0	0	1	0	32	0	0
B127	2C	CLASSROOM	Classrooms (age 9 plus)	793	35	26	10	260	0.12	96	96	1	356	0	0	0
B128	2C	MATH	Classrooms (age 9 plus)	457	35	9	10	90	0.12	55	55	1	145	0	0	0
B129	2C	BREAKOUT	Classrooms (age 9 plus)	192	35	4	10	40	0.12	24	24	1	64	0	0	0
B130	2C	CLASSROOM	Classrooms (age 9 plus)	795	35	26	10	260	0.12	96	96	1	356	0	0	0
B131	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B132	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B133	2C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B134	2C	ART	Art Classroom	892	20	26	10	260	0.18	161	161	1	421	0	624	0
B135	2C	SCIENCE	Classrooms (age 9 plus)	1079	35	26	10	260	0.12	130	130	1	390	0	0	0
B135A	2C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B136	2C	TOILET	Restroom	51	0	0	0	0	0	0	0	1	0	50	0	1
B137	2C	TEACHER	Break/Lounge	333	25	12	5	60	0.06	20	20	1	80	0	0	0
B138	2C	FLEX CLASSROOM	Classrooms (age 9 plus)	1323	35	26	10	260	0.12	159	159	1	419	0	0	0
C101S/C107/C108	2C	CORRIDOR	Corridor	5461	0	0	0	0	0.06	328	328	1	328	0	0	0
B201	3C	SCIENCE	Classrooms (age 9 plus)	1066	35	26	10	260	0.12	128	128	1	388	0	0	0
B201A	3C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B202	3C	JANITOR	Janitor	34	0	0	0	0	0	0	0	1	0	34	0	0
B203	3C	FLEX CLASSROOM	Classrooms (age 9 plus)	1193	35	26	10	260	0.12	144	144	1	404	0	0	0
B204	3C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B205	3C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B206	3C	CLASSROOM	Classrooms (age 9 plus)	782	35	26	10	260	0.12	94	94	1	354	0	0	0
B207	3C	CLASSROOM	Classrooms (age 9 plus)	793	35	26	10	260	0.12	96	96	1	356	0	0	0
B208	3C	BREAKOUT	Classrooms (age 9 plus)	189	35	4	10	40	0.12	23	23	1	63	0	0	0
B209	3C	SGI	Conference/Meeting	244	50	5	5	25	0.06	15	15	1	40	0	0	0
B210	3C	READING	Classrooms (age 9 plus)	451	35	9	10	90	0.12	55	55	1	145	0	0	0
B211	3C	CLASSROOM	Classrooms (age 9 plus)	773	35	26	10	260	0.12	93	93	1	353	0	0	5
B212	3C	TOILET	Restroom	206	0	0	0	0	0	0	0	1	0	250	0	5
B213	3C	TOILET	Restroom	221	0	0	0	0	0	0	0	1	0	250	0	5
B214	3C	STRIDE	Classrooms (age 9 plus)	580	35	15	10	150	0.12	70	70	1	220	0	0	1
B215A	3C	JANITOR	Janitor	50	0	0	0	0	0	0	0	1	0	50	0	0
B216	3C	TOILET	Restroom	53	0	0	0	0	0	0	0	1	0	50	0	1
B218	3C	TOILET	Restroom	218	0	0	0	0	0	0	0	1	0	250	0	5
B219	3C	TOILET	Restroom	207	0	0	0	0	0	0	0	1	0	250	0	5
B220B	3C	JANITOR	Janitor	48	0	0	0	0	0	0	0	1	0	48	0	0
B221	3C	CLASSROOM	Classrooms (age 9 plus)	784	35	26	10	260	0.12	95	95	1	355	0	0	0
B222	3C	MATH	Classrooms (age 9 plus)	457	35	9	10	90	0.12	55	55	1	145	0	0	0
B223	3C	BREAKOUT	Classrooms (age 9 plus)	180	35	4	10	40	0.12	22	22	1	62	0	0	0
B224	3C	CLASSROOM	Classrooms (age 9 plus)	794	35	26	10	260	0.12	96	96	1	356	0	0	0
B225	3C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B226	3C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	0	0
B227	3C	CLASSROOM	Classrooms (age 9 plus)	781	35	26	10	260	0.12	94	94	1	354	0	623	0
B228	3C	ART	Art Classroom	890	20	26	10	260	0.18	161	161	1	421	0	0	0
B229	3C	SCIENCE	Classrooms (age 9 plus)	1084	35	26	10	260	0.12	131	131	1	391	0	0	1
B229A	3C	PREP	Science Laboratory	100	25	0	10	0	0.18	18	18	1	18	100	0	0
B230	3C	TOILET	Restroom	53	0	0	0	0	0	0	0	1	0	50	0	0
B231	3C	SENSORY ROOM	Office space	45	5	1	5	5	0.06	3	3	1	8	0	0	0
B232	3C	TEACHER	Break/Lounge	471	25	12	5	60	0.06	29	29	1	89	0	0	1
B232A	3C	TOILET	Restroom	53	0	0	0	0	0	0	0	1	0	50	0	0
C201/C202/C203	3C	CORRIDOR	Corridor	4348	0	0	0	0	0.06	261	261	1	261	0	0	0
												TOTAL	43067			

REMARKS:
1. FOR VENTILATION AIR DIVERSITY CALCULATIONS, REFER TO M8.01.

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A LEGENCE Company

PROFESSIONAL SEAL

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL VENTILATION CALCULATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	12" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M8.02

5/18/2026 11:08:05 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

EXHAUST AIR SCHEDULE

SPACE(S) SERVED	EVAV / CAR / EAD	CFM SETPOINT	REMARKS
T-B006 / T-B007 / T-008	EVAV-08	540	1
T-B017	CAR-06	60	1
JAN-B034A / T-B034 / T-B035 / PREP-B038 / T-B039	EVAV-08	535	1
T-A110 / T-A111 / T-118B	EVAV-06	180	1
CHANGING-A123 / T-123A	EVAV-06	360	1
CHANGING-A126 / T-126A / JAN-125A	EVAV-06	380	1
WOMEN A-131 / MEN A-132 / FAMILY-132A	EVAV-06	250	1
T-136A	CAR-06	60	1
T-145 / T-145 / T-147A / T-148 / JAN-149	EVAV-08	515	1
T-B105B	CAR-06	60	1
T-B116 / T-B117	EVAV-08	600	1
T-B119 / JAN-B121A / PREP-B101A	EVAV-06	175	1
T-B122 / T-B136 / PREP-135A	EVAV-06	220	1
T-B124 / T-B124 / JAN-B126A	EVAV-08	635	1
PREP-B201A	CAR-06	100	1
JAN-B202	CAR-06	35	1
T-B212 / T-B213	EVAV-08	600	1
T-B216 / JAN-B215	CAR-06	110	1
T-B230 / T-B232A / PREP-229A	EVAV-06	220	1
T-B218 / T-B219 / JAN-220B	EVAV-08	650	1
OT/PT A130	CAR-06	60	1
SPEECH A127	CAR-06	60	1
SKILLS B104	CAR-08	110	1
KITCHEN A138	CAR-08	170	1
KITCHEN A138	CAR-08	170	1
CHORAL A133	CAR-10	225	1
BAND A134	CAR-10	225	1
SPEC ED SELF CONS B105	CAR-08	115	1
CLASSROOM B108	CAR-10	280	1
STRIDE B118	CAR-08	200	1
GYM A121	EAD-1	7100/580	2
BLACK BOX A140	EAD-2	4000/435	2
CAFETERIA A137	EAD-3	940	1

REMARKS:

1. CONSTANT AIRFLOW SETPOINTS LISTED.
2. MAXIMUM/MINIMUM AIRFLOW SETPOINTS LISTED.

HEAT PUMP & TERMINAL BOX CONTROL SCHEDULE

ZONE	SPACE(S) SERVED	HP LOCATION	HP TAG	# OF TERMINAL BOXES	TERMINAL BOX TAG(S)	TERMINAL BOX CONFIGURATION	# OF AUTOMATIC CONTROL DAMPERS	# OF THERMOSTATS	HP / OCCUPANCY SENSOR INTERLOCK	OA / OCCUPANCY SENSOR INTERLOCK	OCCUPIED COOLING / HEATING SETPOINT	UNOCCUPIED COOLING / HEATING SETPOINT	VAV AIRFLOW SETPOINTS		# OF CARBON DIOXIDE SENSORS	# OF HUMIDITY SENSORS	HOT GAS REHEAT	LOCAL UNOCCUPIED PUMP CONTROL	DUCT SMOKE DETECTOR	EMERGENCY POWER	NOTES
													MAX (CFM)	MIN (CFM)							
1.1	CLASSROOM B027/MATH B028	LOWER LEVEL	VHP-030	2	VAV-06-1.1A / VAV-04-1.1B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)145	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.2	IT OFFICE B024/OFFICE B026	LOWER LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
1.3	MULTI-MEDIA PRODUCTION B026	LOWER LEVEL	HHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	215	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO GREEN SCREEN B026A
1.4	TEACHER B040/FLEX CLASSROOM B041	LOWER LEVEL	VHP-042	2	VAV-04-1.4A / VAV-08-1.4B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)80/(B)410	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.5	STRIDE B036/SCEINCE B038	LOWER LEVEL	HHP-048	2	VAV-06-1.5A / VAV-08-1.5B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)185/(B)390	(A)0/(B)0	2	0	NO	NO	NO	NO	SUPPLY AIR TO SENSORY B037
1.6	CLASSROOM B032/CLASSROOM B033	LOWER LEVEL	VHP-048	2	VAV-06-1.6A / VAV-06-1.6B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.7	CLASSROOM B030/CLASSROOM B031	LOWER LEVEL	VHP-048	2	VAV-06-1.7A / VAV-06-1.7B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.8	BREAKOUT B029/CORRIDOR 003	LOWER LEVEL	VHP-019	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
1.9	CLASSROOM B012/CLASSROOM B011	LOWER LEVEL	VHP-048	2	VAV-06-1.9A / VAV-06-1.9B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.10	CLASSROOM B009/CLASSROOM B010	LOWER LEVEL	VHP-048	2	VAV-06-1.10A / VAV-06-1.10B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
1.11	ELEC B004A/MECH B005/EM B005B	LOWER LEVEL	VHP-042	1	VAV-04	DIRECT TO SPACE	0	2	NO	NO	75F°/75F°	75F°/75F°	70	0	0	0	NO	YES	NO	YES	VAV-04 SERVES MECH B005, AVG. THERMOSTATS
1.12	SCIENCE B001	LOWER LEVEL	VHP-036	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	390	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO PREP B001A
1.13	MAKER B019	LOWER LEVEL	VHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	245	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO TECH B019A, CORRIDOR C002
1.14	BREAKOUT B021/BREAKOUT B022/ BREAKOUT B023	LOWER LEVEL	HHP-012	1	VAV-04	DUCTED TO RETURN	0	3	YES	YES	73F°/69F°	85F°/60F°	135	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
1.15	SMALL GROUP B014/READING B015/CLASSROOM B016	LOWER LEVEL	VHP-042	3	VAV-04-1.15A / VAV-04-1.15B / VAV-06-1.15C	DIRECT TO SPACE	3	3	YES	YES	73F°/69F°	85F°/60F°	(A)50/(B)145/(C)360	(A)0/(B)0/(C)0	3	0	NO	NO	NO	NO	
1.16	BREAKOUT B013/CORRIDOR 002	LOWER LEVEL	VHP-019	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
CORRIDOR C001	CORRIDOR C001	LOWER LEVEL		1	CAV-04	DIRECT TO SPACE							100	100	0						CONSTANT AIR VOLUME BOX
MDF B018	MDF B018	LOWER LEVEL	HHP-012	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY
2.1	CLASSROOM B127/MATH B128	MAIN LEVEL	VHP-030	2	VAV-06-2.1A / VAV-04-2.1B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)145	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.2	MEDIA CENTER B020	MAIN LEVEL	VHP-096	1	VAV-10	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	880	0	1	1	YES	NO	NO	NO	AVERAGING THERMOSTATS
2.3	TEACHER B137/FLEX LAB B138	MAIN LEVEL	VHP-042	2	VAV-04-2.3A / VAV-08-2.3B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)80/(B)420	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.4	SCIENCE B135	MAIN LEVEL	VHP-036	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	390	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO PREP B135A
2.5	ART B134	MAIN LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	EVENT: 575 / NORMAL: 425	0	1	0	NO	NO	NO	NO	EXHAUST FAN INTERLOCK, FAN EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED
2.6	CLASSROOM B132/CLASSROOM B133	MAIN LEVEL	VHP-048	2	VAV-06-2.6A / VAV-06-2.6B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.7	CLASSROOM B130/CLASSROOM B131	MAIN LEVEL	VHP-048	2	VAV-06-2.7A / VAV-06-2.7B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.8	BREAKOUT B129/CORRIDOR C108	MAIN LEVEL	VHP-019	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
2.9	CLASSROOM B110/CLASSROOM B111	MAIN LEVEL	VHP-048	2	VAV-06-2.9A / VAV-06-2.9B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.10	CLASSROOM B108/CLASSROOM B109	MAIN LEVEL	VHP-048	2	VAV-06-2.10A / VAV-06-2.10B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
2.11	SPECIAL EDUCATION B105	MAIN LEVEL	VHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	200	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO BED PREP B105C & SENSORY B106
2.12	SCIENCE B101	MAIN LEVEL	VHP-036	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	390	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO PREP B101A
2.13	STRIDE B118	MAIN LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	220	0	1	0	NO	NO	NO	NO	
2.14	SMALL GROUP B113/READING B0114/CLASSROOM B115	MAIN LEVEL	VHP-042	3	VAV-04-2.14A / VAV-04-2.14B / VAV-06-2.14C	DIRECT TO SPACE	3	3	YES	YES	73F°/69F°	85F°/60F°	(A)50/(B)145/(C)360	(A)0/(B)0/(C)0	3	0	NO	NO	NO	NO	
2.15	BREAKOUT B112/CORRIDOR C107	MAIN LEVEL	VHP-019	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
2.16	NURSE A118/EXAM A120	MAIN LEVEL	HHP-012	1	VAV-04	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	90	0	0	0	NO	NO	NO	NO	INCLUDES COTS A119, AVG. THERMOSTATS
2.17	COUNSELOR A107/COUNSELOR A108/PYSCHOLOGIST A109	MAIN LEVEL	HHP-012	1	VAV-04	DUCTED TO RETURN	0	3	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.18	SOCIAL WORKER A104/SOCIAL WORKER A105/COUNSELOR A106	MAIN LEVEL	HHP-012	1	VAV-04	DUCTED TO RETURN	0	3	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.19	PRINCIPAL A103	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	1	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	
2.20	ASSISTANT PRINCIPAL A102/ASSISTANT PRINCIPAL A101	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.21	ADMINISTRATION A100	MAIN LEVEL	HHP-012	1	VAV-04	DUCTED TO RETURN	0	1	YES	YES	73F°/69F°	85F°/60F°	75	0	0	0	NO	NO	NO	NO	
2.22	WORKROOM A117	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	1	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	
2.23	CONFERENCE A116	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	1	YES	YES	73F°/69F°	85F°/60F°	80	0	1	0	NO	NO	NO	NO	
2.24	CONFERENCE A115	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	1	YES	YES	73F°/69F°	85F°/60F°	95	0	1	0	NO	NO	NO	NO	
2.25	ISS A114	MAIN LEVEL	HHP-007	1	VAV-04	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	50	0	0	0	NO	NO	NO	NO	SA & OA AIR TO ADMIN A100, AVG THERMOSTATS
2.26	AUX GYM A122	MAIN LEVEL, GYM MEZZANINE	VHP-072	1	VAV-08	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	615	0	1	1	YES	NO	NO	NO	AVERAGING THERMOSTATS
2.27	WEIGHT ROOM A122C	MAIN LEVEL, GYM MEZZANINE	VHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	225	0	1	0	NO	NO	NO	NO	
2.28	GYM A121	MAIN LEVEL, GYM MEZZANINE	VHP-300	1	VAV-08	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	EVENT: 7290 / NORMAL: 655	0	1	1	YES	NO	YES	NO	EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED, DOAS DIRECTLY PROVIDES EVENT MAX AIRFLOW, SEE CONTROL SEQUENCES. AVERAGING THERMOSTATS
2.29	CHANGING A123/OFFICE A124	MAIN LEVEL	HHP-012	1	VAV-06	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	300	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.30	OFFICE A125/CHANGING A126	MAIN LEVEL	HHP-012	1	VAV-06	DUCTED TO RETURN	0	2	YES	YES	73F°/69F°	85F°/60F°	305	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.31	SPEECH A127	MAIN LEVEL	HHP-007	1	VAV-04	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	85	0	1	0	NO	NO	NO	NO	
2.32	SE OFFICE A128/SE ADMINISTRATION A129	MAIN LEVEL	HHP-007	1	VAV-04	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	30	0	0	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.33	OT/PT A130	MAIN LEVEL	VHP-019	1	VAV-04	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	95	0	1	0	NO	NO	NO	NO	
2.34	WORKROOM B103/SKILLS B104	MAIN LEVEL	VHP-024	1	VAV-06	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	185	0	2	0	NO	NO	NO	NO	
2.35	ROBOTICS A141	MAIN LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	EVENT: 485 / NORMAL: 385	0	1	0	NO	NO	NO	NO	EXHAUST FAN INTERLOCK
2.36	TECH SHOP A142	MAIN LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	385	0	1	0	NO	NO	NO	NO	
2.37	FAM CONS SCI A143/SEC OFFICE A144	MAIN LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	400	0	1	0	NO	NO	NO	NO	AVERAGING THERMOSTATS
2.38	PLANETARIUM A150	MAIN LEVEL	VHP-048	1	VAV-04	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	85	0	1	0	NO	NO	NO	NO	
2.39	LOAD 147/OFFICE A147B	MAIN LEVEL	HHP-007	1	VAV-04	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	100	0	0	0	NO	NO	NO	NO	OUTSIDE AIR TO LOADING A147
2.40	BLACK BOX A140	MAIN LEVEL, PLATFORM MEZZANINE	VHP-240	1	VAV-12-2.40A / VAV-12-2.40B / VAV-10-2.40C	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	EVENT: 4490 / NORMAL: 485	0	1	1	YES	NO	YES	NO	BLACK BOX A140 INCLUDES PLATFORM A139. EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED, SEE CONTROL SEQUENCES. AVERAGING THERMOSTATS
2.41	KITCHEN A138	MAIN LEVEL, PLATFORM MEZZANINE	VHP-072	1	VAV-08-2.41A / VAV-08-2.41B	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	EVENT: 1300 / NORMAL: 300	0	1	1	YES	NO	YES	NO	SUPPLY AIR TO OFFICE A138A. EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED, SEE CONTROL SEQUENCES. AVERAGING THERMOSTATS
2.42	CAFETERIA A137	MAIN LEVEL, PLATFORM MEZZANINE	VHP-240	1	VAV-12-2.42A / VAV-12-2.42B	DIRECT TO SPACE	0	2	YES	YES	73F°/69F°	85F°/60F°	EVENT: 2900 / NORMAL: 1020	0	1	1	YES	NO	YES	NO	EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED, SEE CONTROL SEQUENCES. AVERAGING THERMOSTATS
2.43	CHORAL A133	MAIN LEVEL	VHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	380	0	1	0	NO	NO	NO	NO	
2.44	BAND A134	MAIN LEVEL	VHP-030	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	385	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO STORAGE A134A
2.45	ORCHESTRA A135	MAIN LEVEL	VHP-030	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	385	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO STORAGE A135A
2.46	FACULTY DINING A136	MAIN LEVEL	VHP-019	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	220	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO CORRDOR C104
CORRIDOR C101	CORRIDOR C101	MAIN LEVEL		1	CAV-10	DIRECT TO SPACE							1200	1200	0						CONSTANT AIR VOLUME BOX
CORRIDOR C101S	CORRIDOR C101S	MAIN LEVEL		1	CAV-04	DIRECT TO SPACE							100	100	0						CONSTANT AIR VOLUME BOX
MECH B123	MECH B123	MAIN LEVEL	HHP-012	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY
IT A141A	IT A141A	MAIN LEVEL	HHP-012	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY
ELEC A147D	ELEC A147D	MAIN LEVEL	HHP-019	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY
KITCHEN COOLER	KITCHEN COOLER	MAIN LEVEL	CU-1					1			PER OWNER	PER OWNER						YES		YES	REFER TO FOOD SERVICE PLANS
KITCHEN FREEZER	KITCHEN FREEZER	MAIN LEVEL	CU-2					1			PER OWNER	PER OWNER						YES		YES	REFER TO FOOD SERVICE PLANS
GYM MEZZANINE	GYM MEZZANINE	MAIN LEVEL, GYM MEZZANINE	HHP-012	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY
STORAGE A121B	STORAGE A121B	MAIN LEVEL	HHP-007	0			0	1	NO	NO		75F°/75F°				0	NO	NO	NO	YES	COOLING ONLY
CONTROL A139A	CONTROL 139A	MAIN LEVEL	HHP-007	0			0	1	NO	NO		75F°/75F°				0	NO	NO	NO	YES	COOLING ONLY
3.1	CLASSROOM B221/MATH B222	UPPER LEVEL	VHP-030	2	VAV-06-3.1A / VAV-04-3.1B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)145	(A)0/(B)0	2	0	NO	NO	NO	NO	
3.2	TEACHER B232	UPPER LEVEL	HHP-012	1	VAV-04	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	90	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO SENSORY B231
3.3	SCIENCE B229	UPPER LEVEL	VHP-036	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	395	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO PREP B229A
3.4	ART B228	UPPER LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	EVENT: 660 / NORMAL: 425	0	1	0	NO	NO	NO	NO	EXHAUST FAN INTERLOCK, FAN EVENT & NORMAL OPERATION MAX AIRFLOWS LISTED. EXHAUST FAN ALSO SERVES KILN B228A
3.5	CLASSROOM B226/CLASSROOM B227	UPPER LEVEL	VHP-048	2	VAV-06-3.5A / VAV-06-3.5B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
3.6	CLASSROOM B224/CLASSROOM B225	UPPER LEVEL	VHP-048	2	VAV-06-3.6A / VAV-06-3.6B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
3.7	BREAKOUT B223/CORRIDOR 203	UPPER LEVEL	VHP-012	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
3.8	CLASSROOM B206/CLASSROOM B207	UPPER LEVEL	VHP-048	2	VAV-06-3.8A / VAV-06-3.8B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
3.9	CLASSROOM B204/CLASSROOM B205	UPPER LEVEL	VHP-048	2	VAV-06-3.9A / VAV-06-3.9B	DIRECT TO SPACE	2	2	YES	YES	73F°/69F°	85F°/60F°	(A)360/(B)360	(A)0/(B)0	2	0	NO	NO	NO	NO	
3.10	FLEX CLASSROOM B203	UPPER LEVEL	VHP-024	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	405	0	1	0	NO	NO	NO	NO	
3.11	SCIENCE B201	UPPER LEVEL	VHP-036	1	VAV-08	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	390	0	1	0	NO	NO	NO	NO	SUPPLY AIR TO PREP B201A
3.12	STRIDE B214	UPPER LEVEL	VHP-024	1	VAV-06	DIRECT TO SPACE	0	1	YES	YES	73F°/69F°	85F°/60F°	220	0	1	0	NO	NO	NO	NO	
3.13	SMALL GROUP B209/READING B210/CLASSROOM B211	UPPER LEVEL	VHP-042	3	VAV-04-3.13A / VAV-04-3.13B / VAV-06-3.13C	DIRECT TO SPACE	3	3	YES	YES	73F°/69F°	85F°/60F°	(A)50/(B)145/(C)360	(A)0/(B)0/(C)0	3	0	NO	NO	NO	NO	
3.14	BREAKOUT B208/CORRIDOR 202	UPPER LEVEL	VHP-012	1	CAV-06	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	165	165	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
3.15	CORRIDOR 201	UPPER LEVEL	VHP-060	1	CAV-04	DIRECT TO SPACE	0	1	YES	NO	73F°/69F°	85F°/60F°	100	100	0	0	NO	NO	NO	NO	CONSTANT AIR VOLUME BOX
IT B229B	IT B229B	UPPER LEVEL	HHP-012	0			0	1	NO	NO		75F°/75F°				0	NO	YES	NO	YES	COOLING ONLY

REMARKS:

1. FOR ZONES WITH MORE THAN ONE VAV, AIRFLOW SETPOINTS ARE LISTED SEQUENTIALLY.
2. CAVs SHALL OPERATE ON THE OPERATION SCHEDULE OF THE DOAS, PER SEQUENCES.
3. REFER TO FAN INTERLOCK CONTROL SEQUENCES.

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PROFESSIONAL SEAL



TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL HEAT PUMP & TERMINAL BOX CONTROL SCHEDULE

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	12" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M8.03

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OUTSIDE AIR UNIT SCHEDULE PART 1

MARK	MANUFACTURER MODEL NO.	TYPE	CONFIGURATION	NOMINAL SIZE LxWxH (IN.)	WEIGHT (LBS)	SUPPLY FAN								EXHAUST FAN								OUTSIDE PRE-FILTER				OUTSIDE POST-FILTER				RETURN FILTER				HEAT PUMP REFRIGERATION															HOT GAS REHEAT COIL			
						TOTAL CFM	# OF FANS	FAN TYPE	TSP (IN. W.C.)	SA ESP (IN. W.C.)	RPM	MOTOR BHP PER FAN	MOTOR HP PER FAN	TOTAL CFM	# OF FANS	FAN TYPE	TSP (IN. W.C.)	RA ESP (IN. W.C.)	RPM	MOTOR BHP PER FAN	MOTOR HP PER FAN	TYPE	EFF.	QUANTITY	AIRFLOW	TYPE	EFF.	QUANTITY	AIRFLOW	TYPE	EFF.	QUANTITY	AIRFLOW	TOTAL FLOW (GPM)	TOTAL PRESSURE DROP (FT H2O)	TONS	FACE VELOCITY (FPM)	COOLING					HEATING							FACE VELOCITY (FPM)	EAT (DB/WB) (°F)	LAT (DB/WB) (°F)	TOTAL CAPACITY (MBH)
																																					EAT (DB/WB) (°F)	LAT (DB/WB) (°F)	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	EWT/LWT (°F)	EER	EAT/LAT (DB) (°F)	TOTAL CAPACITY (MBH)	EWT/LWT (°F)	COP				
DOAS-1	INNOVENT ERU-OU-WH-30000-HP-HG-460	DEDICATED OUTSIDE AIR	COUNTER-FLOW OVER UNDER	360x240x136.5	29500	30000	4	PLENUM	6.88	3.50	3220	13.3	15	30000	4	PLENUM	5.27	3.75	2046	8.9	10	PLEATED	MERV 8	20	33000	CARTRIDGE	MERV 13	20	33000	PLEATED	MERV 8	20	27000	190	16.4	68	500	76.4/66.5	58.0/58.0	813.7	595.3	85.0/97.3	21.1	54.0/74.6	673.2	47.0/40.9	6.4	492	60.0/58.8	74.5/64.0	470

OUTSIDE AIR UNIT SCHEDULE PART 2

| ENERGY RECOVERY WHEEL | | | | | | | | | | | | | | | | | | |

EXHAUST FAN SCHEDULE

MARK	MANUFACTURER	MODEL #	SERVICE	TYPE	AIRFLOW (CFM)	E.S.P. (IN. W.G.)	DRIVE	RPM	MOTOR HP	ELECTRICAL DATA			SONES	REMARKS
										VOLTAGE	PHASE	HZ		
KEF-1	GREENHECK	CUE-160XP-VG	KITCHEN HOOD, TYPE 1	CENTRIFUGAL ROOF EXHAUSTER, UPBLAST	1330	1.5	DIRECT	1975	1	208	3	60	13.7	1, 2, 3, 4, 5
KEF-2	GREENHECK	CUE-140-VG	KITCHEN HOOD, TYPE 2	CENTRIFUGAL ROOF EXHAUSTER, UPBLAST	1870	1.5	DIRECT	1665	1	208	3	60	12.7	1, 2, 3, 4, 5
EF-1	GREENHECK	CSP-A390-VG	ART B134	INLINE CABINET FAN	240	0.1	DIRECT	861	0.03	120	1	60	0.5	1, 2, 3, 5, 6
EF-2	GREENHECK	CSP-A390-VG	ART B228/KILN B228A	INLINE CABINET FAN	325	0.1	DIRECT	1066	0.06	120	1	60	1.6	1, 2, 3, 5, 6
EF-3	GREENHECK	CSP-A125	ELECTRICAL ROOMS	INLINE CABINET FAN	100	0.1	DIRECT	980	0.03	120	1	60	0.3	1, 2, 3, 5, 6
EF-4	GREENHECK	G-070-VG	ROBOTICS A141	CENTRIFUGAL ROOF EXHAUSTER, DOWNBLAST	100	0.1	DIRECT	806	1/15	120	1	60	0.4	1, 2, 3, 4, 5
EF-5	CONTINENTAL	DVK100B-C	LAUNDRY B105A DRYER	INLINE BOOSTER FAN	140	0.15	DIRECT	2620	85 (WATTS)	120	1	60	0.4	1, 7, 8

REMARKS:

1. PROVIDE WITH NEC COMPLIANT INTEGRAL DISCONNECT MEANS.
2. PROVIDE WITH VARI-GREEN INTEGRAL UNIT-MOUNTED SPEED DIAL FOR BALANCING AIRFLOW.
3. PROVIDE WITH BACKDRAFT DAMPER AND VIBRATION ISOLATORS.
4. PROVIDE WITH INSULATION 18" TALL PLENUM CURB.
5. REFER TO CONTROL DRAWINGS FOR MORE INFORMATION.
6. STARTING/OPERATING BRAKE HORSEPOWER LISTED.
7. PROVIDE WITH LINT TRAP, ALUMINUM WALL CAP WITH INTEGRAL BDD FLAP, AND CURRENT SENSOR SENSOR BY E.C. TO INTERLOCK WITH DRYER OPERATION.
8. PROVIDE WITH VARIABLE SPEED CONTROL KNOB ADJACENT TO FAN FOR BALANCING ONLY. NO SWITCH NEEDED.

AUTOMATIC CONTROL VALVE SCHEDULE

TAG	SYSTEM SERVED	LOCATION	PIPE SIZE (INLET / OUTLET)	CONTROL MODE	FLOW RATE (GPM)	ACCEPTABLE CV RANGE	WORKING PRESSURE (PSIG)	CONTROL ACTION	VALVE ACTUATOR	VALVE TYPE	VALVE MANUFACTURER	REMARKS
ACV-1A	SYSTEM GW MINIMUM FLOW	UPPER LEVEL MECH B203A	4" / 4"	2-WAY MODULATING	120	50-55	175	FAIL LAST	ELECTRIC	BALL	BELIMO	1,2,3
ACV-1B	SYSTEM GW MINIMUM FLOW	PLATFORM MEZZANINE	2.5" / 2.5"	2-WAY MODULATING	45	21-25	175	FAIL LAST	ELECTRIC	BALL	BELIMO	1,2,3
ACV-2A	DOAS-1	DOAS PIPING CHASE	2.5" / 2.5"	2-WAY MODULATING	63	30-35	175	NO	ELECTRIC	BALL	BELIMO	ALL
ACV-2B	DOAS-1	DOAS PIPING CHASE	2.5" / 2.5"	2-WAY MODULATING	63	30-35	175	NO	ELECTRIC	BALL	BELIMO	ALL
ACV-2C	DOAS-1	DOAS PIPING CHASE	2.5" / 2.5"	2-WAY MODULATING	63	30-35	175	NO	ELECTRIC	BALL	BELIMO	ALL
ACV-3A	DWH-1	MAIN MECH ROOM	2" / 2"	2-WAY 2-POSITION	45	--	175	NO	ELECTRIC	BUTTERFLY	BELIMO	1,2,3
ACV-3B	DWH-2	MAIN MECH ROOM	2" / 2"	2-WAY 2-POSITION	45	--	175	NO	ELECTRIC	BUTTERFLY	BELIMO	1,2,3
ACV-4	GEOTHERMAL BYPASS	MAIN MECH ROOM	8" / 8"	2-WAY MODULATING	700	808	175	FAIL CLOSED	ELECTRIC	BUTTERFLY	BELIMO	1,2,3
ACV-5	LOOP FILTER	MAIN MECH ROOM	3" / 3"	2-WAY MODULATING	70	35-45	175	NC	ELECTRIC	BALL	BELIMO	1,2,3

REMARKS:

1. ATC SUBCONTRACTOR SHALL FURNISH ALL CONTROL VALVES FOR PROJECT MC TO INSTALL IN PIPE.
2. ALL 120V ACTUATORS SHALL BE POWERED BY PROJECT EC. ALL 24V ACTUATORS TO BE PROVIDED BY THE ATC INCLUDING ALL CONTROL TRANSFORMERS AS REQUIRED (TO BE PLENUM RATED IF INSTALLED IN PLENUM).
3. VALVE SIZE CANNOT BE LESS THAN (2) PIPE DIAMETER SIZES THAN INLET/OUTLET PIPE.
4. VALVE SHALL BE PROVIDED BY DOAS-1 MANUFACTURER.

SILENCER SCHEDULE

TAG	SYSTEM	PRESSURE CLASS ("WG)	DIMENSIONS			AIR FLOW	VELOCITY (FPM)	MIN D.P. (IN.WG.)	MIN. DYNAMIC INSERTION LOSS / MAX. GENERATED NOISE (dB) OCTAVE BAND CENTER FREQUENCY								MANUFACTURER MODEL NUMBER	REMARKS
			WIDTH (IN.)	HEIGHT (IN.)	LENGTH (IN.)				63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		
SA-1	DOAS-1 OUTSIDE AIR	8	60	40	96	20,800	+1248	0.14	7 / 59	13 / 42	30 / 31	37 / 31	35 / 32	24 / 27	16 / 13	11 / 20	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-2	DOAS-1 OUTSIDE AIR	8	48	32	96	12,900	+1219	0.10	10 / 57	16 / 39	32 / 28	38 / 28	34 / 29	23 / 24	17 / 10	12 / 17	VAW SYSTEMS MODEL: RSA	1,3,4,5,6,8,9
SA-3	DOAS-1 OUTSIDE AIR	8	24	14	96	3,000	+1286	0.09	10 / 49	16 / 34	32 / 25	38 / 24	34 / 26	23 / 24	17 / 10	12 / 14	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-4	DOAS-1 EXHAUST AIR	8	60	40	84	22,000	-1320	0.12	5 / 56	14 / 56	30 / 45	41 / 41	42 / 44	33 / 40	22 / 24	14 / 26	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-5	DOAS-1 EXHAUST AIR	8	40	26	96	8,900	-1232	0.11	11 / 51	15 / 41	31 / 40	37 / 35	34 / 39	22 / 34	16 / 20	9 / 20	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-6	DOAS-1 EXHAUST AIR	8	24	14	72	2,500	-1071	0.15	6 / 48	15 / 45	29 / 42	41 / 43	48 / 45	38 / 42	24 / 29	16 / 21	VAW SYSTEMS MODEL: RSA-EW	1,3,4,5,6,8,9
SA-7	DOAS-1 OUTSIDE AIR	8	36	28	84	8,000	+1143	0.14	3 / 56	8 / 48	15 / 40	27 / 39	41 / 40	34 / 41	24 / 33	16 / 27	VAW SYSTEMS MODEL: RSA	1,3,4,5,6,7
SA-8	DOAS-1 EXHAUST AIR	8	36	30	84	7,200	-960	0.08	9 / 50	15 / 45	34 / 41	48 / 43	51 / 47	41 / 42	25 / 26	15 / 18	VAW SYSTEMS MODEL: RSA	1,3,4,5,6,7
SA-9	VHP-048-2.38 SUPPLY AIR	8	40	26	96	8,900	-1232	0.11	8 / 49	10 / 35	18 / 30	22 / 30	19 / 30	13 / 24	12 / 14	8 / 17	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-10	VHP-240-2.40 SUPPLY AIR	8	24	14	72	2,500	-1071	0.15	2 / 53	8 / 45	14 / 39	24 / 37	30 / 40	28 / 39	22 / 30	16 / 27	VAW SYSTEMS MODEL: RSA-HTL	1,3,4,5,6,8,9
SA-11	VHP-240-2.40 RETURN AIR	8	40	26	96	8,900	-1232	0.11	5 / 50	10 / 44	19 / 41	27 / 42	29 / 45	22 / 39	16 / 23	11 / 17	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6
SA-12	VHP-300-2.28 RETURN AIR	8	24	14	72	2,500	-1071	0.15	4 / 51	7 / 38	13 / 38	26 / 31	38 / 37	25 / 30	17 / <10	16 / 13	VAW SYSTEMS MODEL: RSA	1,2,3,4,5,6

REMARKS:

1. CASING JOINTS LOCKFORMED AND MASTIC FILLED SEAMS
2. CASING 22 GA. GALV; PERF 22 GA. GALV
3. MEDIA AND PROTECTION SHALL BE FORMALDEHYDE FREE FIBERGLASS WITH CLOTH.
4. 2" SLIP INLET AND OUTLET CONNECTION.
5. PRESSURE DROP SHALL NOT EXCEED SCHEDULED VALUE.
6. ACOUSTIC PERFORMANCE SHALL BE MEET OR EXCEED SCHEDULED VALUES.
7. CASING 22 GA. SS304; PERF 24 GA. 304 SS
8. CASING 16 GA. GALV; PERF 22 GA. GALV
9. PROVIDE HIGH TRANSMISSION LOSS CASING (16 GA. OR THICKER)

EXPANSION TANK SCHEDULE

UNIT NO.	SERVICE	LOCATION	REQUIRED TANK VOLUME (GAL.)	REQUIRED ACCEPTANCE VOLUME (GAL.)	ACTUAL TANK VOLUME (GAL.)	ACTUAL ACCEPTANCE VOLUME (GAL.)	PHYSICAL SIZE HxD (IN.)	FILL PRESSURE (PSIG)	MAX WORKING PRESSURE (PSIG)	MAX DESIGN TEMPERATURE (°F)	MANUFACTURERS MODEL NO.	REMARKS
ET-1	GEOTHERMAL SYSTEM	MECHANICAL ROOM	150	115	158	158	65x30	25	125.0	95	BELL & GOSSETT - B600	1

REMARKS:

1. TANK SHALL BE INSTALLED ON 4" CONCRETE PAD ON MECHANICAL ROOM FLOOR.

ELECTRIC HEATER SCHEDULE

UNIT NO.	MANUFACTURERS MODEL NO.	LOCATION	TYPE	INPUT (KW)	MBH	CFM	V/Ø/HZ	WEIGHT (LBS)	DIMENSIONS WxDxH (IN)	REMARKS
EUH-1	INDEECO 922IC45	SEE PLANS	ELECTRIC	6	20.5	500	208/3/60	160	45x9.75x26.375	1, 3, 4, 5, 6
EUH-2	INDEECO CDI9371	SEE PLANS	ELECTRIC	5	17.1	300	208/3/60	40	23.73x23.75x7	1, 3, 4, 5, 6
EUH-3	QMARK MUH078	LOADING DOCK	ELECTRIC	7.5	25.6	650	208/3/60	38	19x7.5x21.75	2, 7

REMARKS:

1. MC TO PROVIDE EACH UNIT WITH INTEGRAL DISCONNECT, 24 VAC TRANSFORMER, INTEGRAL MECHANICAL THERMOSTAT, AND PERMANENT WASHABLE INTAKE FILTER. PROVIDE AUTOMATIC AND MANUAL THERMAL RESETS AND REQUIRED HARDWARE FOR FIELD INSTALLATION.
2. MC TO PROVIDE AND INSTALL ELECTRIC UNIT HEATER WITH INTEGRAL DISCONNECT AND THERMOSTAT, COORDINATE WIRING WITH EC.
3. UNIT SHALL HAVE FRONT INLET AND FRONT DISCHARGE.
4. COORDINATE FINISH WITH ARCHITECT.
5. COORDINATE ELECTRICAL KNOCKOUTS WITH ARCHITECT.
6. UNIT SHALL BE FULLY RECESSED. PROVIDE WITH WALL/CEILING RECESS TRIM KIT.
7. PROVIDE WITH CEILING MOUNT ANGLE IRON.

LOOP FILTER SCHEDULE

MARK	SERVICE	GPM	FILTER	P.D. (PSI)	DIAMETER (IN)	HEIGHT (IN)	MANUFACTURERS MODEL NO.	REMARKS
LF-1	GEOTHERMAL SYSTEM	70	HC/170-20	25	13	39	HARMSCO HUR 170 HP	ALL

REMARKS:

1. PROVIDE OWNER WITH 3 SETS OF EXTRA FILTERS AFTER COMPLETION OF PROJECT.
2. PROVIDE 1" DRAIN PIPING AND 1" BALL VALVE WHICH SHALL BE ROUTED TO NEAREST FLOOR DRAIN.
3. APPROVED MANUFACTURERS ARE HARMSCO, LAKOS, J.L. WINGERT.

LOUVER SCHEDULE

UNIT ID	MODEL	SERVICE	CFM	DIMENSIONS WxH (IN.)	FREE AREA (SF)	VELOCITY (FPM)	P.D. ("WG)	REMARKS
L-1	RUSKIN ELF375DXH	ART ROOMS	325	24"x12"	1.08	301	0.01	ALL

REMARKS:

1. COLOR TO BE SELECTED BY ARCHITECT.
2. PROVIDE MESH SCREEN
3. PROVIDE WITH COATING FOR PREMIUM FINISH AND WEATHER PROTECTION.
4. PROVIDE LOUVERS WITH DOWNSPOUTS AND CAULKING SURFACES FOR DRAINAGE FROM THE FRONT OF THE LOUVER

AIRFLOW MEASURING CONTROL DAMPER SCHEDULE

MARK	SERVICE	SIZE (W"xH")	MAX CFM	MIN CFM	MANUFACTURERS MODEL NO.	REMARKS
EAD-1	GYM	36 x 30	7100	580	GREENHECK VCD-33 EBTRON AIR-IQ2	1,2,3,4,6
OAD-1	GYM	36 X 28	8000	0	GREENHECK VCD-33 EBTRON AIR-IQ2	1,2,3,4,6
EAD-2	BLACK BOX	36 x 22	4000	435	GREENHECK VCD-23 EBTRON AIR-IQ2	1,2,4,5,6
EAD-3	CAFETERIA	14 x 14	940	940	GREENHECK VCD-23 EBTRON AIR-IQ2	1,2,4,5,6

REMARKS:

1. PROVIDE WITH STRAIGHT DUCT LENGTH INLET / OUTLET PER MANUFACTURER'S RECOMMENDATION. PROVIDE WITH HUMIDITY SENSOR.
2. EXHAUST/RETURN/OUTSIDE AIR ASSEMBLIES WILL REQUIRE GREENHECK DAMPER TO BE PROVIDED W/ 14" SLEEVE. DAMPER SHALL BE INSTALLED OUTDOORS.
3. PROVIDE NEMA 4X ACTUATOR. SEE SPECIFICATIONS FOR MORE INFORMATION.
4. ASSEMBLIES WILL REQUIRE EBTRON PROBES TO BE MOUNTED 1 DUCT DIAMETER ((WIDTH + HEIGHT)/2) UPSTREAM DAMPER.
5. IF CONCEALED MOUNTING IS REQUIRED, AN ACCESS DOOR MUST BE PROVIDED TRHU WEATHER PROOF INSULATION AND JACKETING
6. ALL 120V ACTUATORS SHALL BE POWERED BY PROJECT EC. ALL 24V ACTUATORS TO BE PROVIDED BY THE ATC INCLUDING ALL CONTROL TRANSFORMERS AS REQUIRED (TO BE PLENUM RATED IF INSTALLED IN PLENUM).

CONDENSATE PUMP

MARK	SERVICE	GPH	HEAD (FT H2O)	DISCHARGE SIZE Ø (IN)	SIZE (L"xW"xH")	V/Ø/HZ	MANUFACTURER.	MODEL NO.	REMARKS
CP-1	GEOTHERMAL SYSTEM	65	1	3/8	11x5x7	115/60/1	LITTLE GIANT	VCMA-15ULST	ALL

REMARKS:

1. DEVICE AND ASSOCIATED CABLING SHALL BE PLENUM RATED.

AIR SEPARATOR SCHEDULE

MARK	SERVICE	INLET SIZE Ø (IN)	OUTLET SIZE Ø (IN)	GPM	WPD (FT. H2O)	MANUFACTURER MODEL NO.	ACCESSORIES	REMARKS
AS-1	GEOTHERMAL SYSTEM	8	8	780	1.35	BELL & GOSSETT R-8F	ASME RATED	ALL

REMARKS:

1. NO STRAINER REQUIRED.
2. PROVIDE WITH MANUAL AIR VENT, PIPE TO FLOOR DRAIN.
3. PROVIDE HANGERS TO SUPPORT AIR SEPARATOR FROM BODY OF UNIT.

GRILLE, REGISTER, & DIFFUSER SCHEDULE

MARK	SERVICE	MODULE SIZE OR LENGTH	NECK SIZE	FINISH	MATERIAL	MOUNTING	CFM RANGE	MAX. PRESSURE DROP	MAX N.C. RATING	MANUFACTURERS MODEL NO.	REMARKS
SD-1	SUPPLY	24" x 24"	6" DIA	PER ARCH	ALUMINUM	LAY-IN	0-100	0.02"	10	TITUS MODEL OMNI-AA	SEE NOTES 1, 2, 3, & 4
SD-2	SUPPLY	24" x 24"	8" DIA	PER ARCH	ALUMINUM	LAY-IN	101-200	0.04"	10	TITUS MODEL OMNI-AA	SEE NOTES 1, 2, 3, & 4
SD-3	SUPPLY	24" x 24"	10" DIA	PER ARCH	ALUMINUM	LAY-IN	201-350	0.06"	12	TITUS MODEL OMNI-AA	SEE NOTES 1, 2, 3, & 4
SD-4	SUPPLY	24" x 24"	12" DIA	PER ARCH	ALUMINUM	LAY-IN	351-500	0.06"	13	TITUS MODEL OMNI-AA	SEE NOTES 1, 2, 3, & 4
SD-5	KITCHEN SUPPLY	24" x 24"	8" x 8"	PER ARCH	ALUMINUM	LAY-IN	0-235	0.03"	17	TITUS MODEL PMC-AA	SEE NOTES 1, 3, & 4
SD-6	KITCHEN SUPPLY	24" x 24"	10" x 10"	PER ARCH	ALUMINUM	LAY-IN	235-350	0.04"	21	TITUS MODEL PMC-AA	SEE NOTES 1, 3, & 4
SD-7	WEIGHT ROOM SUPPLY	24" x 24"	8" x 8"	PER ARCH	STEEL	LAY-IN	0-235	0.03"	17	TITUS MODEL PMC	SEE NOTES 1, 3, & 4
SG-1	SUPPLY	14" x 8"	12" x 6"	PER ARCH	ALUMINUM	SIDEWALL	0-175	0.05"	11	TITUS MODEL 300FS	SEE NOTES 3, 5, & 9
SG-2	SUPPLY	22" x 8"	20" x 6"	PER ARCH	ALUMINUM	SIDEWALL	175-350	0.02"	16	TITUS MODEL 300FS	SEE NOTES 3, 5, & 9
SG-3	SUPPLY	24" x 12"	22" x 10"	PER ARCH	ALUMINUM	SIDEWALL	600-675	0.07"	22	TITUS MODEL 300FS	SEE NOTES 3, 5, & 9
SG-4	SUPPLY	24" x 12"	22" x 10"	PER ARCH	STEEL	SIDEWALL	600-675	0.07"	22	TITUS MODEL 300RS	SEE NOTES 3, 5, & 9
SG-5	SUPPLY	26" x 14"	24" x 12"	PER ARCH	ALUMINUM	SIDEWALL	725-900	0.07"	24	TITUS MODEL 300FS	SEE NOTES 3, 5, & 9
SG-6	AUX GYM / MEDIA CENTER SUPPLY	19.7" x 7.7"	18" x 6"	PER ARCH	STEEL	DUCT MOUNT	300-400	0.13"	21	TITUS MODEL US-DL-SV	SEE NOTES 5 & 8
SG-7	CAFETERIA SUPPLY	25.7" x 7.7"	24" x 6"	PER ARCH	STEEL	DUCT MOUNT	400-500	0.10"	21	TITUS MODEL US-DL-SV	SEE NOTES 5 & 8
SG-8	GYM SUPPLY	37.7" x 7.7"	36" x 6"	PER ARCH	STEEL	DUCT MOUNT	625-1000	0.18"	31	TITUS MODEL US-DL-SV	SEE NOTES 5 & 8
LD-1	SUPPLY	4'-0" (1 SLOT)	6" DIA	PER ARCH	ALUMINUM	LAY-IN	0-99	0.05"	10	TITUS MODEL FL-10-HT	SEE NOTES 3 & 6
LD-2	SUPPLY	4'-0" (1 SLOT)	8" DIA	PER ARCH	ALUMINUM	LAY-IN	100-250	0.12"	24	TITUS MODEL FL-15-HT	SEE NOTES 3 & 6
LD-3	SUPPLY	5'-0" (2 SLOT)	12" DIA	PER ARCH	ALUMINUM	SIDEWALL	600-1450	0.05"	10	TITUS MODEL FT-30-HT	SEE NOTES 3 & 6
LR-1	RETURN	6" x 112"	--	PER ARCH	ALUMINUM	SIDEWALL	1600	0.03"	24	TITUS MODEL CT-540	SEE NOTES 3 & 7
RR-1	RETURN	12" x 12"	6" x 6"	PER ARCH	ALUMINUM	LAY-IN	0-125	0.07"	24	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-2	RETURN	24" x 24"	8" x 8"	PER ARCH	ALUMINUM	LAY-IN	126-225	0.02"	14	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-3	RETURN	24" x 24"	10" x 10"	PER ARCH	ALUMINUM	LAY-IN	226-350	0.02"	17	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-4	RETURN	24" x 24"	12" x 12"	PER ARCH	ALUMINUM	LAY-IN	351-500	0.02"	20	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-5	RETURN	24" x 24"	15" x 15"	PER ARCH	ALUMINUM	LAY-IN	501-900	0.02"	24	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-6	RETURN	24" x 24"	18" x 18"	PER ARCH	ALUMINUM	LAY-IN	901-1200	0.02"	26	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-7	RETURN	24" x 24"	--	PER ARCH	ALUMINUM	LAY-IN	--	--	--	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-8	KITCHEN RETURN	24" x 24"	18" x 18"	PER ARCH	ALUMINUM	LAY-IN	901-1200	0.02"	26	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
RR-9	WEIGHT ROOM RETURN	24" x 24"	15" x 15"	PER ARCH	STEEL	LAY-IN	501-900	0.02"	24	TITUS MODEL PXP	SEE NOTES 2 & 3
ER-1	EXHAUST	12" x 12"	6" DIA	PER ARCH	ALUMINUM	LAY-IN	0-100	0.02"	13	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
ER-2	EXHAUST	24" x 24"	8" DIA	PER ARCH	ALUMINUM	LAY-IN	101-200	0.03"	17	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
ER-3	EXHAUST	24" x 24"	10" DIA	PER ARCH	ALUMINUM	LAY-IN	201-350	0.02"	22	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
ER-4	EXHAUST	24" x 24"	12" DIA	PER ARCH	ALUMINUM	LAY-IN	351-500	0.03"	24	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
ER-5	WEIGHT ROOM EXHAUST	24" x 24"	8" x 8"	PER ARCH	STEEL	LAY-IN	101-200	0.03"	17	TITUS MODEL PXP	SEE NOTES 2 & 3
ER-6	KITCHEN EXHAUST	24" x 24"	8" x 8"	PER ARCH	ALUMINUM	LAY-IN	101-200	0.03"	17	TITUS MODEL PXP-AA	SEE NOTES 2 & 3
EG/RG-1	EXHAUST/ RETURN	26" x 12"	24" x 10"	PER ARCH	STEEL	SIDEWALL	600-650	0.05"	18	TITUS MODEL 33RL	SEE NOTES 3 & 5
EG/RG-2	EXHAUST/ RETURN	26" x 14"	24" x 12"	PER ARCH	ALUMINUM	SIDEWALL	700-800	0.04"	13	TITUS MODEL 350FL	SEE NOTES 3 & 5
EG/RG-3	EXHAUST/ RETURN	20" x 20"	18" x 18"	PER ARCH	ALUMINUM	SIDEWALL	925-975	0.04"	13	TITUS MODEL 350FL	SEE NOTES 3 & 5
EG/RG-4	EXHAUST/ RETURN	32" x 32"	30" x 30"	PER ARCH	STEEL	SIDEWALL	2400	0.04"	23	TITUS MODEL 33RL	SEE NOTES 3 & 5
EG/RG-5	EXHAUST/ RETURN	44" x 26"	42" x 24"	PER ARCH	ALUMINUM	SIDEWALL	3200	0.05"	17	TITUS MODEL 350FL	SEE NOTES 3 & 5
EG/RG-6	BLACK BOX EXHAUST	44" x 38"	42" x 36"	PER ARCH	ALUMINUM	SIDEWALL	4000	0.05"	11	TITUS MODEL 350FL	SEE NOTES 3 & 5
EG/RG-7	BLACK BOX RETURN	86" x 32"	42" x 30" (TYP. 2)	PER ARCH	ALUMINUM	SIDEWALL	6400	0.02"	10	TITUS MODEL 350FL	SEE NOTES 3, 5, & 10
EG/RG-8	CAFETERIA RETURN	70" x 36"	34" x 34" (TYP. 2)	PER ARCH	ALUMINUM	SIDEWALL	6400	0.04"	15	TITUS MODEL 350FL	SEE NOTES 3, 5, & 10
EG/RG-9	GYM EXHAUST	50" x 50"	48" x 48"	PER ARCH	STEEL	SIDEWALL	7100	0.05"	30	TITUS MODEL 33RL	SEE NOTES 3 & 5
EG/RG-10	GYM RETURN	44" x 74"	42" x 24" (TYP. 3)	PER ARCH	STEEL	SIDEWALL	10000	0.07"	26	TITUS MODEL 33RL	SEE NOTES 3, 5, & 10

REMARKS:

1. DIFFUSERS SHALL HAVE A UNIFORM FACE APPEARANCE FOR ALL NECK SIZES WITHIN THE SAME SPACE. PROVIDE WITH INSULATED BACK PANEL.
2. PROVIDE CEILING DIFFUSERS WITH SQUARE TO ROUND TRANSITIONS WHERE NECESSARY (3" MINIMUM HEIGHT) WITH EXTERNALLY INSULATED PLENUM.
3. MECHANICAL CONTRACTOR SHALL VERIFY AIR DEVICES ARE COMPATIBLE WITH CEILING/WALL CONSTRUCTION TYPES INDICATED ON ARCHITECTURAL DRAWINGS AND PROVIDE AIR DEVICE WITH APPROPRIATE BORDER FOR INSTALLATION IN CEILING/WALL CONSTRUCTION PRIOR TO PURCHASING AIR DEVICES.
4. ALL SUPPLY DIFFUSERS SHALL BE 4-WAY BLOW PATTERN UNLESS INDICATED OTHERWISE WITH DIRECTIONAL ARROWS ON PLAN.
5. COORDINATE FINISH WITH ARCHITECT.
6. PROVIDE LINEAR SLOT DIFFUSER WITH FACTORY SUPPLIED INSULATED PLENUM #MPI-39. COORDINATE BORDER, HANGERS, AND MOUNTING CLIPS WITH CEILING / INSTALL LOCATION. SEVERAL DIFFUSERS SHALL BE INSTALLED WITH UHC HANGERS TO SUPPLY BETWEEN CLOUD CEILINGS.
7. PROVIDE WITH 0° DEFLECTION AND TYPE 22 BORDER WITH TAPE AND SPACKLE. DEVICE SHALL BE INSTALLED TO MATCH CURVED WALL AND SHALL BE UTILIZED AS RETURN PLENUM OPENING THROUGH WALL.
8. PROVIDE WITH BLADE SCOOP.
9. DIFFUSER SHALL BE 22.5° BLADES.
10. PROVIDE ONE SEGMENTED DEVICE WITH MULTIPLE NECK CONNECTIONS AS SCHEDULED.

AUTOMATIC SMOKE VENT SCHEDULE

MARK	MANUFACTURER	MODEL	SERVICE/TYPE	TYPE	SMOKE VENT SIZE	MATERIAL	WEIGHT (LBS)
AD-1	ACUDOR	SVZG48X120D2N165R	ACOUSTICALLY SOUND RATED OITC 47, STC 50	DOUBLE LEAF	4' x 10'	STEEL	1840.5

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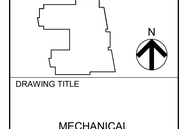

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

MECHANICAL SCHEDULES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	5/19/2026
DRAWN BY	BH
APPROVED BY	BKK

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

M9.02

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ABBREVIATIONS

A	AMPERE
AFCI	ARC-FAULT CIRCUIT INTERRUPTOR
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
AIC	AMPERE INTERRUPTING CURRENT
AI	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTES
ATS	AUTOMATIC TRANSFER SWITCH
AV	AUDIO VISUAL
AWG	AMERICAN WIRE GAUGE
CONDUIT	CONDUIT
CATV	COMMUNITY ANTENNA TELEVISION
CB	CIRCUIT BREAKER
CK	CLOCK
CKT	CIRCUIT
cmil	CIRCULAR MIL
CO/ALR	COPPER-ALUMINUM, REVISED
COPS	CRITICAL OPERATIONS POWER SYSTEMS
CR	CARD READER
CSA	CANADIAN STANDARDS ASSOCIATION
Cu	COPPER
DIA	DIAMETER
DOCA	DESIGNATED CRITICAL OPERATIONS AREAS
DS	DISCONNECT SWITCH
EC	ELECTRICAL CONTRACTOR
EGC	EQUIPMENT GROUNDING CONDUCTOR
EM	EMERGENCY
EMF	ELECTROMOTIVE FORCE
EMT	ELECTRICAL METALLIC TUBING
ENT	ELECTRICAL NONMETALLIC TUBING
EPO	EMERGENCY POWER OFF
ESS	ENERGY STORAGE SYSTEM
EV	ELECTRICAL VEHICLE
EVPE	ELECTRICAL VEHICLE POWER EXPORT EQUIPMENT
EVSE	ELECTRICAL VEHICLE SUPPLY EQUIPMENT
F	FUSE
FLA	FULL-LOAD AMPERES
FMC	FLEXIBLE METAL CONDUIT
FMT	FLEXIBLE METAL TUBING
FT	FEET
FURN.	FURNISHED
GC	GENERAL CONTRACTOR
GEC	GROUNDING ELECTRODE CONDUCTOR
GF	GROUND FAULT
GFI	GROUND-FAULT INTERRUPTER
GFCI	GROUND-FAULT CIRCUIT INTERRUPTER
GFPE	GROUND-FAULT PROTECTION OF EQUIPMENT
GND	GROUND
HACR	HEATING, AIR CONDITIONING, AND REFRIGERATION
HDPE	HIGH DENSITY POLYETHYLENE
HGT.	HEIGHT
HID	HIGH INTENSITY DISCHARGE
HOA	HAND, OFF, AUTOMATIC SWITCH
hp	HORSEPOWER
HVAC	HEATING, VENTILATION, AND AIR CONDITIONING
Hz	HERTZ (CYCLE PER SECOND)
IAEI	INTERNATIONAL ASSOCIATIONS OF ELECTRICAL INSPECTORS
IBT	INTERSYSEM BONDING TERMINATION
IEC	INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEEE	INSTITUTE OF ELECTRICAL ELECTRONICS ENGINEERS
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
IS	INTRINSICALLY SAFE
ITE	INFORMATION TECHNOLOGY EQUIPMENT
JB	JUNCTION BOX
kcmil	ONE THOUSAND CIRCULAR MILS
kVA	KILOVOLT-AMPERES
KVAR	KILOVOLT-AMPERES REACTIVE
kW	KILWATTS
LCDI	LEAKAGE - CURRENT DETECTOR - INTERRUPTER
LED	LIGHT-EMITTING DIODE
LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT
LFNC	LIQUIDTIGHT FLEXIBLE NON-METALLIC CONDUIT
LISW	LOAD INTERRUPTER SWITCH
LNG	LIQUIFIED NATURAL GAS
LP-GAS	LIQUIFIED PETROLEUM GAS
LRC	LOCKED-ROTOR CURRENT
MC	MECHANICAL CONTRACTOR
MCB	MAIN CIRCUIT BREAKER
MDC	MODULAR DATA CENTER
MFR.	MANUFACTURER
MG. SET	MOTOR-GENERATOR SET
MIDI	MUSICAL INSTRUMENT DIGITAL INTERFACE
MISC	MISCELLANEOUS
MLO	MAIN LUG ONLY
MSHA	MINE SAFTEY AND HEALTH ADMINISTRATION
MTD	MOUNTED
MW	MEGAWATTS
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NESC	NATIONAL ELECTRICAL SAFTEY CODE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NIU	NETWORK INTERFACE UNIT
NO	NORMALLY OPEN
NPT	NATIONAL (AMERICAN) STANDARD PIPE TAPER
NRTL	NATIONALLY RECOGNIZED TESTING LABORATORIES
NTS	NOT TO SCALE
NUCC	NONMETALLIC UNDERGROUND CONDUIT WITH CONDUCTORS
OCPD	OVERCURRENT PROTECTIVE DEVICE
ONT	OPTICAL NETWORK TERMINAL
P	POLE
PB	PULLBOX OR PUSHBUTTON
PCS	POWER CONVERSION SYSTEM
PCU	POWER-CONDITIONING UNIT
PE	POLYETHYLENE
PF	POWER FACTOR
PHEV	PLUG-IN HYBRID ELECTRIC VEHICLE
PLC	PROGRAMMABLE LOGIC CONTROLLERS
PLFA	POWER-LIMITED FIRE ALARM
PNL	PANEL
PoE	POWER OF ETHERNET
PWR	POWER
RMC	RIGID METAL CONDUIT
RMS	ROOT MEAN SQUARE
RNC	RIGID NONMETALLIC CONDUIT
RPM	REVOLUTIONS PER MINUTE
RTRC	REINFORCED THERMOSETTING RESIN CONDUIT
SCR	SUPERVISORY CONTROLLED RECTIFIER
SI	INTERNATIONAL SYSTEM OF UNITS
SP	SPARE
SPD	SURGE-PROTECTIVE DEVICE
SW	SWITCH
SWD	SWITCHING DUTY
SYM	SYMMETRICAL
TEFC	TOTALLY ENCLOSED FAN-COOLED
TEMPL	TEMPERATURE
TMCB	THERMAL MAGNETIC CIRCUIT BREAKER
TR	TAMPER-RESISTANT
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP.	TYPICAL
UL	UNDERWRITERS LABORTORIES
UPS	UNINTERRUPTIBLE POWER SUPPLY
USB	UNIVERSAL SERIAL BUS
V	VOLT
VA	VOLT-AMPERE
V AC	VOLTS ALTERNATING CURRENT
VAR	VOLT-AMPERE REACTIVE
V DC	VOLTS DIRECT CURRENT
VFD	VAIRABLE FREQUENCY DRIVE
VT	VOLTAGE TRANSFORMER
VOM	VOLT-OHM-MULTIMETER
W	WIRE
W-hr	WATT-HOUR
WP	WEATHER-PROOF
WPT	WIRELESS POWER TRANSFORMER
WPTE	WIRELESS POWER TRANSFORMER EQUIPMENT
WR	WEATHER RESISTANT
XFMR	TRANSFORMER
Δ	DELTA
Y	WYE
ϕ	PHASE

CODES AND STANDARDS COMPLIANCE

1. PROJECT SHALL COMPLY WITH THE FOLLOWING STANDARDS AND CODES.
   - A. ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES.
   - B. CONNECTICUT STATE BUILDING CODE (IBC 2021 WITH AMENDMENTS).
   - C. 2022 ENERGY CONSERVATION CODE OF CONNECTICUT.
   - D. 2022 CONNECTICUT ELECTRICAL CODE (NFPA 70 2020 WITH AMENDMENTS).

DESCRIPTION	MOUNTING HEIGHT	SYMBOL
LIGHTING CONTROLS		
LIGHT SWITCH: LOW VOLTAGE (WHEN PRESENT, # INDICATES QUANTITY OF CHANNELS)		$ #, $ VS
SWITCHING NOTATION: "3" - INDICATES QUANTITY OF SWITCH POLES 'abc' - INDICATES SWITCH LEG(S). SWITCHLEGS TO BE CONTROLLED FROM UNIQUE SWITCH CHANNEL "AA" - INDICATES SWITCH TYPE. REFER TO TYPES BELOW		$3 $AA
LOW VOLTAGE DIMMER SWITCH (WHEN PRESENT, # INDICATES QUANTITY OF CHANNELS)		$ DI
LINE VOLTAGE SWITCH		$ LV
GRAPHIC TOUCHSCREEN CONTROL STATION		$ G
KEYED SWITCH		$ K
OCCUPANCY OR VACANCY SENSOR SWITCH		$ OS, $ VS
OCCUPANCY OR VACANCY SENSOR SWITCH WITH DIMMING		$ DOS
TIMER SWITCH		$ T
OCCUPANCY OR VACANCY SENSOR, CEILING MOUNT	CLG	OS, VS
DAYLIGHT SENSOR	AS NOTED	DS
PHOTOCELL	AS NOTED	PC
LIGHTING RELAY	AS NOTED	LR
EMERGENCY AUTOMATIC TRANSFER SWITCH FOR LIGHTING CONTROLS (REFER TO DETAIL)	CLG	ERC
LIGHTING CONTROL PANEL		LCP
POWER OUTLETS		
SIMPLEX RECEPTACLE (WHERE PRESENT, TEXT INDICATES RECEPTACLE TYPE)	1'-6"	
DUPLEX RECEPTACLE	1'-6"	
CONTROLLED DUPLEX RECEPTACLE	1'-6"	
SLASH THROUGH ANY DEVICE INDICATES MOUNTING ABOVE COUNTERTOP 4" ABOVE BACKSPLASH (WHERE PRESENT, TEXT INDICATES RECEPTACLE TYPE)		
'G' INDICATES INTEGRAL GROUND FAULT PROTECTION (GFCI)	1'-6"	
DEAD FRONT GFCI DEVICE, LABEL AND INSTALL IN READILY ACCESSIBLE LOCATION		
DUPLEX RECEPTACLE WITH TWO INTEGRAL USB CHARGING PORTS	1'-6"	USB
USB CHARGING OUTLET WITH FOUR INTEGRAL USB PORTS	1'-6"	USB
GANG RECEPTACLE IN COMBINATION WITH SWITCH (PROVIDE DIVIDER IF LIGHTING CIRCUIT IS 277V)	48"	
RECEPTACLE. CEILING MOUNTED (DUPLEX & QUADRUPLEX)	CLG	
QUADRUPLEX RECEPTACLE	1'-6"	
JUNCTION BOX, CEILING OR WALL		
VOLTAGE/2 POLE RECEPTACLE, TEXT INDICATES NEMA TYPE. REFER TO SPECIAL PURPOSE RECEPTACLES SCHEDULE FOR SPECIFICATIONS.	1'-6"	
VOLTAGE/3 POLE RECEPTACLE, TEXT INDICATES NEMA TYPE. REFER TO SPECIAL PURPOSE RECEPTACLES SCHEDULE FOR SPECIFICATIONS.	1'-6"	
'T' INDICATES SAFETY TYPE, TAMPER RESISTANT OUTLET(S)		T
SS INDICATES SURGE SUPPRESION TYPE OUTLET(S)		
SPLIT CONTROLLED PLUG LOAD DUPLEX / QUAD RECEPTACLE		
GROUND FAULT PROTECTED DUPLEX WITH WEATHER-PROOF "WHILE IN USE" TYPE DIE-CAST METAL COVERPLATE WITH LOCKABLE ENCLOSURE AT OUTLET - SEE SPECIFICATIONS	2'-2"	WP
BOX ON ANY DEVICE INDICATES SURFACE MOUNTED BACKBOX/WIREMOLD		
CIRCLE ON ANY DEVICE INDICATES DEVICE FED FROM STUB UP CONDUIT		
DUPLEX RECEPTACLE FOR TELEVISION. REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR MOUNTING HEIGHTS.		TV
SPECIAL OUTLETS		
FLOORBOX, AS SCHEDULED	FLOOR	FB
WALLBOX, AS SCHEDULED	WALL	WB
SURFACE PLUG-MOLD		
SURFACE WIRE-MOLD		
POWER POLE AS NOTED		PP
ONE-LINE LEGEND		
FUSE		
FUSE/UNFUSED DISCONNECT		
CIRCUIT BREAKER - MOLDED CASE "AF" DENOTES AMPERE FRAME SIZE "AT" DENOTES AMPERE TRIP SETTINGS		AF/AT
CIRCUIT BREAKER - MOLDED CASE "AF" DENOTES AMPERE FRAME SIZE "AT" DENOTES AMPERE TRIP SETTINGS		AF/AT
ENCLOSED CIRCUIT BREAKER "AF" DENOTES AMPERE FRAME SIZE "AT" DENOTES AMPERE TRIP SETTINGS		AF/AT
AUTOMATIC TRANSFER SWITCH "ATS"		ATS TS1 100A N 6 E
TRANSFORMER		TRANSFORMER T# ## kVA H1 H2 X1 X2
PANELBOARD		PANEL P1 NORMAL 208Y/120V/3Ø/4W 100A
RISER GENERATOR		GENERATOR GEN1 480Y/277V/3Ø/4W 750kVA/600kW
RISER SWITCHBOARD		SWITCHBOARD 480V/277V ####A

DESCRIPTION	MOUNTING HEIGHT	SYMBOL
LIGHTING FIXTURES AND EQUIPMENT		
REFER TO LUMINAIRE SCHEDULE FOR EXACT FIXTURE SPECIFICATIONS, MOUNTING HEIGHTS, ETC.		
FIXTURE ANNOTATIONS AND CIRCUITRY NOTATION: "AA1" - ALPHA-NUMERIC DESIGNATION DENOTES FIXTURE TYPE. "123" - CIRCUIT NUMBER TO WHICH FIXTURE IS CONNECTED 'abc' - LETTER(S) OF SWITCH(ES) CONTROLLING FIXTURE		AA1 123abc
SURFACE OR SUSPENDED CEILING FIXTURE		
POLE MOUNTED AREA LIGHT WITH CONCRETE BASE		
EMERGENCY BATTERY WALL-PACK		
WALL MOUNT FIXTURE		
TRACK COMPLETE WITH POWER SUPPLIES AND FIXTURE HEADS		
FLOODLIGHT		
EXIT LIGHT (CEILING, END, WALL MOUNT) WITH OR WITHOUT DIRECTIONAL ARROWS, WITH OR WITHOUT EGRESS HEADS		
STRIP FIXTURE		
SHADING AND 'EM' TAG INDICATED EMERGENCY FIXTURE		AA1/EM
REMOTE LIGHT FIXTURE DRIVER	AS NOTED	RD
REMOTE BATTERY BACKUP	AS NOTED	RB
CENTRAL BATTERY INVERTER	AS NOTED	CV
MISCELLANEOUS		
CONDUIT CONCEALED IN WALLS OR IN CEILING SPACE: ARROW(S) INDICATE(S) HOME RUN & # OF CIRCUITS: HASHMARKS INDICATE # OF CONDUCTORS.		PHASE NEUTRAL GROUND
NON-REVERSING MOTOR STARTER SNAP SWITCH	AS NOTED	$ M
MOMENTARY CONTACT SWITCH	46"	$ MC
HAND-OFF-AUTO 3-POSITION SWITCH	46"	$ HOA
DISCONNECT SWITCH	5'-0"	
MAGNETIC STARTER	5'-0"	
MAGNETIC COMBINATION STARTER	5'-0"	
VARIABLE FREQUENCY DRIVE	5'-0"	
ENCLOSED FLUSH MTD. CIRCUIT BREAKER	5'-0"	
MUSHROOM SWITCH	46"	
PUSHBUTTON STATION WITH 1, 2, OR 3 BUTTONS.	46"	
PANELBOARD, SURFACE OR FLUSH MOUNTED	6'-6" TO TOP	
TRANSFORMER	AS NOTED	
EQUIPMENT HARDWIRE CONNECTION (SEE DETAIL)		
MOTOR CONNECTION. REFER TO EQUIPMENT CONNECTION SCHEDULE		
SURGE PROTECTION DEVICE (SURFACE OR FLUSH MOUNTED)		SPD
CONDUIT UP		
CONDUIT DOWN		
FLEXIBLE CONDUIT		
GROUND BUS BAR ON INSULATED STANDOFFS	2'-0"	
LADDER CABLE TRAY, SIZE AS NOTED	AS SHOWN	
MECHANICAL EQUIPMENT DESIGNATOR (SEE MECH. SCHEDULES)		EQUIP-#
TAGGED NOTE		
REVISION TAG		
SCHEDULED NOTE		

LINETYPE LEGEND	
	EXISTING
	DEMOLISHED
	NEW

EXISTING EQUIPMENT LEGEND	
EXISTING DEVICE TO BE REMOVED AND CIRCUIT PULLED BACK TO POINT OF ORIGIN	X
EXISTING DEVICE TO BE MAINTAINED	XM
EXISTING DEVICE TO BE RELOCATED	XTR
NEW LOCATION OF EXISTING DEVICE. EXTEND BRANCH/FEEDER CIRCUIT TO NEW LOCATION	XN
EXISTING DEVICE TO BE REWORKED	XW

ABBREVIATIONS	
UNLESS OTHERWISE NOTED	UON
OWNER FURNISHED CONTRACTOR INSTALLED	OFCI
OWNER FURNISHED OWNER INSTALLED	OFOI
CONTRACTOR FURNISHED CONTRACTOR INSTALLED	CFCI
CONTRACTOR FURNISHED OWNER INSTALLED	CFOI
INDICATES EMERGENCY POWER	EM
WIREGUARD - PROVIDE MANUFACTURER'S SPECIFIC GUARD FOR DEVICE NOTED	WG
WEATHERPROOF - NEMA-3R; WET LOCATION LISTED. PROVIDE COVERS, RATINGS, ETC. AS SUITABLE FOR OUTDOORS.	WP
EXPLOSION PROOF - PROVIDE WIRING METHODS, ENCLOSURES, RATINGS, ETC. AS SUITABLE FOR HAZARDOUS LOCATION.	XP

GENERAL NOTES (LEGEND):

A. EACH CONTRACTOR, PROPOSER, SUPPLIER AND/OR MANUFACTURER SHALL REFER TO ALL DOCUMENTS PERTAINING TO THIS PROJECT AND COORDINATE ACCORDINGLY SO AS TO ENSURE ADEQUACY OF FIT, COMPLIANCE WITH SPECIFICATIONS, PROPER VOLTAGE AND CURRENT CHARACTERISTICS TO AVOID CONFLICT WITH ANY OTHER BUILDINGS SYSTEMS. VERIFY SAME WITH SHOP DRAWINGS.

B. ADDITIONAL ELECTRICAL REQUIREMENTS MAY BE SHOWN ON PLANS FROM OTHER DISCIPLINES IN THIS SET. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL PLANS AND SPECIFICATIONS FOR A COMPLETE UNDERSTANDING OF THE PROJECT REQUIREMENTS.

C. WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF ALL LOCAL, STATE, AND NATIONAL CODES. INCLUDING BUT NOT LIMITED TO NFPA 70 (NEC), NFPA 72, INTERNATIONAL BUILDING CODES, ETC. IN ADDITION, OBSERVE ALL APPLICABLE RULES AND REGULATIONS THAT MAY APPLY TO THE WORK UNDER THIS CONTRACT FROM CITY, COUNTY, LOCAL, STATE, FEDERAL, MUNICIPALITY, UTILITY COMPANY, OSHA, ETC.

D. CONTRACTOR SHALL FOLLOW SEISMIC RESTRAINT AND DESIGN REQUIREMENTS CONTAINED IN LATEST ADOPTED STATE AND INTERNATIONAL BUILDING CODES, WITH ALL AMENDMENTS AS ADOPTED BY THE CURRENT LEGISLATION. REFER TO ELECTRICAL AND STRUCTURAL SPECIFICATIONS FOR ADDITIONAL INFORMATION.

E. ADVISE THE ENGINEER OF ANY CONFLICTS, ERRORS, OMISSIONS, ETC. AT LEAST TEN DAYS PRIOR TO BID DATE, TO ALLOW CLARIFICATION BY WRITTEN ADDENDUM.

F. WHERE CONFLICTS ARE FOUND BETWEEN DRAWINGS, DETAILS, OR SPECIFICATIONS, THE MORE STRINGENT REQUIREMENT SHALL APPLY. NOTIFY ARCHITECT OF DISCREPANCY IN WRITING.

G. DEVIATION FROM SPECIFICATIONS OR PLANS REQUIRES PRIOR WRITTEN APPROVAL FROM THE ENGINEERS AND MUST BE SUBMITTED IN WRITING NO LATER THAN TEN DAYS PRIOR TO THE BID DATE.

H. ALL ELECTRICAL COMPONENTS OR EQUIPMENT SHALL BE LISTED AND LABELED BY UNDERWRITER'S LABORATORIES OR OTHER APPROVED LISTING AGENCY. APPROVAL AND LABELING OF INDIVIDUAL COMPONENTS ON AN ASSEMBLY IS NOT ACCEPTABLE AS MEETING THIS REQUIREMENT, UNLESS WAIVED BY THE ENGINEER IN WRITING.

I. ALL MATERIALS FURNISHED AND ALL WORK INSTALLED SHALL COMPLY WITH THE CURRENT EDITION OF THE NATIONAL ELECTRICAL CODES, NATIONAL FIRE CODES OF THE NATIONAL FIRE PROTECTION ASSOCIATION, THE REQUIREMENTS OF LOCAL UTILITY COMPANIES, AND WITH THE REQUIREMENTS OF ALL GOVERNMENTAL AGENCIES OR DEPARTMENTS HAVING JURISDICTION. IF ANY CONFLICTS OR DISCREPANCIES OCCUR THE MOST STRINGENT SHALL APPLY.

J. MOUNTING HEIGHTS FOR WALL MOUNTED DEVICES INDICATED ABOVE FINISHED FLOOR ARE TO CENTER OF DEVICE UNO. MOUNTING HEIGHTS TO CEILING SUSPENDED DEVICES ARE TO BOTTOM OF DEVICE UNO. WHERE MOUNTING HEIGHTS ARE NOT INDICATED OR ARE IN CONFLICT WITH ANY OTHER BUILDING SYSTEM, CONTACT THE ENGINEER BEFORE AFFECTING INSTALLATION. REFER ALSO TO ARCHITECTURAL INTERIOR AND EXTERIOR ELEVATIONS, CEILING HEIGHTS AND OTHER DETAILS OF THESE DOCUMENTS, AS APPLICABLE.

K. DO NOT SCALE FROM DRAWINGS, AS PRINTING DISTORTS SCALE. WORK SHALL BE LAID OUT FROM DIMENSIONED DRAWINGS, OR DIMENSIONS SUPPLIED TO THE CONTRACTOR.

L. REFER TO ARCHITECTURAL WALL ELEVATIONS (WHERE GIVEN) FOR HEIGHTS AND MOUNTING RELATIONSHIP OF OUTLETS AND FURNITURE, CASEWORK, AND/OR EQUIPMENT. ADDITIONAL OUTLETS MAY BE SHOWN ON ARCHITECTURAL DRAWINGS AND SHALL BE INCLUDED IN THE CONTRACT.

M. FLUSH OR PEDESTAL TYPE FLOOR OUTLETS/BOXES, AS INDICATED ON PLAN, SHALL BE LOCATED BY DIMENSIONS PROVIDED BY THE ARCHITECT, UNLESS OTHERWISE SHOWN ON PLANS. IF IN DOUBT, CONTACT THE ENGINEER PRIOR TO ROUGHING-IN ANY WORK.

N. INSTALL EQUIPMENT, MATERIALS, ETC. IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND DIRECTIONS. IF IN CONFLICT WITH THE DESIGN INDICATED IN CONTRACT DOCUMENTS, ADVISE THE ENGINEER PRIOR TO INSTALLATION FOR CLARIFICATION.

O. THE CONSTRUCTION MANAGER, GENERAL CONTRACTOR, OR WHOMEVER HOLDS THE PRIME CONTRACT(S) FOR THIS CONSTRUCTION IS RESPONSIBLE FOR THE COORDINATION, APPEARANCE, SCHEDULING AND TIMELINESS OF THE WORK OF ALL TRADES, CONTRACTORS, SUPPLIERS, INSTALLERS, ETC. POOR OR UNTIMELY WORK ON THE PART OF ANY SUBCONTRACTOR SHALL BE RESOLVED BY THE PARTY WHO ENGAGED THEM ON THIS PROJECT.

P. THE PURPOSE AND INTENT OF ALL OF THE DOCUMENTS PERTAINING TO THIS PROJECT IS TO PROVIDE A COMPLETE, FUNCTIONAL, SAFE, LIKE-NEW FACILITY. ANYTHING LESS SHALL BE UNACCEPTABLE.

Q. ALL SYSTEMS, EQUIPMENT AND MATERIALS ARE TO BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. WORK NOT MEETING THIS CRITERION SHALL BE REMOVED AND REINSTALLED SATISFACTORILY. FINAL DETERMINATION OF THE ACCEPTABILITY OF THE QUALITY OF WORK RESIDES WITH THE ENGINEER

R. ALL WORK, MATERIALS, EQUIPMENT, ETC. SHALL BE FULLY GUARANTEED FOR ONE FULL CALENDAR YEAR FROM THE DATE OF SUBSTANTIAL COMPLETION AS DOCUMENTED BY THE ENGINEER, UNLESS LONGER WARRANTY PERIODS FOR EQUIPMENT ARE SPECIFIED.

S. ALL WORK SHALL BE CONCEALED UNLESS SPECIFICALLY INDICATED TO BE EXPOSED, OR REQUIRED TO BE EXPOSED. IF IN DOUBT, CONTACT THE ENGINEER FOR CLARIFICATIONS PRIOR TO INSTALLING ANY SUCH WORK.

T. UNLESS OTHERWISE SPECIFIED OR INDICATED, ALL EQUIPMENT AND/OR MATERIALS WITHIN OCCUPIED SPACES OR EXPOSED TO VIEW ON THE BUILDING EXTERIOR SHALL BE PRIMED AND FINISHED SO AS TO COMPLEMENT ADJACENT SURFACE, UNLESS OTHERWISE NOTED. COORDINATE WORK AND COLORS WITH ARCHITECT.

U. WHERE PENETRATING ROOFING MEMBRANE OR OTHER MATERIALS USED FOR WEATHERPROOFING THE BUILDING, MAKE SUCH PENETRATION IN A WAY THAT WILL NOT VOID OR DIMINISH THE ROOFING WARRANTY OR INTEGRITY IN ANYWAY. COORDINATE ALL SUCH PENETRATIONS WITH THE ROOFING MANUFACTURER AND ARCHITECT.

V. CEILING-MOUNTED ELECTRICAL DEVICES SHALL BE CENTERED IN 2'X2' CEILING TILE AND INSTALLED CENTERED ON 2' DIMENSION OF 2'X4' TILE AND ON CENTERLINE OR A QUARTER POINT ON 4' DIMENSION.

W. PROVIDE DETAILED SHOP DRAWINGS TO ENGINEER PRIOR TO PURCHASING OR INSTALLING ANY EQUIPMENT DEVIATIONS IN SIZES, CAPACITIES, FIT, FINISH, ETC. FOR EQUIPMENT FROM THAT PRIME SPECIFIED SHALL BE THE RESPONSIBILITY OF THE PURCHASER OF THAT EQUIPMENT. ANY PROVISIONS REQUIRED TO ACCOMMODATE A DEVIATION, WHETHER APPROVED BY THE ENGINEER OR NOT, SHALL BE THE RESPONSIBILITY OF THE PURCHASER.

X. WHERE FIRE-RATED CEILING ASSEMBLIES ARE NOTED, PROVIDE UL-LISTED FIRE-RATED GYPSUM BOARD OR PRE-MANUFACTURED ENCLOSURES ABOVE LUMINAIRES, CEILING DEVICES, ETC. IN OR ON CEILING, AS REQUIRED TO MAINTAIN CEILING RATINGS.

Y. DO NOT RECESS PANELBOARD TUBS OR OTHER FLUSH-MOUNTED EQUIPMENT IN WALLS THAT HAVE A FIRE RATING. NO INSTALLATION SHALL DIMINISH OR VOID FIRE RESISTIVE RATINGS IN ANYWAY.

Z. COORDINATE THE LOCATION OF DRAINS, ELECTRICAL OUTLETS, GAS OUTLETS, ETC. WITH ALL CASEWORK, KITCHEN EQUIPMENT, MECHANICAL ROOM EQUIPMENT, ETC. PRIOR TO COMMENCING INSTALLATION. WORK NOT SO COORDINATED SHALL BE REMOVED AND PROPERLY INSTALLED AT THE EXPENSE OF THE RESPONSIBLE CONTRACTOR(S).

AA. ALL OFFSETS, TURNS, FITTINGS, TRIM, DETAIL, ETC. MAY NOT BE INDICATED, BUT SHALL BE PROVIDED AS REQUIRED. ADDITIONAL ALLOWANCES SHALL BE INCLUDED FOR SAME AT EACH PROPOSER'S DISCRETION.

BB. INSTALL NO PIPING, CONDUIT, DUCTWORK, ETC. IN A LOCATION OR IN A MANNER WHICH WILL ALLOW FREEZING OR THE COLLECTION OF CONDENSATION THEREON. IF IN DOUBT, CONTACT THE ENGINEER.

CC. ALL WIRING SYSTEMS SHALL BE INSTALLED WITH A MINIMUM OF SPLICES. CONDUCTORS, WHETHER SINGLE OR MULTI-PAIR, SHALL BE INSTALLED CONTINUOUS INSOFAR AS POSSIBLE FROM TERMINAL POINT TO TERMINAL POINT.

DD. NO CONDUIT, SUPPORTS, ETC. SHALL BE RUN THROUGH ACCESS CLEARANCES OF EQUIPMENT BY OTHER TRADES (I.E. VAV BOXES). COORDINATE WITH ALL TRADES PRIOR TO CONSTRUCTION.

EE. ALL SUPPORTS FOR EQUIPMENT, DEVICES OR FIXTURES SHALL BE UNIQUE, DIRECTLY FROM THE BUILDING STRUCTURE. DO NOT SUPPORT WORK FROM OTHER TRADES EQUIPMENT OR SUPPORTS WITHOUT WRITTEN PERMISSION FROM THE ENGINEER AND CONSENT OF THE OTHER TRADE, IN WRITING.

FF. WHERE BACKBOXES ARE LOCATED IN THE SAME VERTICAL CHANNEL/STUD SPACE ON OPPOSITE SIDES OF THE SAME WALL, PROVIDE SOUND-INSULATING PUTTY AROUND BOXES AS REQUIRED TO ELIMINATE SOUND TRANSMISSION FROM ROOM TO ROOM.

GG. JUNCTION BOXES LOCATED ABOVE ACCESSIBLE CEILINGS SHALL BE LOCATED NO MORE THAN 36" ABOVE CEILING LEVEL. LABEL EACH BOX IN AREA OF WORK WITH A PERMANENT MARKER OR IN ACCORDANCE WITH SPECIFICATIONS, WHICHEVER IS MORE STRINGENT.

HH. ANY VIBRATING, OSCILLATING OR OTHER NOISE OR MOTION PRODUCING EQUIPMENT SHALL BE ISOLATED FROM SURROUNDING SYSTEMS IN AN APPROVED MANNER. NOISY OR STRUCTURALLY DAMAGING INSTALLATIONS SHALL BE SATISFACTORILY REPLACED OR REPAIRED AT THE INSTALLING CONTRACTORS' EXPENSE. THE FINAL DECISION ON THE SUITABILITY OF A PARTICULAR INSTALLATION'S ACCEPTABILITY SHALL BE THAT OF THE ENGINEER.

II. CHECK ALL THREE PHASE MOTORS WITH A PHASE ROTATION METER, PRIOR TO PLACING IN SERVICE.

JJ. ALL ITEMS HAVING KEYED LOCKS/OPERATORS SHALL HAVE CORED LOCKS/OPERATORS. ALL KEYING SHALL MATCH THE OWNER'S EXISTING KEY-WAYS. COORDINATE EXACT REQUIREMENTS WITH OWNER PRIOR TO CONSTRUCTION.

KK. NOISY WORK, WORK OUTSIDE CONSTRUCTION BARRIERS, WORK IN OCCUPIED AREAS, ETC. SHALL BE PERFORMED AFTER HOURS OR ON WEEKENDS. COORDINATE EXACT SCHEDULING WITH FACILITY PRIOR TO CONSTRUCTION.

LL. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED FOR HIS WORK. ALL CUTTING AND PATCHING SHALL BE IN ACCORDANCE WITH THE ARCHITECT'S STANDARDS FOR SUCH WORK.

MM. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY COMPANY FEES, CASH CONTRIBUTIONS OR OTHER COSTS THAT THE UTILITY COMPANY MAY REQUIRE TO COMPLETE THEIR WORK. (ELECTRIC, TELEPHONE, TELEVISION, DATA, ETC.).

NN. ALL CONTRACTORS SHALL EXERCISE EXTREME CARE IN THE COURSE OF THEIR WORK SO AS TO ENSURE THAT THEY DO NOT INTERRUPT ANY EXISTING SERVICE OR SUB-SERVICE FOR SAFETY PURPOSES. PAY PARTICULAR ATTENTION TO THIS PRECAUTION RELATIVE TO NATURAL GAS AND ELECTRICAL LINES. VERIFY THE LOCATION, SIZE, TYPE. ETC. OF EACH UNDERGROUND OR OVERHEAD UTILITY. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL FEDERAL, STATE AND/OR LOCAL RULES, REGULATIONS, STANDARD AND SAFETY REQUIREMENTS. UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE MUNICIPALITY OR UTILITY COMPANY STANDARDS. IN ALL CASES, THE MOST STRINGENT REQUIREMENT SHALL APPLY.

OO. INTERRUPTION OF ANY EXISTING SERVICES SHALL BE COORDINATED WITH THE OWNER, GENERAL CONTRACTOR, UTILITY COMPANY AS NECESSARY, AND THE ARCHITECT. AT LEAST TWO WEEKS IN ADVANCE OF ANTICIPATED INTERRUPTION. A SCHEDULE FOR THESE OUTAGES SHALL BE DEVELOPED AND AGREED UPON BETWEEN THE PARTIES MENTIONED TO AVOID UNNECESSARY INCONVENIENCE TO THE OWNER OR ANY AFFECTED PARTY. NOTIFY THE UTILITY COMPANY OF ANY ANTICIPATED SERVICES REQUIRED TWO WEEKS IN ADVANCE, IN WRITING. IF UTILITY COMPANY REQUIRES A LONGER NOTIFICATION PERIOD, SO PROVIDE.

PP. WHERE INTERRUPTING AN EXISTING UTILITY OR SERVICE DELIBERATELY OR ACCIDENTALLY, THE RESPONSIBLE CONTRACTOR SHALL WORK CONTINUOUSLY AS NEEDED TO RESTORE SAME, PROVIDING PREMIUM TIME AS NEEDED.

QQ. AS APPLICABLE, REFER TO ARCHITECTURAL PHASING PLANS AND PHASING BOUNDARIES ON THESE DRAWINGS FOR SEQUENCING OF WORK, FULL EXTENT OF AREAS INVOLVED, EXTENT OF CEILING WORK, ETC. PROVIDE TEMPORARY CONNECTIONS FOR CIRCUITS AND WORK AS REQUIRED TO MAINTAIN SEQUENCE OF THE WORK FROM PHASE TO PHASE. P

GENERAL NOTES (LIGHTING):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. REFER TO LIGHTING FIXTURE SCHEDULE ON SHEET E7.11 FOR MORE INFORMATION ON FIXTURES AND MOUNTING HEIGHTS. MOUNTING HEIGHTS SHALL BE PER ARCHITECTURAL PLANS AND FIXTURE SCHEDULE, U.O.N.

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER N.E.C. # 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER N.E.C. #300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN N.E.C #100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. IN HEALTHCARE FACILITIES, ENGRAVE EMERGENCY DEVICE COVERPLATES IN PATIENT CARE AREAS. ALSO, MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. LOCATE CHAIN-HUNG INDUSTRIAL FIXTURES IN MECHANICAL ROOMS TO AVOID DUCTWORK AND PIPING, TO MAXIMIZE AVAILABLE LIGHT, SPACE AROUND EQUIPMENT, AIR HANDLERS, ETC. TO PROVIDE ADEQUATE LIGHTING TO ALL AREAS OF ROOM. PROVIDE ADDITIONAL FIXTURES OF SAME TYPE AS NEEDED TO FULFILL THIS REQUIREMENT.

F. LOCATE EXIT SIGNS FOR MAXIMUM VIEWING AREA TO IDENTIFY EGRESS PATHS AS INDICATED ON PLANS. COORDINATE LOCATIONS SUCH THAT ARCHITECTURAL FEATURES OR EQUIPMENT FROM OTHER TRADES DO NOT OBSTRUCT VIEW.

G. LUMINAIRES INDICATED WITH MULTI-LEVEL SWITCHING SHALL HAVE SIMILAR LAMPS CONTROLLED TOGETHER, I.E. INBOARD AND OUTBOARD LAMPS OR RIGHT AND LEFT HAND LAMPS.

H. ALL LIGHTING FIXTURE LENSES, PARABOLIC LOUVERS, DOWNLIGHTING ALZAK CONES AND "PARACUBE" LOUVERS SHALL BE HANDLED WITH COTTON GLOVES DURING INSTALLATION AND LAMPING TO AVOID FINGERPRINTS OR DIRT DEPOSITS. IT IS PREFERRED THAT FIXTURES BE SHIPPED AND INSTALLED WITH CLEAR PLASTIC BAGS TO PROTECT LOUVERS. AT CLOSE OF PROJECT, AND AFTER CONSTRUCTION AIR FILTERS ARE CHANGED, REMOVE BAGS. ANY LOUVER OR CONE SHOWING DIRT OR FINGER PRINTS SHALL BE CLEANED WITH SOLVENT RECOMMENDED BY THE MANUFACTURER, OR REPLACED AS NECESSARY IN ORDER TO TURN OVER TO THE OWNER NEW FIXTURES AT OCCUPANCY.

I. RECESSED LUMINAIRES SHALL BE SECURED SUCH THAT THE FORCE REQUIRED INSERTING LAMPS, TRIMS, LENSES, LOUVERS, OR DOOR FRAMES DOES NOT SHIFT HOUSING. ALL TRIMS SHALL BE COMPLETELY FLUSH WITH FINISHED CEILINGS AT COMPLETION OF CONSTRUCTION.

J. CONTRACTOR SHALL PROVIDE UNSWITCHED CONDUCTOR TO ALL EXIT SIGNS, EMERGENCY INVERTER BATTERY PACKS, AND NIGHT LIGHTS AS REQUIRED.

TAGGED NOTES

E24 PROVIDE TOTAL OF (3) WATERPROOF/IMPACT-RESISTANT LED LIGHT FIXTURES, COMPLETE WITH PROTECTIVE GUARD, CONTROLLED BY A WEATHERPROOF SWITCH LOCATED ADJACENT TO THE PIT ACCESS. (1) FIXTURE SHALL BE LOCATED IN ELEVATOR PIT, AND (2) FIXTURES SHALL BE VERTICALLY SPACED ALONG ELEVATOR SHAFT FOR EQUIPMENT MAINTENANCE PURPOSES. ALL EQUIPMENT AND INSTALLATION SHALL COMPLY WITH NEC AND ELEVATOR CODE REQUIREMENTS.

E40 DAYLIGHT SENSOR TO BE CAPABLE OF CONTROLLING FIXTURES IN BOTH PRIMARY AND SECONDARY DAYLIGHT ZONES FROM SINGLE LOCATION. SENSING FOR SECONDARY DAYLIGHT ZONE TO BE PROGRAMMED WITH DIMMING OFFSET.

E45 CORRIDOR FIXTURES TO BE CONTROLLED THROUGH INTERIOR LIGHTING CONTROL PANEL WITH LOCAL SWITCH OVERRIDE IN ADMIN A100. REFER TO SHEET E-1.02A FOR OVERRIDE SWITCH LOCATION. REFER TO SHEET E-7.12 FOR LIGHTING CONTROL PANEL SCHEDULE.

E55 PROVIDE LIGHTING CONTROL PANEL TO CONTROL CORRIDOR AND COMMON SPACE LIGHTING. PROVIDE TIME CLOCK ACCESSORY TO CONTROL INTERIOR LIGHTING IN ADDITION TO OCCUPANCY SENSOR OVERRIDE AFTER HOURS. COORDINATE FINAL EQUIPMENT LOCATION WITH APPLICABLE TRADES. PROVIDE POWER AS INDICATED. REFER TO LCP RELAY SCHEDULE ON SHEET E7.12 FOR MORE INFORMATION.



1 LOWER LEVEL LIGHTING PLAN
1/8" = 1'-0"

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ROBERT A. MAHS PE.47088 LICENSED PROFESSIONAL ENGINEER STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

LOWER LEVEL ELECTRICAL LIGHTING PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E1.01

5/18/2026 11:11:25 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (LIGHTING):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. REFER TO LIGHTING FIXTURE SCHEDULE ON SHEET E7.11 FOR MORE INFORMATION ON FIXTURES AND MOUNTING HEIGHTS. MOUNTING HEIGHTS SHALL BE PER ARCHITECTURAL PLANS AND FIXTURE SCHEDULE, U.O.N.

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TAGGED NOTES

(##)

E39 SWITCH LEGS 'c' & 'e' SHALL BE 3-WAY. SWITCHES IN THIS AREA SHALL BE WITHIN 2' FROM EDGE OF WALL.

E40 DAYLIGHT SENSOR TO BE CAPABLE OF CONTROLLING FIXTURES IN BOTH PRIMARY AND SECONDARY DAYLIGHT ZONES FROM SINGLE LOCATION. SENSING FOR SECONDARY DAYLIGHT ZONE TO BE PROGRAMMED WITH DIMMING OFFSET.

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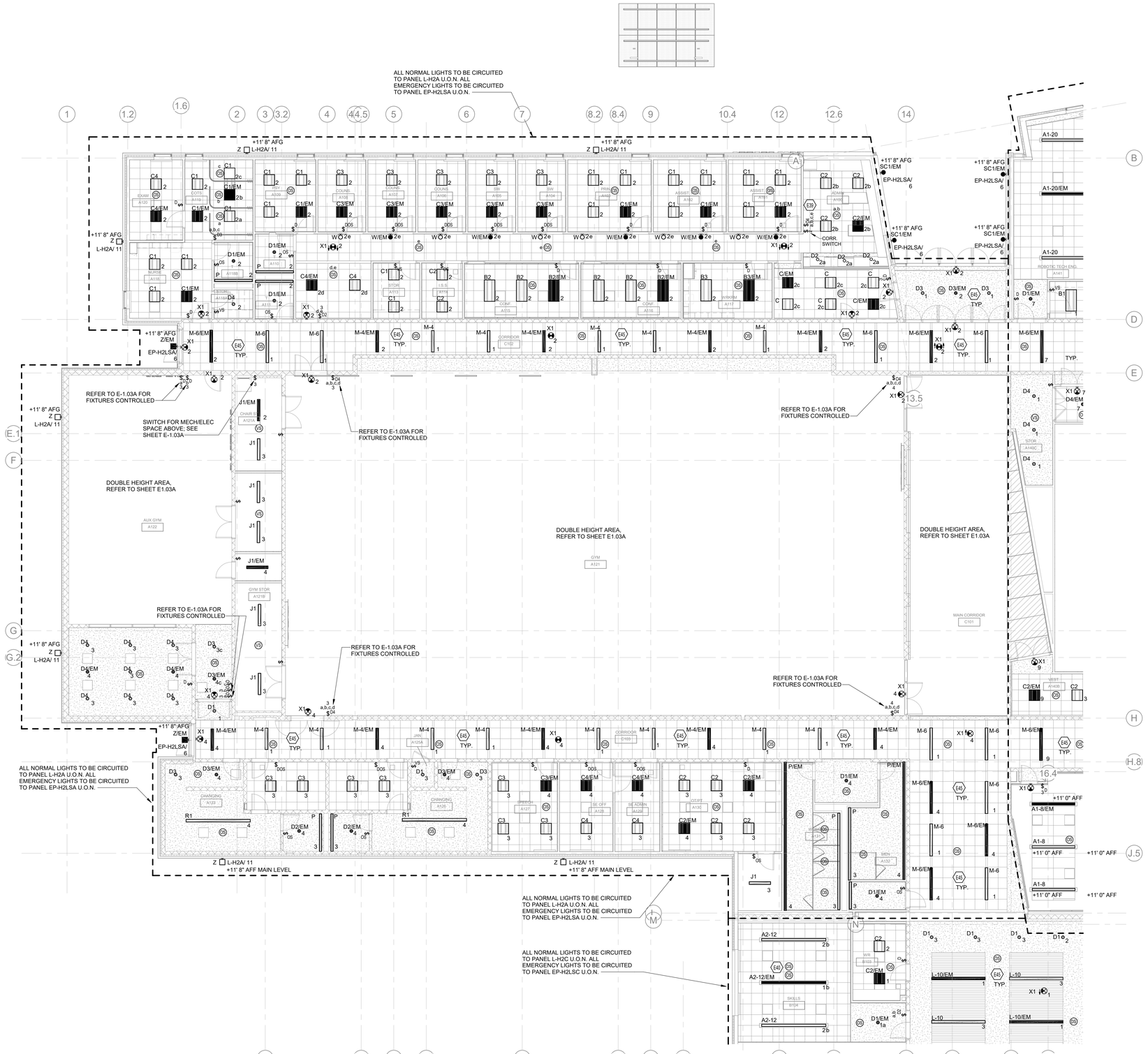

1 MAIN LEVEL LIGHTING PLAN - AREA A
SCALE: 1/8" = 1'-0"

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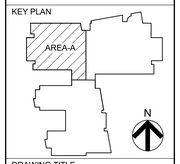
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL LIGHTING PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E1.02A

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TAGGED NOTES (##)

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E48 PLANETARIUM PERIMETER FIXTURE TOTAL RUN LENGTH TO BE COORDINATED WITH ARCHITECTURAL COVE CHANNEL DETAILS AND PLANETARIUM STRUCTURE DRAWINGS. FIXTURE IS ORDERED IN 1FT SEGMENTS. FIXTURE SHALL BE POWERED FROM LIGHTING CONTROL PANEL IN LOCATION INDICATED. FIXTURE SHALL HAVE LOCAL FADER CONTROLS MOUNTED AT CONTROL STATION.

E49 BLACK BOX AREA SWITCH(ES) TO CONTROL TYPE "I" FIXTURES. REFER TO THEATER PLANS FOR SWITCHING DESIGN REQUIREMENTS AND OCCUPANCY SENSOR OVERRIDES DURING PERFORMANCES.

E56 PROVIDE LIGHTING CONTROL PANEL TO CONTROL CORRIDOR AND COMMON SPACE LIGHTING. PROVIDE TIME CLOCK ACCESSORY TO CONTROL INTERIOR LIGHTING IN ADDITION TO OCCUPANCY SENSOR OVERRIDE AFTER HOURS. PROVIDE PHOTOCELL ACCESSORY AND MOUNT AT EXTERIOR FACING NORTH TO CONTROL DUSK-TO-DAWN EXTERIOR LIGHTING. COORDINATE FINAL EQUIPMENT LOCATION WITH APPLICABLE TRADES. PROVIDE POWER AS INDICATED. REFER TO LCP RELAY SCHEDULE ON SHEET E7.12 FOR MORE INFORMATION.



1 MAIN LEVEL LIGHTING PLAN - AREA B
1/8" = 1'-0"

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PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL LIGHTING PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
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E1.02B

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GENERAL NOTES (LIGHTING):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. REFER TO LIGHTING FIXTURE SCHEDULE ON SHEET E7.11 FOR MORE INFORMATION ON FIXTURES AND MOUNTING HEIGHTS. MOUNTING HEIGHTS SHALL BE PER ARCHITECTURAL PLANS AND FIXTURE SCHEDULE, U.O.N.

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER N.E.C. # 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER N.E.C. #300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN N.E.C #100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. IN HEALTHCARE FACILITIES, ENGRAVE EMERGENCY DEVICE COVERPLATES IN PATIENT CARE AREAS. ALSO, MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. LOCATE CHAIN-HUNG INDUSTRIAL FIXTURES IN MECHANICAL ROOMS TO AVOID DUCTWORK AND PIPING, TO MAXIMIZE AVAILABLE LIGHT, SPACE AROUND EQUIPMENT, AIR HANDLERS, ETC. TO PROVIDE ADEQUATE LIGHTING TO ALL AREAS OF ROOM. PROVIDE ADDITIONAL FIXTURES OF SAME TYPE AS NEEDED TO FULFILL THIS REQUIREMENT.

F. LOCATE EXIT SIGNS FOR MAXIMUM VIEWING AREA TO IDENTIFY EGRESS PATHS AS INDICATED ON PLANS. COORDINATE LOCATIONS SUCH THAT ARCHITECTURAL FEATURES OR EQUIPMENT FROM OTHER TRADES DO NOT OBSTRUCT VIEW.

G. LUMINAIRES INDICATED WITH MULTI-LEVEL SWITCHING SHALL HAVE SIMILAR LAMPS CONTROLLED TOGETHER, I.E. INBOARD AND OUTBOARD LAMPS OR RIGHT AND LEFT HAND LAMPS.

H. ALL LIGHTING FIXTURE LENSES, PARABOLIC LOUVERS, DOWNLIGHTING ALZAK CONES AND "PARACUBE" LOUVERS SHALL BE HANDLED WITH COTTON GLOVES DURING INSTALLATION AND LAMPING TO AVOID FINGERPRINTS OR DIRT DEPOSITS. IT IS PREFERRED THAT FIXTURES BE SHIPPED AND INSTALLED WITH CLEAR PLASTIC BAGS TO PROTECT LOUVERS. AT CLOSE OF PROJECT, AND AFTER CONSTRUCTION AIR FILTERS ARE CHANGED, REMOVE BAGS. ANY LOUVER OR CONE SHOWING DIRT OR FINGER PRINTS SHALL BE CLEANED WITH SOLVENT RECOMMENDED BY THE MANUFACTURER, OR REPLACED AS NECESSARY IN ORDER TO TURN OVER TO THE OWNER NEW FIXTURES AT OCCUPANCY.

I. RECESSED LUMINAIRES SHALL BE SECURED SUCH THAT THE FORCE REQUIRED INSERTING LAMPS, TRIMS, LENSES, LOUVERS, OR DOOR FRAMES DOES NOT SHIFT HOUSING. ALL TRIMS SHALL BE COMPLETELY FLUSH WITH FINISHED CEILINGS AT COMPLETION OF CONSTRUCTION.

J. CONTRACTOR SHALL PROVIDE UNSWITCHED CONDUCTOR TO ALL EXIT SIGNS, EMERGENCY INVERTER BATTERY PACKS, AND NIGHT LIGHTS AS REQUIRED.

TAGGED NOTES

(##)

- E40 DAYLIGHT SENSOR TO BE CAPABLE OF CONTROLLING FIXTURES IN BOTH PRIMARY AND SECONDARY DAYLIGHT ZONES FROM SINGLE LOCATION. SENSING FOR SECONDARY DAYLIGHT ZONE TO BE PROGRAMMED WITH DIMMING OFFSET.
- E44 FIXTURE TO BE SWITCHED FROM LEVEL BELOW. REFER TO CORRESPONDING PLAN FOR MORE INFORMATION AND SWITCH(ES) LOCATION(S).
- E45 CORRIDOR FIXTURES TO BE CONTROLLED THROUGH INTERIOR LIGHTING CONTROL PANEL WITH LOCAL SWITCH OVERRIDE IN ADMIN A100. REFER TO SHEET E-1.02A FOR OVERRIDE SWITCH LOCATION. REFER TO SHEET E-7.12 FOR LIGHTING CONTROL PANEL SCHEDULE.
- E55 PROVIDE LIGHTING CONTROL PANEL TO CONTROL CORRIDOR AND COMMON SPACE LIGHTING. PROVIDE TIME CLOCK ACCESSORY TO CONTROL INTERIOR LIGHTING IN ADDITION TO OCCUPANCY SENSOR OVERRIDE AFTER HOURS. COORDINATE FINAL EQUIPMENT LOCATION WITH APPLICABLE TRADES. PROVIDE POWER AS INDICATED. REFER TO LCP RELAY SCHEDULE ON SHEET E7.12 FOR MORE INFORMATION.



1 MAIN LEVEL LIGHTING PLAN - AREA C
1/8" = 1'-0"

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REGISTERED PROFESSIONAL ENGINEER
STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

AREA-C

N

DRAWING TITLE

MAIN LEVEL ELECTRICAL LIGHTING PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E1.02C

5/19/2026 11:11:35 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (LIGHTING):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. REFER TO LIGHTING FIXTURE SCHEDULE ON SHEET E7.11 FOR MORE INFORMATION ON FIXTURES AND MOUNTING HEIGHTS. MOUNTING HEIGHTS SHALL BE PER ARCHITECTURAL PLANS AND FIXTURE SCHEDULE, U.O.N.

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER N.E.C. # 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER N.E.C. #300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN N.E.C #100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. IN HEALTHCARE FACILITIES, ENGRAVE EMERGENCY DEVICE COVERPLATES IN PATIENT CARE AREAS. ALSO, MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. LOCATE CHAIN-HUNG INDUSTRIAL FIXTURES IN MECHANICAL ROOMS TO AVOID DUCTWORK AND PIPING, TO MAXIMIZE AVAILABLE LIGHT, SPACE AROUND EQUIPMENT, AIR HANDLERS, ETC. TO PROVIDE ADEQUATE LIGHTING TO ALL AREAS OF ROOM. PROVIDE ADDITIONAL FIXTURES OF SAME TYPE AS NEEDED TO FULFILL THIS REQUIREMENT.

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G. LUMINAIRES INDICATED WITH MULTI-LEVEL SWITCHING SHALL HAVE SIMILAR LAMPS CONTROLLED TOGETHER, I.E. INBOARD AND OUTBOARD LAMPS OR RIGHT AND LEFT HAND LAMPS.

H. ALL LIGHTING FIXTURE LENSES, PARABOLIC LOUVERS, DOWNLIGHTING ALZAK CONES AND "PARACUBE" LOUVERS SHALL BE HANDLED WITH COTTON GLOVES DURING INSTALLATION AND LAMPING TO AVOID FINGERPRINTS OR DIRT DEPOSITS. IT IS PREFERRED THAT FIXTURES BE SHIPPED AND INSTALLED WITH CLEAR PLASTIC BAGS TO PROTECT LOUVERS. AT CLOSE OF PROJECT, AND AFTER CONSTRUCTION AIR FILTERS ARE CHANGED, REMOVE BAGS. ANY LOUVER OR CONE SHOWING DIRT OR FINGER PRINTS SHALL BE CLEANED WITH SOLVENT RECOMMENDED BY THE MANUFACTURER, OR REPLACED AS NECESSARY IN ORDER TO TURN OVER TO THE OWNER NEW FIXTURES AT OCCUPANCY.

I. RECESSED LUMINAIRES SHALL BE SECURED SUCH THAT THE FORCE REQUIRED INSERTING LAMPS, TRIMS, LENSES, LOUVERS, OR DOOR FRAMES DOES NOT SHIFT HOUSING. ALL TRIMS SHALL BE COMPLETELY FLUSH WITH FINISHED CEILINGS AT COMPLETION OF CONSTRUCTION.

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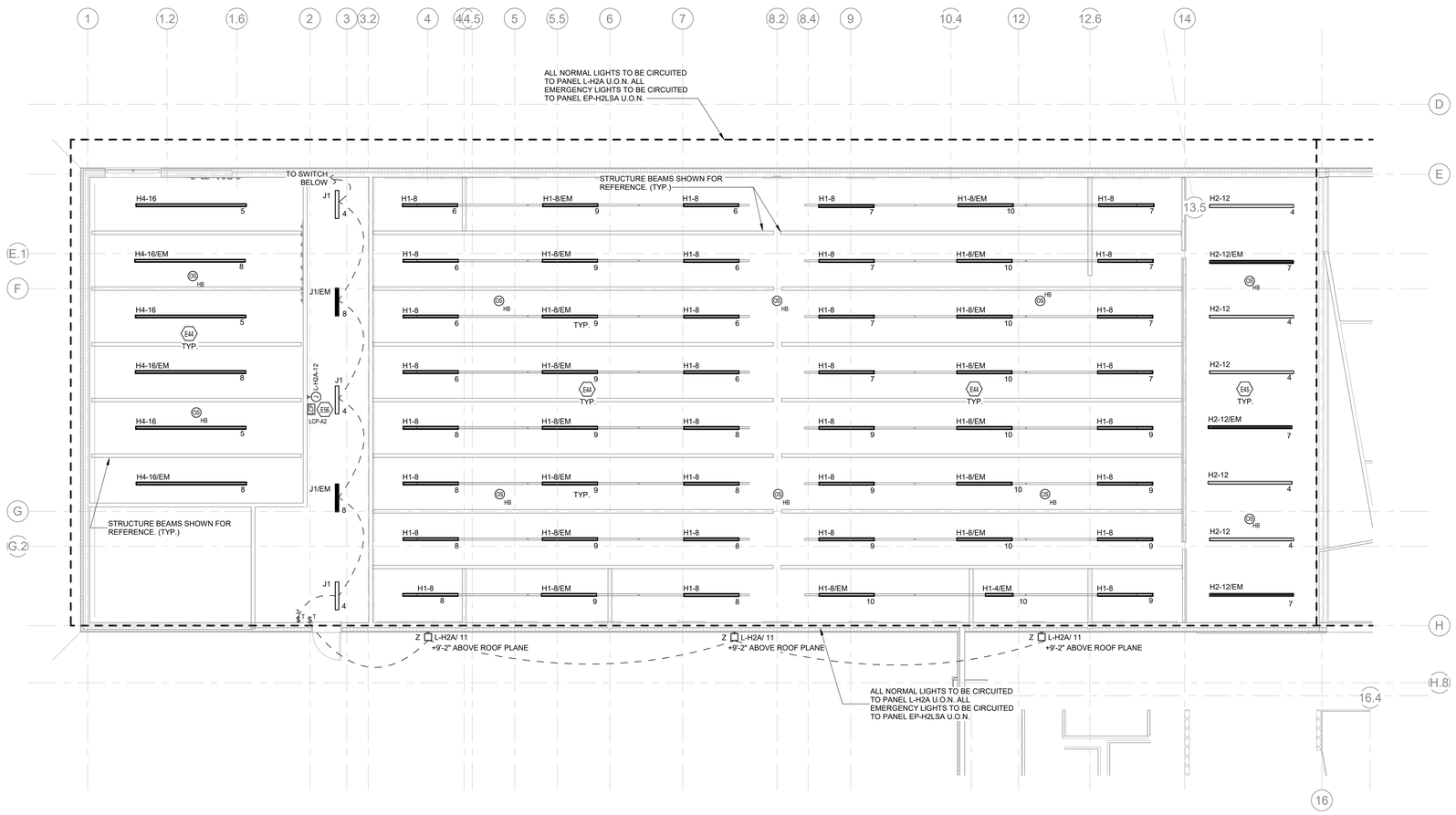
TAGGED NOTES

(##)

E44 FIXTURE TO BE SWITCHED FROM LEVEL BELOW. REFER TO CORRESPONDING PLAN FOR MORE INFORMATION AND SWITCH(ES) LOCATION(S).

E45 CORRIDOR FIXTURES TO BE CONTROLLED THROUGH INTERIOR LIGHTING CONTROL PANEL WITH LOCAL SWITCH OVERRIDE IN ADMIN A100. REFER TO SHEET E-1.02A FOR OVERRIDE SWITCH LOCATION. REFER TO SHEET E-7.12 FOR LIGHTING CONTROL PANEL SCHEDULE.

E56 PROVIDE LIGHTING CONTROL PANEL TO CONTROL CORRIDOR AND COMMON SPACE LIGHTING. PROVIDE TIME CLOCK ACCESSORY TO CONTROL INTERIOR LIGHTING IN ADDITION TO OCCUPANCY SENSOR OVERRIDE AFTER HOURS. PROVIDE PHOTOCELL ACCESSORY AND MOUNT AT EXTERIOR FACING NORTH TO CONTROL DUSK-TO-DAWN EXTERIOR LIGHTING. COORDINATE FINAL EQUIPMENT LOCATION WITH APPLICABLE TRADES. PROVIDE POWER AS INDICATED. REFER TO LCP RELAY SCHEDULE ON SHEET E7.12 FOR MORE INFORMATION.



1 UPPER LEVEL LIGHTING PLAN - AREA A
1/8" = 1'-0"

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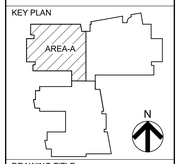
REGISTERED PROFESSIONAL ENGINEER
STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL LIGHTING PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E1.03A

5/18/2026 11:11:37 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (LIGHTING):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

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D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. IN HEALTHCARE FACILITIES, ENGRAVE EMERGENCY DEVICE COVERPLATES IN PATIENT CARE AREAS. ALSO, MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

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H. ALL LIGHTING FIXTURE LENSES, PARABOLIC LOUVERS, DOWNLIGHTING ALZAK CONES AND "PARACUBE" LOUVERS SHALL BE HANDLED WITH COTTON GLOVES DURING INSTALLATION AND LAMPING TO AVOID FINGERPRINTS OR DIRT DEPOSITS. IT IS PREFERRED THAT FIXTURES BE SHIPPED AND INSTALLED WITH CLEAR PLASTIC BAGS TO PROTECT LOUVERS. AT CLOSE OF PROJECT, AND AFTER CONSTRUCTION AIR FILTERS ARE CHANGED, REMOVE BAGS. ANY LOUVER OR CONE SHOWING DIRT OR FINGER PRINTS SHALL BE CLEANED WITH SOLVENT RECOMMENDED BY THE MANUFACTURER, OR REPLACED AS NECESSARY IN ORDER TO TURN OVER TO THE OWNER NEW FIXTURES AT OCCUPANCY.

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TAGGED NOTES

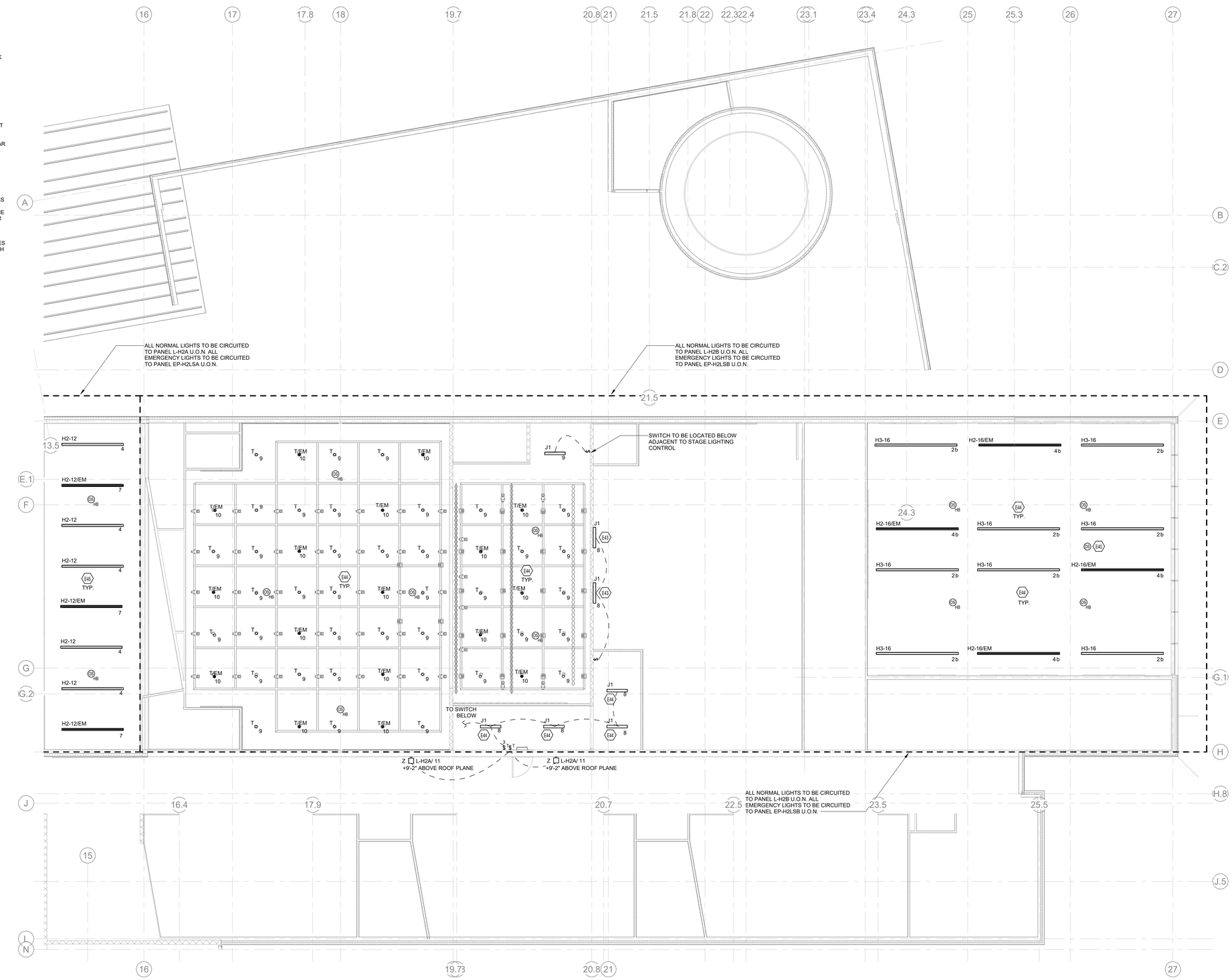
(##)

E40 DAYLIGHT SENSOR TO BE CAPABLE OF CONTROLLING FIXTURES IN BOTH PRIMARY AND SECONDARY DAYLIGHT ZONES FROM SINGLE LOCATION. SENSING FOR SECONDARY DAYLIGHT ZONE TO BE PROGRAMMED WITH DIMMING OFFSET.

E43 UTILITY FIXTURE FOR EASE OF WALK-IN FRIDGE/FREEZER MAINTENANCE. FIXTURES TO BE WALL MOUNTED IN CRAWL SPACE ABOVE UNITS. COORDINATE WITH APPLICABLE TRADES. FIXTURES TO BE CONTROLLED BY LOCAL SWITCH INDICATED.

E44 FIXTURE TO BE SWITCHED FROM LEVEL BELOW. REFER TO CORRESPONDING PLAN FOR MORE INFORMATION AND SWITCH(ES) LOCATION(S).

E45 CORRIDOR FIXTURES TO BE CONTROLLED THROUGH INTERIOR LIGHTING CONTROL PANEL WITH LOCAL SWITCH OVERRIDE IN ADMIN A100. REFER TO SHEET E-1.02A FOR OVERRIDE SWITCH LOCATION. REFER TO SHEET E-7.12 FOR LIGHTING CONTROL PANEL SCHEDULE.



1 UPPER LEVEL LIGHTING PLAN - AREA B
1/8" = 1'-0"

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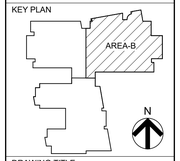
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL LIGHTING PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E1.03B

5/19/2026 11:11:39 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (LIGHTING):

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B. REFER TO LIGHTING FIXTURE SCHEDULE ON SHEET E7.11 FOR MORE INFORMATION ON FIXTURES AND MOUNTING HEIGHTS. MOUNTING HEIGHTS SHALL BE PER ARCHITECTURAL PLANS AND FIXTURE SCHEDULE, U.O.N.

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TAGGED NOTES

(##)

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1 UPPER LEVEL LIGHTING PLAN - AREA C
1/8" = 1'-0"

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ROBERT A. MAHS, P.E. #27026, STATE OF CONNECTICUT, REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL LIGHTING PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
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5	5/19/2026	100% CD

E1.03C

5/18/2026 11:11:42 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. RECEPTACLES THAT ARE CONTROLLED BY AN AUTOMATIC MEANS SUCH AS OCCUPANCY SENSOR OR ENERGY MANAGEMENT SYSTEM SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3(E).

F. LOCATIONS OF ELECTRICAL CONNECTIONS AND LOCAL DISCONNECTS SHALL BE COORDINATED WITH MECHANICAL AND PLUMBING CONTRACTORS TO ENSURE ACCESS AND WORKING CLEARANCE IS MAINTAINED PER NEC. NOTIFY OTHER TRADES OF REQUIRED CLEARANCE AREAS TO AVOID ROUTING OF OTHER SYSTEMS IN THESE AREAS. DO NOT INSTALL ELECTRICAL EQUIPMENT OVER EQUIPMENT NAMEPLATES OR ACCESS PANELS OR THROUGH ACCESS/MAINTENANCE CLEARANCES OF EQUIPMENT BY OTHER TRADES.

G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

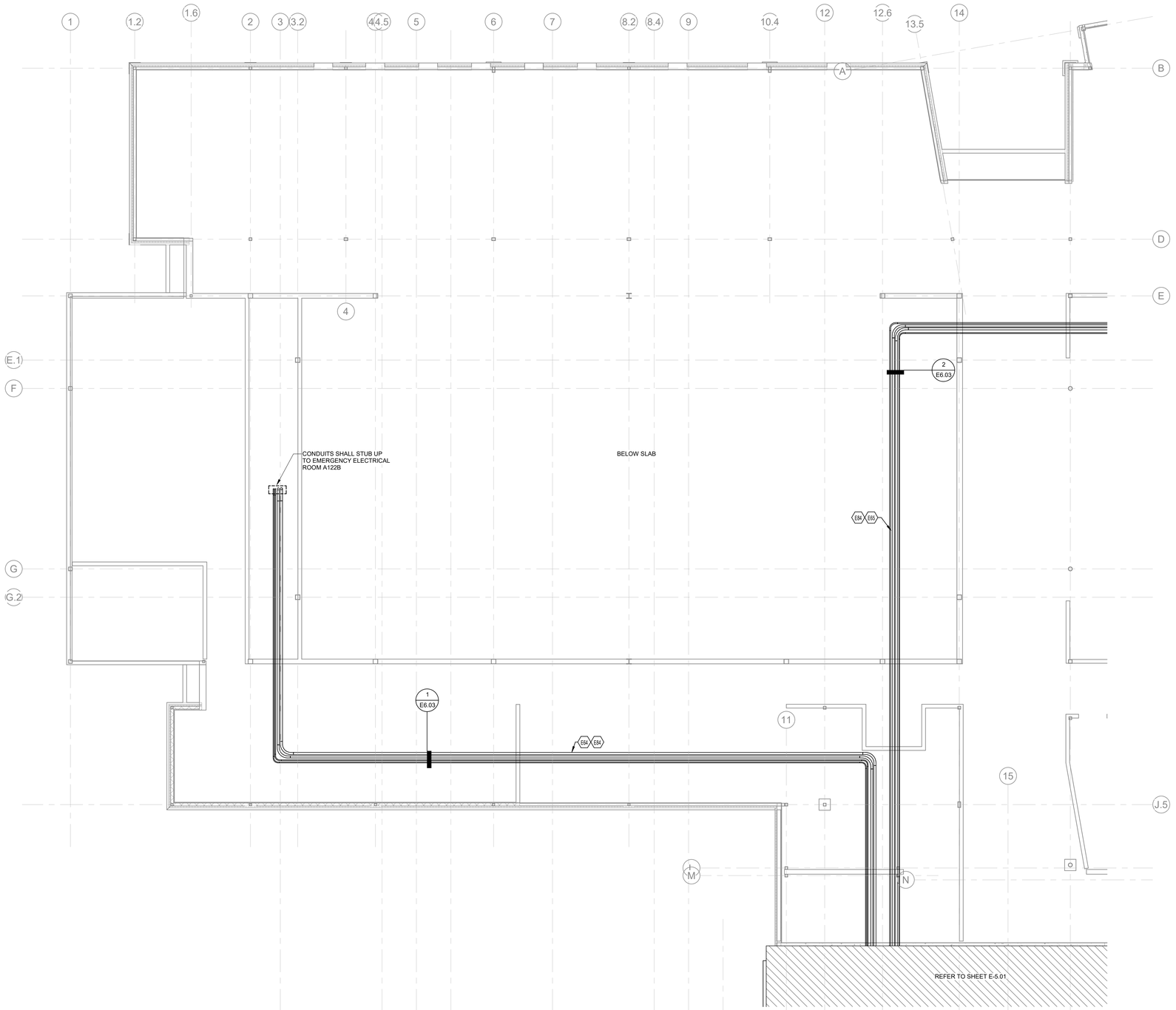
H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES

E64 FEEDERS FROM MAIN ELECTRICAL ROOM TO PANELS DP-H2A AND EP-L2OSA IN MAIN LEVEL MEZZANINE, AND PANEL EP-H2LSA IN MAIN LEVEL EMERGENCY ELECTRICAL ROOM SHALL BE ROUTED BELOW GRADE. REFER TO DUCTBANK SECTION DETAIL AND SINGLE LINE DIAGRAM FOR FURTHER INFORMATION. CONDUITS RUNNING UNDER SLAB SHALL BE RMC (RIGID METAL CONDUIT).

E65 FEEDERS FROM MAIN ELECTRICAL ROOM TO PANELS DP-H2B AND EP-H2OSB IN KITCHEN ELECTRICAL ROOM, AND PANEL EP-H2LSB IN KITCHEN EMERGENCY ELECTRICAL ROOM SHALL BE ROUTED BELOW GRADE. REFER TO DUCTBANK SECTION DETAIL AND SINGLE LINE DIAGRAM FOR FURTHER INFORMATION. CONDUITS RUNNING UNDER SLAB SHALL BE RMC (RIGID METAL CONDUIT).

E84 CONDUIT PATH IS DIAGRAMMATIC ONLY. EXACT FINAL QUANTITY AND ROUTING OF CONDUITS TO BE DETERMINED IN THE FIELD. COORDINATE WITH OTHER TRADES AND ALL OTHER BELOW-SLAB UTILITIES AND FOOTINGS PRIOR TO STARTING WORK. PULLBOXES SHALL BE PROVIDED FOR EVERY 360 DEGREES OF BENDS IN A STRAIGHT RUN AS WELL AS WHERE NECESSARY FOR A COMPLETE INSTALLATION.



1 LOWER LEVEL ELECTRICAL POWER PLAN - AREA A
1/8" = 1'-0"

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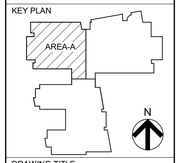
STATE OF CONNECTICUT
REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL ELECTRICAL POWER PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.01A

5/18/2026 11:11:43 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

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G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

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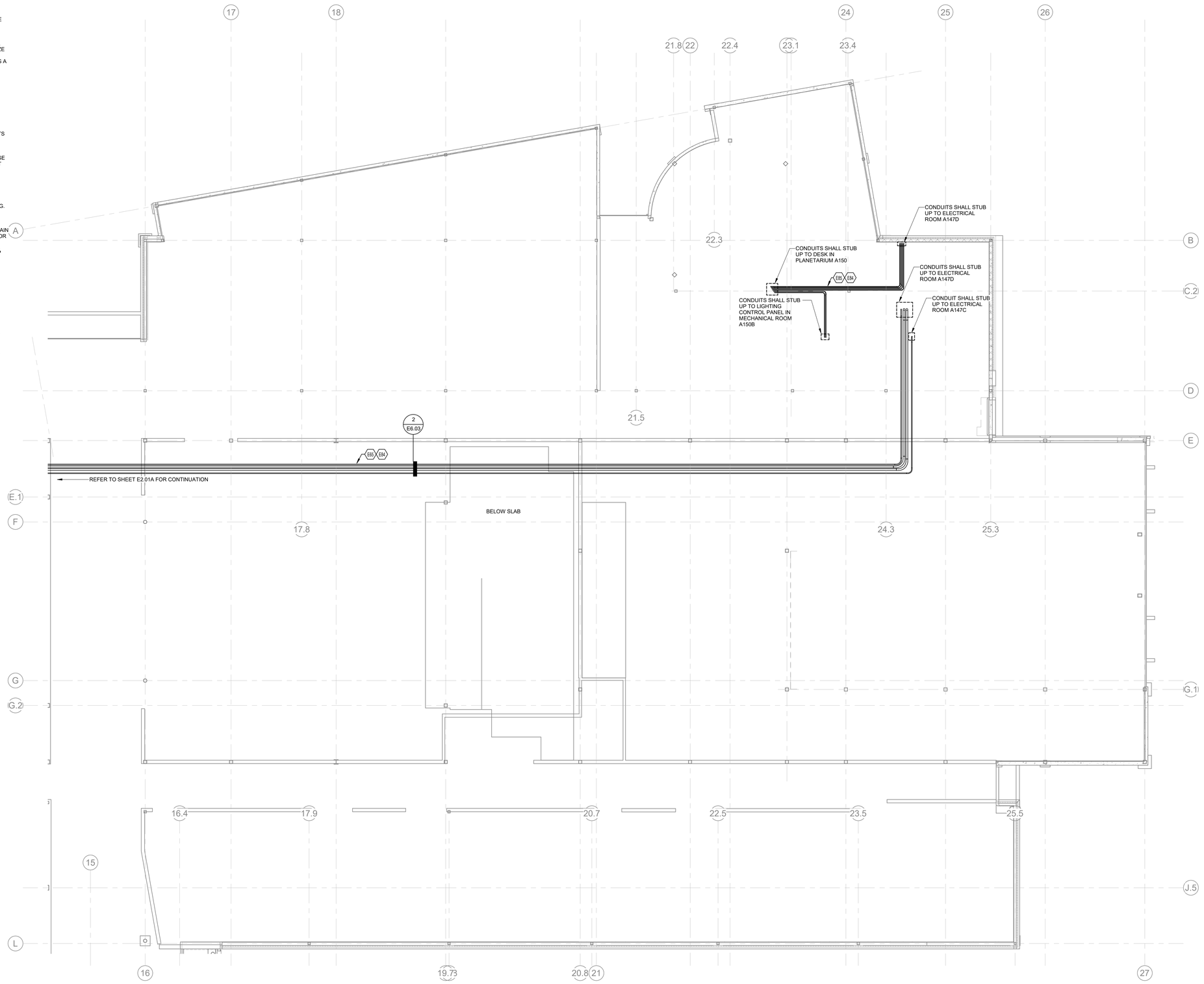
TAGGED NOTES

E65 FEEDERS FROM MAIN ELECTRICAL ROOM TO PANELS DP-H2B AND EP-H2OSB IN KITCHEN ELECTRICAL ROOM, AND PANEL EP-H2LSB IN KITCHEN EMERGENCY ELECTRICAL ROOM SHALL BE ROUTED BELOW GRADE. REFER TO DUCTBANK SECTION DETAIL AND SINGLE LINE DIAGRAM FOR FURTHER INFORMATION. CONDUITS RUNNING UNDER SLAB SHALL BE RMC (RIGID METAL CONDUIT).

E84 CONDUIT PATH IS DIAGRAMMATIC ONLY. EXACT FINAL QUANTITY AND ROUTING OF CONDUITS TO BE DETERMINED IN THE FIELD. COORDINATE WITH OTHER TRADES AND ALL OTHER BELOW-SLAB UTILITIES AND FOOTINGS PRIOR TO STARTING WORK. PULLBOXES SHALL BE PROVIDED FOR EVERY 360 DEGREES OF BENDS IN A STRAIGHT RUN AS WELL AS WHERE NECESSARY FOR A COMPLETE INSTALLATION.

E85 PROVIDE (6) 3/4" CONDUITS BELOW SLAB FOR POWER, AV, AND LIGHTING CONTROLS AT PLANETARIUM DESK. (4) CONDUITS SHALL STUB UP TO ELECTRICAL ROOM A147D AND (2) CONDUITS SHALL STUB UP TO MECHANICAL ROOM A150B. SPARE CONDUITS SHALL BE PROVIDED WITH PULLSTRING AND CAPPED. CONDUIT RUNNING BELOW SLAB SHALL BE RMC (RIGID METAL CONDUIT).



1 LOWER LEVEL ELECTRICAL POWER PLAN - AREA B
1/8" = 1'-0"

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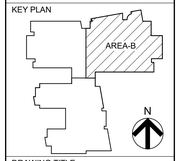
REGISTERED PROFESSIONAL ENGINEER
STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL ELECTRICAL POWER PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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GENERAL NOTES (POWER):

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B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

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TAGGED NOTES (##)

E5 120V DEDICATED CIRCUIT TO VAV CONTROLS. COORDINATE INTERCONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. FURNISH AND INSTALL 1" CONDUIT(S) AS REQUIRED FROM POWER SOURCE TO VAV CONTROL PANEL. MAXIMUM OF 6 VAV UNITS CONNECTED TO EACH CIRCUIT.

E11 PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER.

E22 DEDICATED RECEPTACLE FOR BOTTLE-FILLING WATER FOUNTAIN. PROVIDE GFCI PROTECTION AT BREAKER. COORDINATE EXACT FINAL LOCATION OF ELECTRICAL OUTLET WITH WATER FOUNTAIN MANUFACTURER AND INSTALLER PRIOR TO STARTING WORK.

E29 POWER FOR MICROWAVE. PROVIDE DEDICATED CIRCUIT WITH GFI AT BREAKER. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL DRAWINGS.

E30 POWER FOR UNDERCOUNTER REFRIGERATOR. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTUAL DRAWINGS.

E63 PROVIDE GFI RECEPTACLE AT ELEVATOR PIT. COORDINATE EXACT LOCATION WITH ELEVATOR MANUFACTURER.

E72 PROVIDE POWER FOR MOTORIZED SHADES. COORDINATE EXACT FINAL LOCATION OF CONNECTION PRIOR TO STARTING WORK. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR FURTHER INFORMATION.

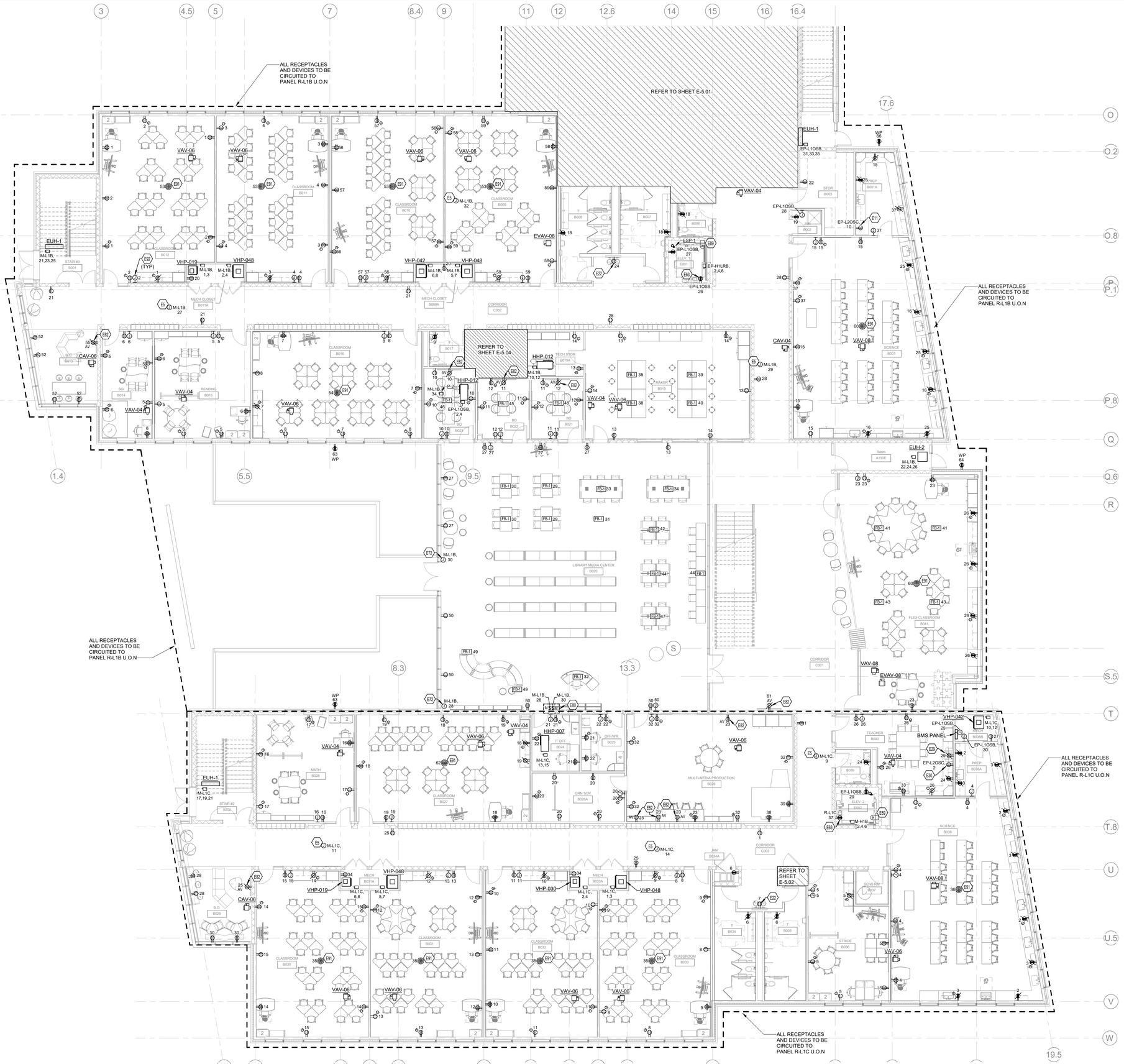
E80 PROVIDE CONTROLS FOR MOTORIZED SHADES. COORDINATE EXACT FINAL LOCATION OF CONNECTION PRIOR TO STARTING WORK. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR FURTHER INFORMATION.

E82 REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E89 PROVIDE EMERGENCY STOP SWITCH AT ELEVATOR PIT. COORDINATE EXACT LOCATION WITH ELEVATOR MANUFACTURER PRIOR TO STARTING WORK.

E91 PROVIDE CEILING MOUNTED QUADRUPLEX RECEPTACLE FOR CLASSROOM SOUND REINFORCEMENT SYSTEM. REFER TO TELECOM PLANS FOR FURTHER INFORMATION.

E92 PROVIDE DEDICATED 120V HARDWIRED CONNECTION TO CLOCK. COORDINATE EXACT FINAL LOCATIONS WITH TELECOM CONTRACTOR. REFER TO TELECOM PLANS FOR ADDITIONAL INFORMATION.



1 LOWER LEVEL ELECTRICAL POWER PLAN
1/8" = 1'-0"

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ROBERT A. MAHS PE.47026 STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

LOWER LEVEL ELECTRICAL POWER PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.01C

5/18/2026 11:11:52 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

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C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

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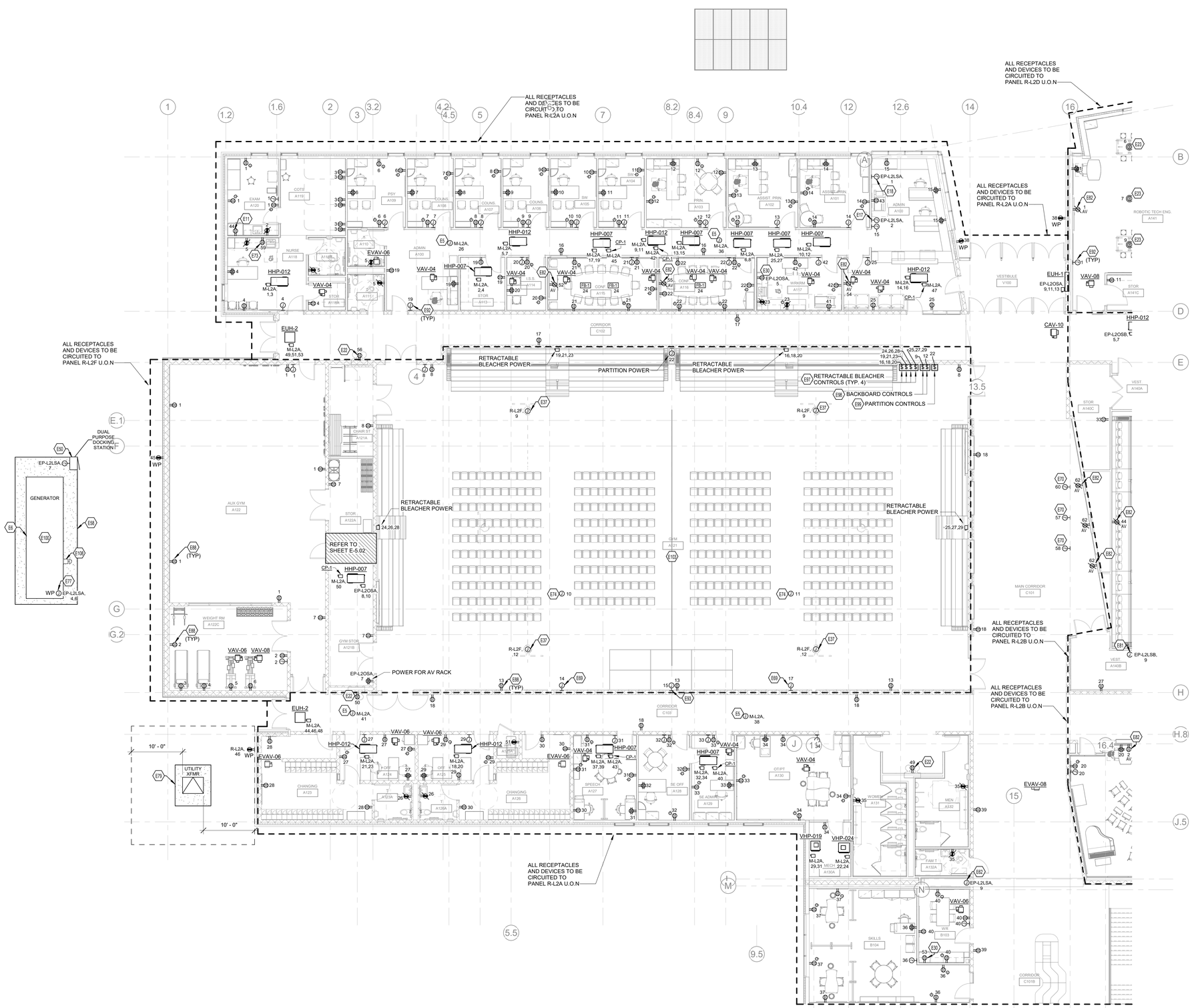
H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES

E5	120V DEDICATED CIRCUIT TO VAV CONTROLS. COORDINATE INTERCONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. FURNISH AND INSTALL 1" CONDUIT(S) AS REQUIRED FROM POWER SOURCE TO VAV CONTROL PANEL. MAXIMUM OF 6 VAV UNITS CONNECTED TO EACH CIRCUIT.
E6	PROVIDE 4-WIRE START SIGNAL WITH 2-HR RATED CABLE FROM DOCKING STATION TO GENERATOR. START SIGNAL SHALL CONNECT FROM DOCKING STATIONS TO EACH ATS.
E11	PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER.
E17	EC TO PROVIDE DEDICATED 120V 20A LIFE SAFETY CIRCUIT TO FIRE ALARM CONTROL PANEL.
E18	EC TO PROVIDE DEDICATED 120V 20A LIFE SAFETY CIRCUIT TO BI-DIRECTIONAL AMPLIFIER ANNUNCIATOR PANEL.
E22	DEDICATED RECEPTACLE FOR BOTTLE-FILLING WATER FOUNTAIN. PROVIDE GFCI PROTECTION AT BREAKER. COORDINATE EXACT FINAL LOCATION OF ELECTRICAL OUTLET WITH WATER FOUNTAIN MANUFACTURER AND INSTALLER PRIOR TO STARTING WORK.
E23	PROVIDE KH INDUSTRIES RTF CORD REEL OR APPROVED EQUAL MOUNTED TO CEILING. PROVIDE RTFD3L-WW-B12G. FIELD INSTALL 20A/1P RECEPTACLE AND BACKBOX TO CORD REEL QUAD BOX RECEPTACLE. TERMINATE 1H, N, 1G INTO DEVICE AT CEILING.
E30	POWER FOR UNDERCOUNTER REFRIGERATOR. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL DRAWINGS.
E37	120V CONNECTION TO MOTORIZED BASKETBALL HOOP. COORDINATE CONNECTIONS WITH MANUFACTURER.
E50	PROVIDE BOD: ESL POWER SYSTEMS DUALCONNECT DUAL PURPOSE DOCKING STATION 8212 SERIES OR APPROVED EQUIVALENT. DUAL PURPOSE DOCKING STATION SHALL BE RATED FOR 480V, 3-PHASE, 4W, 1200A, PROVIDED IN A NEMA 3R ENCLOSURE, AND UL LISTED. REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
E58	CONCRETE PAD FOR MOUNTING OF GENERATOR AND DOCKING STATION. REFER TO PHASE 1 CONSTRUCTION DOCUMENTS AND SPECIFICATIONS FOR FURTHER INFORMATION.
E62	PROVIDE DEDICATED 120V 20 AMP EMERGENCY CIRCUIT TO SLIDING WON DOOR. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.
E69	PROVIDE POWER FOR WALL-MOUNTED MOTORIZED PROJECTION SCREEN. COORDINATE EXACT FINAL LOCATION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E70	PROVIDE POWER FOR DIGITAL LED MARQUEE SIGN APPROXIMATELY 145" A.F.F. COORDINATE MOUNTING HEIGHTS WITH ARCHITECTURAL PLANS. COORDINATE EXACT FINAL LOCATION OF POWER CONNECTION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E73	PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER FOR UNDERCOUNTER ICE MAKER. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL PLANS.
E74	PROVIDE POWER FOR PROJECTOR. COORDINATE EXACT LOCATION OF POWER CONNECTION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E77	PROVIDE POWER FOR AUXILIARY LOAD CENTER PANEL. COORDINATE CONNECTION WITH MANUFACTURER PRIOR TO STARTING WORK. REFER TO ELECTRICAL DETAILS SHEET E6.01 FOR GENERATOR INTERCONNECTION DETAIL.
E79	CONCRETE PAD FOR UTILITY TRANSFORMER. REFER TO PHASE 1 CONSTRUCTION DOCUMENTS AND SPECIFICATIONS FOR FURTHER INFORMATION.
E81	PROVIDE DEDICATED EMERGENCY 120V 20A CIRCUIT TO VAC POWERED FIRE/SMOKE DAMPERS. COORDINATE FINAL CONNECTIONS WITH MECHANICAL CONTRACTOR.
E82	REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E88	RECEPTACLES IN GYM, AUX GYM, AND WEIGHT ROOM SHALL BE PROVIDED WITH STAINLESS STEEL COVERPLATE.
E92	PROVIDE DEDICATED 120V HARDWIRED CONNECTION TO CLOCK. COORDINATE EXACT FINAL LOCATIONS WITH TELECOM CONTRACTOR. REFER TO TELECOM PLANS FOR ADDITIONAL INFORMATION.
E93	PROVIDE 120V HARDWIRED CONNECTION TO GYM SCOREBOARD. COORDINATE EXACT FINAL LOCATION AND MOUNTING HEIGHTS PRIOR TO STARTING WORK.
E97	PROVIDE 4-GANG BACKBOX FOR KEYED SWITCHES FURNISHED BY EQUIPMENT VENDOR PER MANUFACTURER'S RECOMMENDATIONS. COORDINATE FINAL LOCATION OF CONTROL STATION WITH OWNER AND ARCHITECT PRIOR TO ROUGH IN.
E98	PROVIDE 2-GANG BACKBOX WITH ASSOCIATED PORTER COVER PLATE FOR KEYED SWITCHES FURNISHED BY EQUIPMENT VENDOR PER MANUFACTURER'S RECOMMENDATIONS. COORDINATE FINAL LOCATION OF CONTROL STATION WITH OWNER AND ARCHITECT PRIOR TO ROUGH-IN.
E99	PROVIDE SINGLE GANG BACKBOX WITH ASSOCIATED PORTER COVER PLATE FOR KEYED SWITCHES FURNISHED BY EQUIPMENT VENDOR PER MANUFACTURER'S RECOMMENDATIONS. COORDINATE FINAL LOCATION OF CONTROL STATION WITH OWNER AND ARCHITECT PRIOR TO ROUGH-IN.
E100	BASIS OF DESIGN: CAT C18 600 KW DIESEL STANDBY GENERATOR.
E103	PROVIDE (10) 20A-1P, (4) 20A-2P, AND (4) 20A-3P SPARE CIRCUITS FOR POTENTIAL FUTURE EQUIPMENT FOR GYM FROM PANEL R-L2F.
E108	PROVIDE EMERGENCY STOP SWITCH FOR SHUTDOWN OF GENERATOR. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.



1 MAIN LEVEL ELECTRICAL POWER PLAN - AREA A
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ROBERT A. MAHR, P.E. #27036, STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

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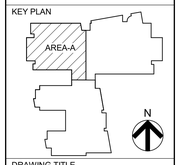
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL POWER PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.02A

5/19/2026 11:11:56 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. RECEPTACLES THAT ARE CONTROLLED BY AN AUTOMATIC MEANS SUCH AS OCCUPANCY SENSOR OR ENERGY MANAGEMENT SYSTEM SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3(E).

F. LOCATIONS OF ELECTRICAL CONNECTIONS AND LOCAL DISCONNECTS SHALL BE COORDINATED WITH MECHANICAL AND PLUMBING CONTRACTORS TO ENSURE ACCESS AND WORKING CLEARANCE IS MAINTAINED PER NEC. NOTIFY OTHER TRADES OF REQUIRED CLEARANCE AREAS TO AVOID ROUTING OF OTHER SYSTEMS IN THESE AREAS. DO NOT INSTALL ELECTRICAL EQUIPMENT OVER EQUIPMENT NAMEPLATES OR ACCESS PANELS OR THROUGH ACCESS/MAINTENANCE CLEARANCES OF EQUIPMENT BY OTHER TRADES.

G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES (##)

E5 120V DEDICATED CIRCUIT TO VAV CONTROLS. COORDINATE INTERCONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. FURNISH AND INSTALL 1" CONDUIT(S) AS REQUIRED FROM POWER SOURCE TO VAV CONTROL PANEL. MAXIMUM OF 6 VAV UNITS CONNECTED TO EACH CIRCUIT.

E11 PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER.

E22 DEDICATED RECEPTACLE FOR BOTTLE-FILLING WATER FOUNTAIN. PROVIDE GFCI PROTECTION AT BREAKER. COORDINATE EXACT FINAL LOCATION OF ELECTRICAL OUTLET WITH WATER FOUNTAIN MANUFACTURER AND INSTALLER PRIOR TO STARTING WORK.

E23 PROVIDE KH INDUSTRIES RTF CORD REEL OR APPROVED EQUAL MOUNTED TO CEILING. PROVIDE RTF03L-WW-8-CRC. FIELD INSTALL 20A/1P RECEPTACLE AND BACKBOX TO CORD REEL QUAD BOX RECEPTACLE. TERMINATE 1H, N, 1G INTO DEVICE AT CEILING.

E29 POWER FOR MICROWAVE. PROVIDE DEDICATED CIRCUIT WITH GFI AT BREAKER. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL DRAWINGS.

E32 POWER FOR DISHWASHER. COORDINATE WITH ARCHITECTURAL DRAWINGS. PROVIDE DEDICATED CIRCUIT WITH GFCI AT BREAKER.

E69 PROVIDE POWER FOR WALL-MOUNTED MOTORIZED PROJECTION SCREEN. COORDINATE EXACT FINAL LOCATION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E70 PROVIDE POWER FOR DIGITAL LED MARQUEE SIGN APPROXIMATELY 145" A.F.F. COORDINATE MOUNTING HEIGHTS WITH ARCHITECTURAL PLANS. COORDINATE EXACT FINAL LOCATION OF POWER CONNECTION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E72 PROVIDE POWER FOR MOTORIZED SHADES. COORDINATE EXACT FINAL LOCATION OF CONNECTION PRIOR TO STARTING WORK. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR FURTHER INFORMATION.

E74 PROVIDE POWER FOR PROJECTOR. COORDINATE EXACT LOCATION OF POWER CONNECTION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E80 PROVIDE CONTROLS FOR MOTORIZED SHADES. COORDINATE EXACT FINAL LOCATION OF CONNECTION PRIOR TO STARTING WORK. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR FURTHER INFORMATION.

E81 PROVIDE DEDICATED EMERGENCY 120V 20A CIRCUIT TO VAC POWERED FIRE/SMOKE DAMPERS. COORDINATE FINAL CONNECTIONS WITH MECHANICAL CONTRACTOR.

E82 REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E83 ELECTRICAL CONTRACTOR SHALL EXTEND POWER FROM STUB-UPS UNDER PLANETARIUM DESK TO AV RECEPTACLE MOUNTED TO DESK. REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND FURTHER INFORMATION. COORDINATE EXACT FINAL LOCATION WITH LOW VOLTAGE CONTRACTOR.

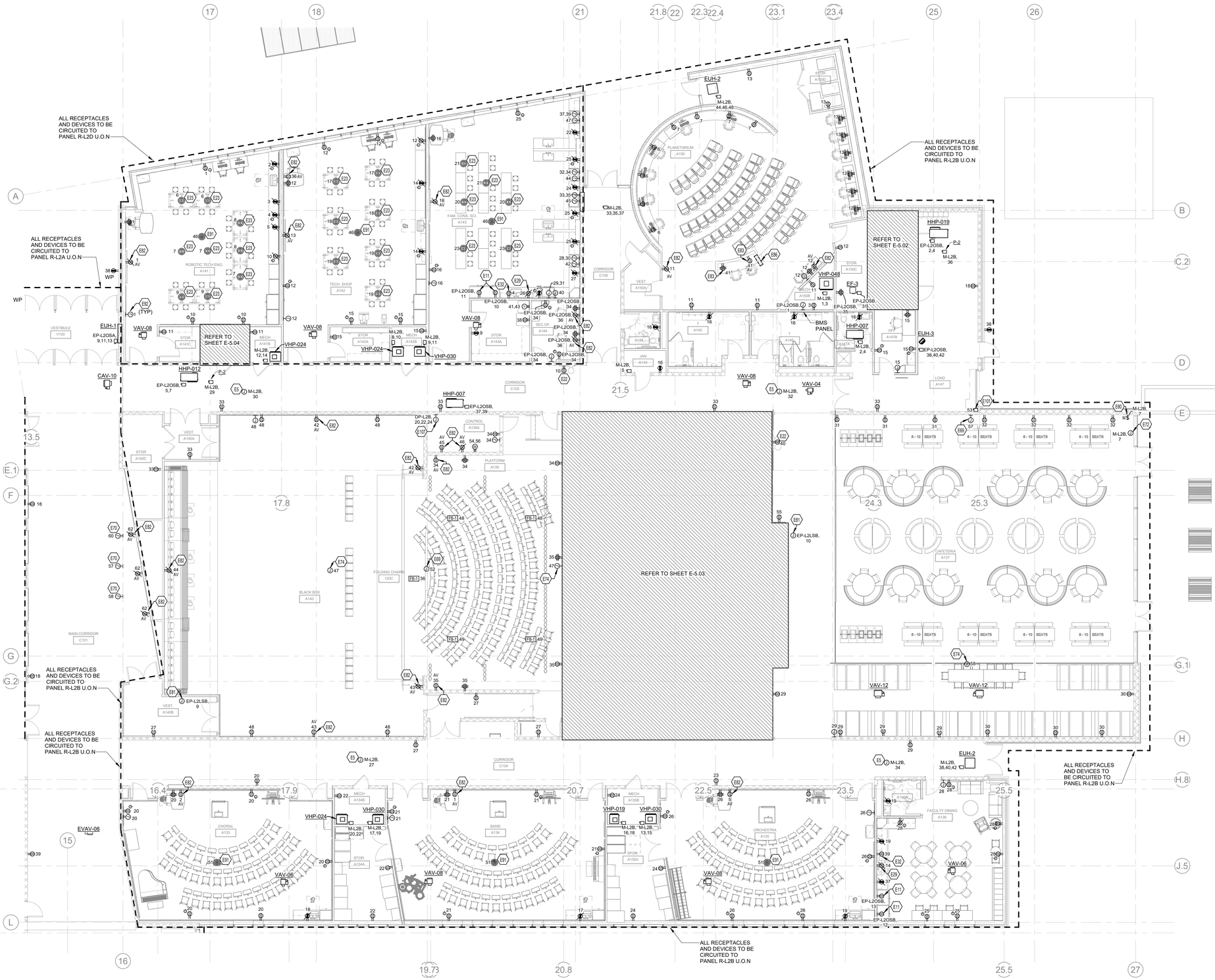
E86 CONDUIT STUB-UPS FOR POWER, AV, AND LIGHTING CONTROLS TO PLANETARIUM DESK. E.C SHALL EXTEND WIRING AS NECESSARY FROM STUB UPS AT FLOOR. REFER TO LOWER LEVEL ELECTRICAL PLAN E3.01B FOR CONDUIT INFORMATION.

E91 PROVIDE CEILING MOUNTED QUADRUPLEX RECEPTACLE FOR CLASSROOM SOUND REINFORCEMENT SYSTEM. REFER TO TELECOM PLANS FOR FURTHER INFORMATION.

E92 PROVIDE DEDICATED 120V HARDWIRED CONNECTION TO CLOCK. COORDINATE EXACT FINAL LOCATIONS WITH TELECOM CONTRACTOR. REFER TO TELECOM PLANS FOR ADDITIONAL INFORMATION.

E101 DEDICATED 120V CONNECTION TO OVERHEAD COILING DOOR. COORDINATE EXACT LOCATION OF CONNECTION WITH MANUFACTURER PRIOR TO STARTING WORK. PROVIDE ANY ADDITIONAL CONDUITS/BACKBOXES FOR COILING DOOR SYSTEM AS REQUIRED BY THE MANUFACTURER AND FOR A FULLY FUNCTIONAL SYSTEM.

E107 PROVIDE POWER TO THEATER LIGHTING RELAY PANEL. REFER TO SINGLE LINE DIAGRAM FOR FURTHER INFORMATION. COORDINATE EXACT FINAL LOCATION AND INTERCONNECTIONS WITH LOW VOLTAGE CONTRACTOR. E.C TO PROVIDE WIRING, CONDUITS, AND SUPPORTS FROM LIGHTING RELAY PANEL TO THEATER LIGHTS AS NECESSARY FOR A COMPLETE INSTALLATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.



1 MAIN LEVEL ELECTRICAL POWER PLAN - AREA B
1/8" = 1'-0"

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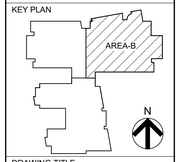
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL POWER PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
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E2.02B

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TAGGED NOTES

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E11 PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER.

E15 PROVIDE (3) 4" CONDUITS FROM PV DISCONNECT OUTSIDE MAIN ELECTRICAL ROOM TO PV PANEL LOCATED ON ROOF AT UPPER LEVEL. CONDUITS TO BE RUN BELOW GRADE FROM DISCONNECT AND STUB UP WITHIN BUILDING. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.

E22 DEDICATED RECEPTACLE FOR BOTTLE-FILLING WATER FOUNTAIN. PROVIDE GFCI PROTECTION AT BREAKER. COORDINATE EXACT FINAL LOCATION OF ELECTRICAL OUTLET WITH WATER FOUNTAIN MANUFACTURER AND INSTALLER PRIOR TO STARTING WORK.

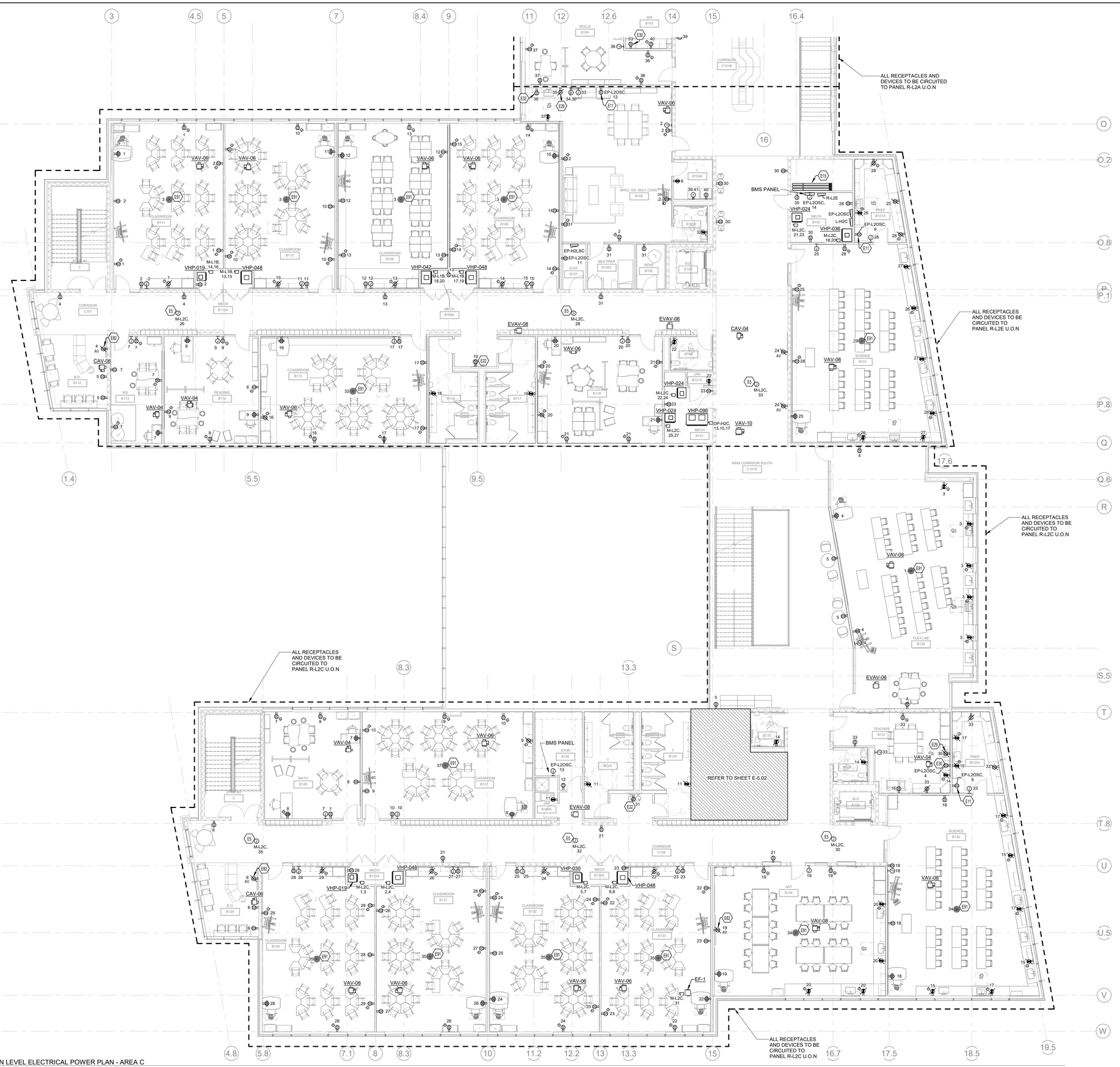
E29 POWER FOR MICROWAVE. PROVIDE DEDICATED CIRCUIT WITH GFI AT BREAKER. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL DRAWINGS.

E30 POWER FOR UNDERCOUNTER REFRIGERATOR. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTUAL DRAWINGS.

E32 POWER FOR DISHWASHER. COORDINATE WITH ARCHITECTURAL DRAWINGS. PROVIDE DEDICATED CIRCUIT WITH GFCI AT BREAKER.

E82 REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

E91 PROVIDE CEILING MOUNTED QUADRUPLEX RECEPTACLE FOR CLASSROOM SOUND REINFORCEMENT SYSTEM. REFER TO TELECOM PLANS FOR FURTHER INFORMATION.



1 MAIN LEVEL ELECTRICAL POWER PLAN - AREA C
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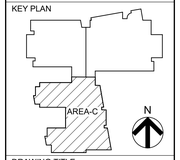
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL POWER PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.02C

5/18/2026 11:12:05 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

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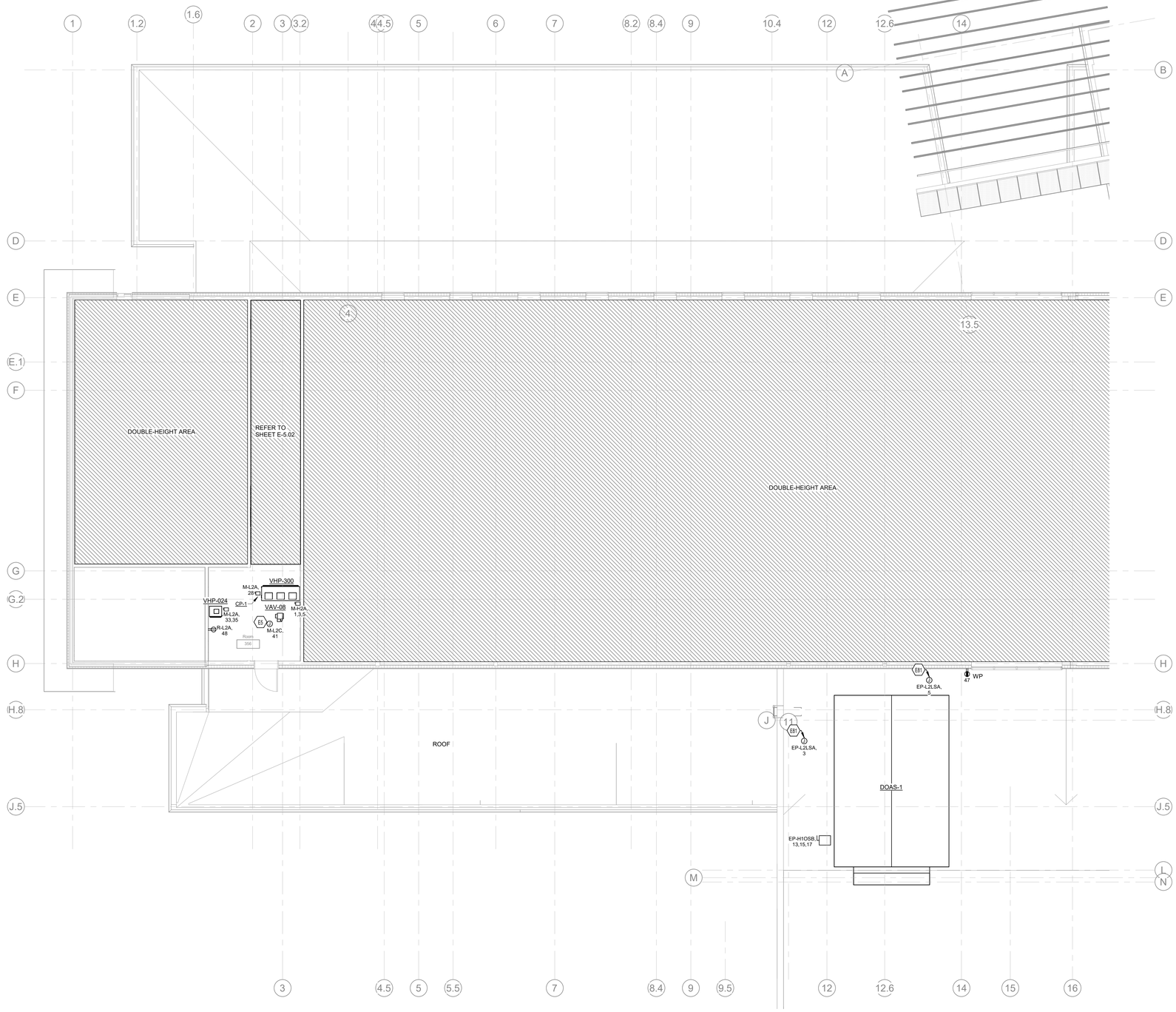
E81 PROVIDE DEDICATED EMERGENCY 120V 20A CIRCUIT TO VAC POWERED FIRE/SMOKE DAMPERS. COORDINATE FINAL CONNECTIONS WITH MECHANICAL CONTRACTOR.



1 UPPER LEVEL ELECTRICAL POWER PLAN - AREA A
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ROBERT A. MAHS PE.47028 STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL POWER PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.03A

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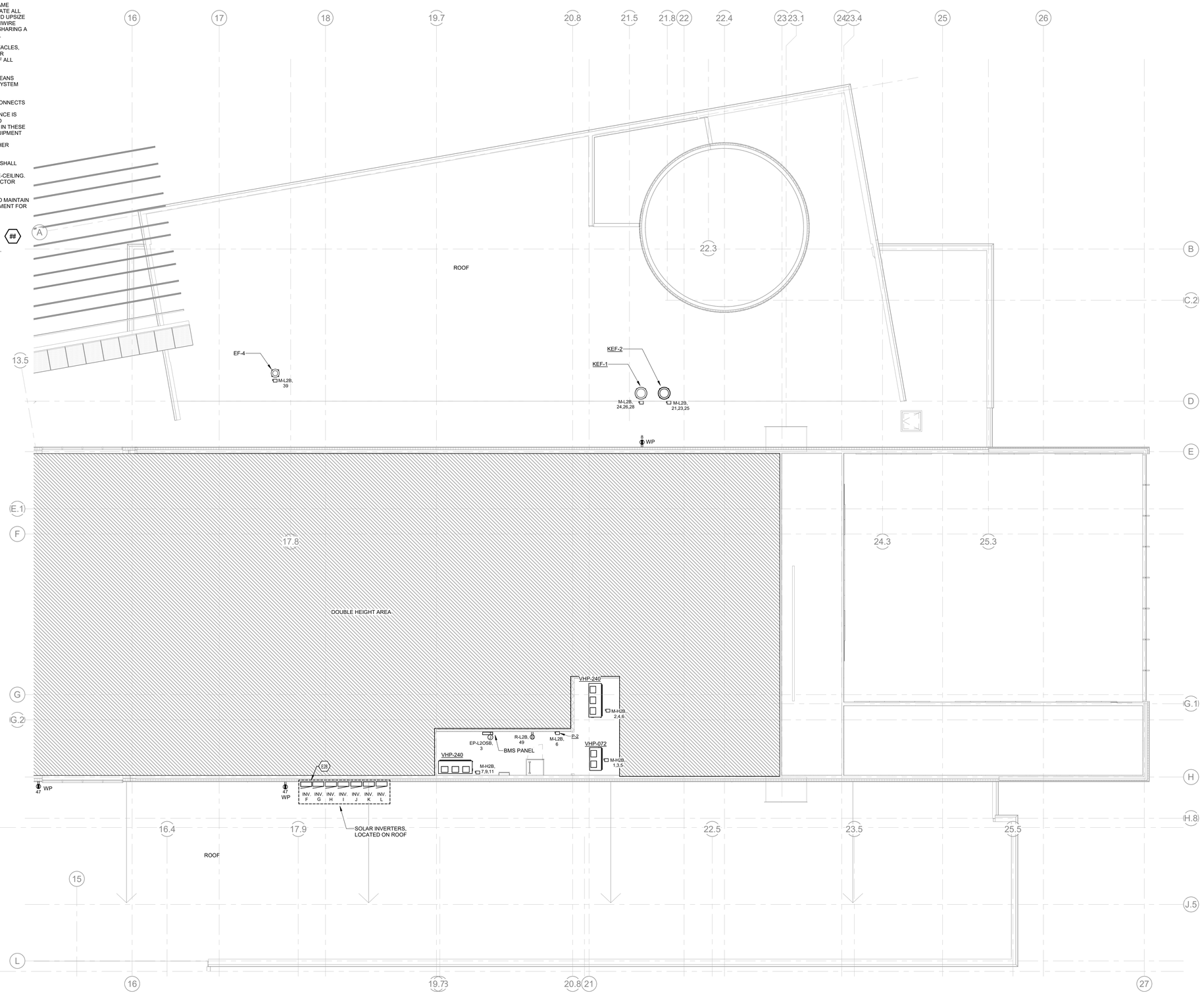
TAGGED NOTES

E28 EQUIPMENT TO BE PROVIDED AS PART OF ADD-ALTERNATE.



1 UPPER LEVEL ELECTRICAL POWER PLAN - AREA B
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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL POWER PLAN - AREA B

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OFFICE PROJ. NO.	250501
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APPROVED BY	MA

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E. RECEPTACLES THAT ARE CONTROLLED BY AN AUTOMATIC MEANS SUCH AS OCCUPANCY SENSOR OR ENERGY MANAGEMENT SYSTEM SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3(E).

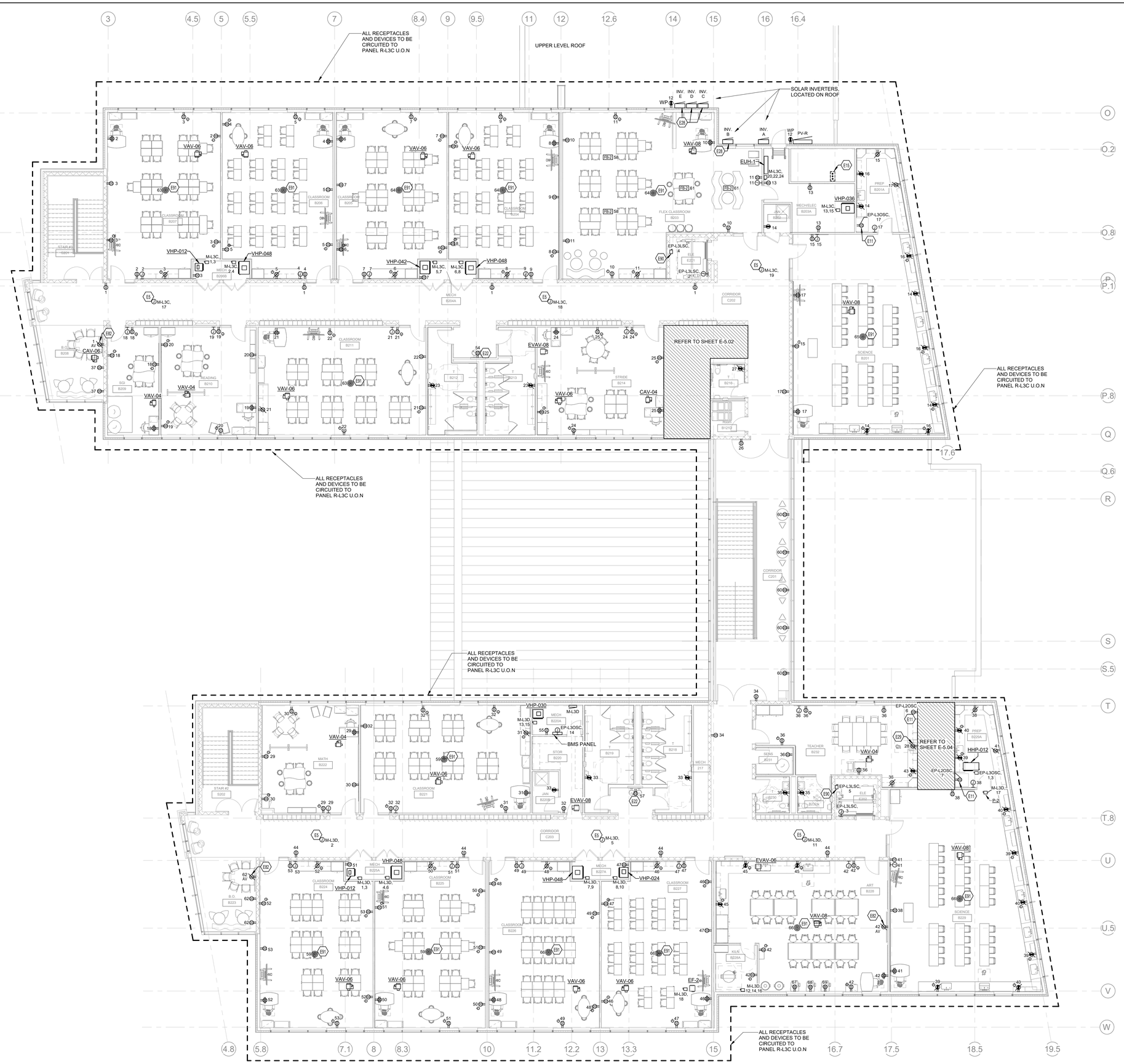
F. LOCATIONS OF ELECTRICAL CONNECTIONS AND LOCAL DISCONNECTS SHALL BE COORDINATED WITH MECHANICAL AND PLUMBING CONTRACTORS TO ENSURE ACCESS AND WORKING CLEARANCE IS MAINTAINED PER NEC. NOTIFY OTHER TRADES OF REQUIRED CLEARANCE AREAS TO AVOID ROUTING OF OTHER SYSTEMS IN THESE AREAS. DO NOT INSTALL ELECTRICAL EQUIPMENT OVER EQUIPMENT NAMEPLATES OR ACCESS PANELS OR THROUGH ACCESS/MAINTENANCE CLEARANCES OF EQUIPMENT BY OTHER TRADES.

G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES

E5	120V DEDICATED CIRCUIT TO VAV CONTROLS. COORDINATE INTERCONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. FURNISH AND INSTALL 1" CONDUIT(S) AS REQUIRED FROM POWER SOURCE TO VAV CONTROL PANEL. MAXIMUM OF 6 VAV UNITS CONNECTED TO EACH CIRCUIT.
E11	PROVIDE DEDICATED CIRCUIT WITH GFCI PROTECTION AT BREAKER.
E15	PROVIDE (3) 4" CONDUITS FROM PV DISCONNECT OUTSIDE MAIN ELECTRICAL ROOM TO PV PANEL LOCATED ON ROOF AT UPPER LEVEL. CONDUITS TO BE RUN BELOW GRADE FROM DISCONNECT AND STUB UP WITHIN BUILDING. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.
E22	DEDICATED RECEPTACLE FOR BOTTLE-FILLING WATER FOUNTAIN. PROVIDE GFCI PROTECTION AT BREAKER. COORDINATE EXACT FINAL LOCATION OF ELECTRICAL OUTLET WITH WATER FOUNTAIN MANUFACTURER AND INSTALLER PRIOR TO STARTING WORK.
E28	EQUIPMENT TO BE PROVIDED AS PART OF ADD-ALTERNATE.
E29	POWER FOR MICROWAVE. PROVIDE DEDICATED CIRCUIT WITH GFI AT BREAKER. COORDINATE EXACT FINAL LOCATION WITH ARCHITECTURAL DRAWINGS.
E82	REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E90	ELEVATOR CAB LIGHT LOCKABLE DISCONNECT SWITCH. COORDINATE EXACT LOCATION WITH ELEVATOR PROVIDER AND INSTALLER PRIOR TO ROUGH IN.
E91	PROVIDE CEILING MOUNTED QUADRUPLEX RECEPTACLE FOR CLASSROOM SOUND REINFORCEMENT SYSTEM. REFER TO TELECOM PLANS FOR FURTHER INFORMATION.



1 UPPER LEVEL ELECTRICAL POWER PLAN
1/8" = 1'-0"

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ROBERT A. MAHS
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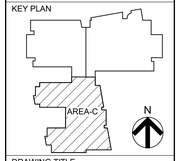
PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL ELECTRICAL POWER PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E2.03C

5/19/2026 11:12:14 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (LIGHTNING PROTECTION):

A. REFER TO ELECTRICAL SYMBOL LEGEND.

B. REFER TO DIVISION 26 SECTIONS FOR ADDITIONAL SPECIFICATIONS.

C. REFER TO ARCHITECTURAL ROOF PLAN FOR ADDITIONAL ROOF INFORMATION

D. CONCEAL ALL DOWN CONDUCTORS IN WALLS TO GROUND RODS.

E. PROVIDE 29 STRAND, 17 GAUGE, 192 LBS/100FT, 59,450 CM(#2 AWG) BASKET WEAVE ALUMINUM CABLE FOR ALL ROOF CONTRACTORS.

F. SYSTEM SHALL BE DESIGNED AND INSTALLED PER MASTER INSTALLER/DESIGNER IN THE STATE OF CONNECTICUT BY THE LIGHTNING PROTECTION INSTITUTE.

G. COORDINATE THROUGH ROOF LOCATIONS TO STRUCTURE WITH STRUCTURE STEEL DRAWINGS.

H. SEAL ALL PENETRATIONS THROUGH ROOF. MINIMIZE PENETRATIONS TO FURTHEST EXTENT POSSIBLE.

I. LIGHTNING PROTECTION SYSTEM SHALL BE INSTALLED IN PROFESSIONAL MANNER TO BLEND IN WITH THE BUILDING'S APPEARANCE.

J. PROVIDE AIR TERMINALS AT EXTENSION OF BUILDING ON 20' MAXIMUM CENTERS AND PROVIDE AIR TERMINALS ON MIDROOF SPANS ON 50' MAXIMUM CENTERS.

K. REFER TO ROOF PLANS FOR ALL ROOFTOP EQUIPMENT THAT WILL NEED TO BE PROTECTED BY LIGHTING PROTECTION SYSTEM.

L. REFER TO LIGHTNING PROTECTION DETAILS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS. INSTALLATION AND DESIGN SHALL COMPLY WITH UL 96 AND NFPA 780. PROVIDE A UL MASTER LABEL.

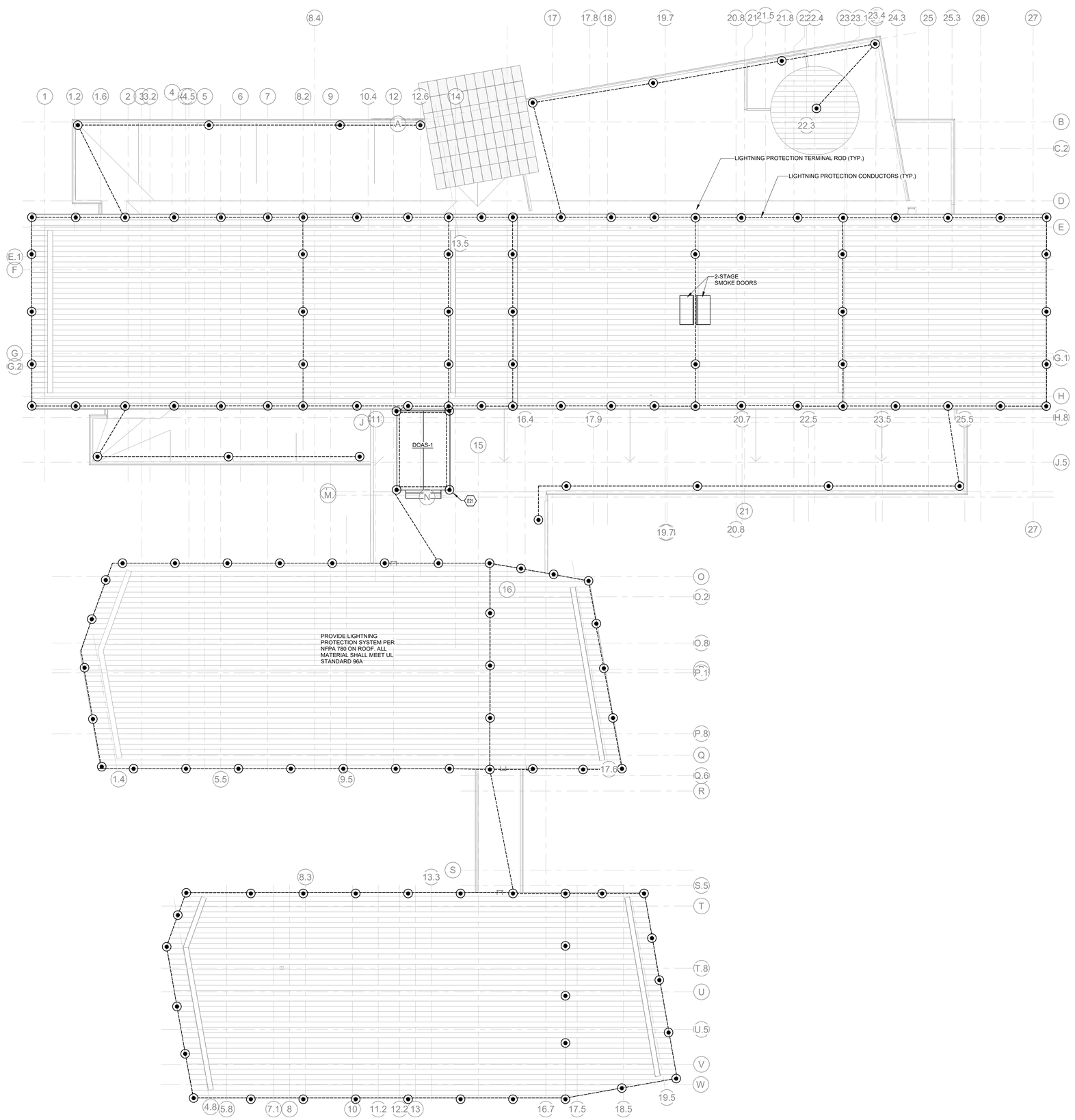
M. REFER TO ARCHITECTURAL ROOF PLANS FOR ADDITIONAL PLANS AND DETAILS. REFER TO MECHANICAL ROOF PLANS FOR LOCATION OF ROOF MOUNTED EQUIPMENT. REFER TO PHOTOVOLTAIC PLANS FOR COORDINATION OF LIGHTNING PROTECTION WITH PV SYSTEM.

N. DOWN CONDUCTORS SHALL BE INTERNALLY COURSED TO GROUNDING ELECTRODE SYSTEM.

TAGGED NOTES

(##)

E21 PROVIDE LIGHTNING PROTECTION TO BE INTEGRATED WITH DOAS UNIT. LIGHTNING PROTECTION RODS TO BE MOUNTED TO DOAS. COORDINATE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK.



1 ROOF ELECTRICAL LIGHTNING PROTECTION PLAN
1/16" = 1'-0"

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ROBERT A. MAHS PE.47028 STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

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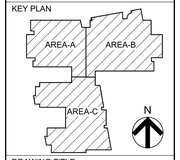
PROJECT STATUS

KEY PLAN



DRAWING TITLE

ROOF ELECTRICAL LIGHTNING PROTECTION PLAN - ADD ALTERNATE

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E3.01

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GENERAL NOTES (LIGHTNING PROTECTION):

A. REFER TO ELECTRICAL SYMBOL LEGEND.

B. REFER TO DIVISION 26 SECTIONS FOR ADDITIONAL SPECIFICATIONS.

C. REFER TO ARCHITECTURAL ROOF PLAN FOR ADDITIONAL ROOF INFORMATION

D. CONCEAL ALL DOWN CONDUCTORS IN WALLS TO GROUND RODS.

E. PROVIDE 29 STRAND, 17 GAUGE, 192 LBS/100FT, 59,450 CM(#2 AWG) BASKET WEAVE ALUMINUM CABLE FOR ALL ROOF CONTRACTORS.

F. SYSTEM SHALL BE DESIGNED AND INSTALLED PER MASTER INSTALLER/DESIGNER IN THE STATE OF CONNECTICUT BY THE LIGHTNING PROTECTION INSTITUTE.

G. COORDINATE THROUGH ROOF LOCATIONS TO STRUCTURE WITH STRUCTURE STEEL DRAWINGS.

H. SEAL ALL PENETRATIONS THROUGH ROOF. MINIMIZE PENETRATIONS TO FURTHEST EXTENT POSSIBLE.

I. LIGHTNING PROTECTION SYSTEM SHALL BE INSTALLED IN PROFESSIONAL MANNER TO BLEND IN WITH THE BUILDING'S APPEARANCE.

J. PROVIDE AIR TERMINALS AT EXTENSION OF BUILDING ON 20' MAXIMUM CENTERS AND PROVIDE AIR TERMINALS ON MIDROOF SPANS ON 50' MAXIMUM CENTERS.

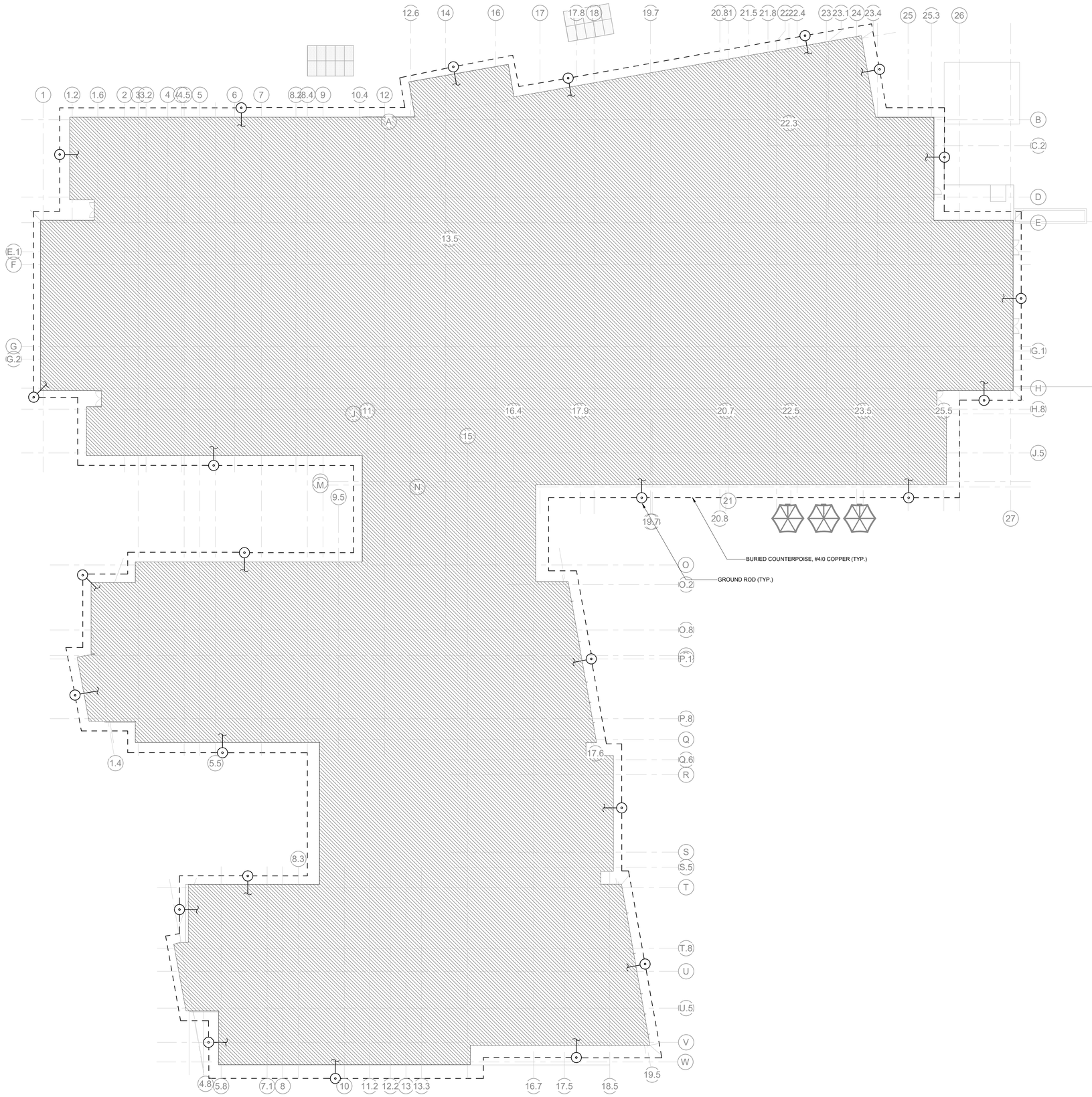
K. REFER TO ROOF PLANS FOR ALL ROOFTOP EQUIPMENT THAT WILL NEED TO BE PROTECTED BY LIGHTING PROTECTION SYSTEM.

L. REFER TO LIGHTNING PROTECTION DETAILS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS. INSTALLATION AND DESIGN SHALL COMPLY WITH UL 96 AND NFPA 780. PROVIDE A UL MASTER LABEL.

M. REFER TO ARCHITECTURAL ROOF PLANS FOR ADDITIONAL PLANS AND DETAILS. REFER TO MECHANICAL ROOF PLANS FOR LOCATION OF ROOF MOUNTED EQUIPMENT. REFER TO PHOTOVOLTAIC PLANS FOR COORDINATION OF LIGHTNING PROTECTION WITH PV SYSTEM.

N. DOWN CONDUCTORS SHALL BE INTERNALLY COURSED TO GROUNDING ELECTRODE SYSTEM.

TAGGED NOTES



1 LOWER LEVEL ELECTRICAL LIGHTNING PROTECTION PLAN
1/16" = 1'-0"

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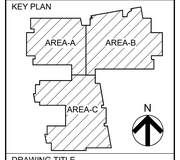
KEY PLAN



DRAWING TITLE

MAIN LEVEL ELECTRICAL LIGHTNING PROTECTION PLAN - ADD ALTERNATE

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

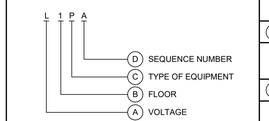
E3.02

5/18/2026 11:12:17 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

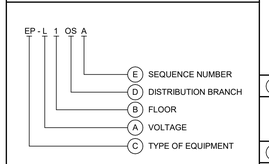
ELECTRICAL EQUIPMENT NAMING LEGEND

EXAMPLES

NORMAL POWER EQUIPMENT



EMERGENCY POWER EQUIPMENT



(A) DISTRIBUTION/SECONDARY VOLTAGE

M: 13,800V
H: 480/277V
L: 208/120V

(B) FLOOR

1: LOWER LEVEL
2: MAIN LEVEL
3. UPPER LEVEL

(C) TYPE OF EQUIPMENT

SWBD: SWITCHBOARD
DP: DISTRIBUTION PANEL
L: LIGHTING PANELBOARD
P: POWER PANELBOARD
K: KITCHEN PANELBOARD
M: MECHANICAL PANELBOARD
LCP: LIGHTING CONTROL PANEL
EV: EV CHARGER PANEL

T: TRANSFORMER
ATS: AUTOMATIC TRANSFER SWITCH

EP: EMERGENCY PANELBOARD

(D) DISTRIBUTION BRANCH

BLANK(): NORMAL POWER
LS: EMERGENCY NEC 700
LR: EMERGENCY NEC 701
OS: EMERGENCY NEC 702

(E) SEQUENCE NUMBER

'A' THROUGH LAST LETTER NEEDED FOR EACH TYPE OF EQUIPMENT ON EACH LEVEL.

THREE PHASE DRY TYPE TRANSFOMER SCHEDULE

GENERAL NOTES:
A. UTILIZE PRIMARY AND SECONDARY FEEDER SIZES BELOW UNLESS OTHERWISE NOTED ON RISER DIAGRAM.
B. CONFIRM / COORDINATE TRANSFORMER AND TERMINAL BREAKERS' LUG SIZES WITH CONDUCTOR SIZES INDICATED.
C. COMPLY WITH NEC 240.87 FOR BREAKERS 1200A AND LARGER.
D. TRANSFORMER SECONDARY CONDUCTORS ARE ADJUSTED TO REFLECT THE NEUTRAL CONDUCTOR AS A CURRENT-CARRYING CONDUCTOR.

NOTES:
1. CONNECT GROUNDING ELECTRODE CONDUCTOR FROM TRANSFORMER X0 TERMINAL TO BUILDING STEEL IF AVAILABLE, OR TO OTHER BUILDING GROUND SYSTEM AS DESIGNATED.
2. CONDUCTOR SIZING BASED ON INDICATED TERMINAL BREAKER. REFER TO PANEL SCHEDULES AND/OR ONE-LINE DIAGRAM FOR FINAL SELECTION.
3. GROUNDING CONDUCTOR FROM TRANSFORMER TO PRIMARY OVERCURRENT DEVICE SIZED AS AN EQUIPMENT GROUNDING CONDUCTOR PER NEC TABLE 250.122.
4. BONDING CONDUCTOR FROM TRANSFORMER TO SECONDARY OVERCURRENT DEVICE SIZED AS A SEPARATELY DERIVED SYSTEM SUPPLY SIDE BONDING JUMPER PER NEC TABLE 250.66.

	PRIMARY - 480 DELTA			SECONDARY - 208Y/120V			
RATED KVA	TERMINAL BREAKER (NOTE 2)	COPPER CONDUCTOR SIZE (NOTE 3)	CONDUIT SIZE	COPPER CONDUCTOR SIZE (NOTE 4)	CONDUIT SIZE	GROUNDING ELECTRODE CONDUCTOR SIZE (NOTE 1)	TERMINAL BREAKER (NOTE 2)
15	30A/3P	3#10, #10G	3/4"	4#6, #8G	1"	#8	60A/3P
30	50A/3P	3#8, #10G	3/4"	4#2, #8G	1 1/2"	#8	100A/3P
45	90A/3P	3#4, #8G	1"	4#2/0, #4G	2"	#4	175A/3P
75	150A/3P	3#1/0, #6G	1 1/2"	4 - 300KCMIL, #2G	2 1/2"	#2	250A/3P
112.5	250A/3P	3 - 250 KCMIL, #4G	2 1/2"	4#4/0, #2/0G (2 SETS)	2 1/2"	#2/0	400A/3P
150	300A/3P	3 - 300 KCMIL, #4G	2 1/2"	4 - 400 KCMIL, #2/0G (2 SETS)	3"	#2/0	500A/3P
225	450A/3P	3 - 500 KCMIL, #3G	3"	4 - 350 KCMIL, #2/0G (3 SETS)	3"	#2/0	800A/3P
300	600A/3P	3#4/0, #2G (2 SETS)	2"	4 - 400 KCMIL, #3/0G (4 SETS)	3"	#3/0	1200A/3P
500	1000A/3P	3#600, #1/0G (3 SETS)	4"	4#600, #1/0G (4 SETS)	4"	#3/0	1600A/3P

THREE PHASE CIRCUIT SCHEDULE (COPPER CONDUCTORS)

CIRCUIT SYMBOL	CIRCUIT OR OCPD RATING 3-POLE	CONDUCTORS; 3 PHASE, 3 WIRE AND GROUND (SIZE IN AWG OR KCMIL)	CIRCUIT SYMBOL	CONDUCTORS; 3 PHASE, 4 WIRE AND GROUND (SIZE IN AWG OR KCMIL) 'N' DENOTES NEUTRAL	RACEWAY SIZE
1	20A	3#12 & 1#12G	1N	4#12 & 1#12G	3/4"
2	30A	3#10 & 1#10G	2N	4#10 & 1#10G	3/4"
3	40A	3#8 & 1#10G	3N	4#8 & 1#10G	3/4"
4	50A	3#6 & 1#10G	4N	4#6 & 1#10G	1"
5	60A	3#4 & 1#8G	5N	4#4 & 1#8G	1 - 1/4"
6	70A	3#4 & 1#8G	6N	4#4 & 1#8G	1 - 1/4"
7	80A	3#3 & 1#8G	7N	4#3 & 1#8G	1 - 1/4"
8	90A	3#2 & 1#8G	8N	4#2 & 1#8G	1 - 1/4"
9	100A	3#1 & 1#8G	9N	4#1 & 1#8G	1 - 1/2"
10	125A	3#1 & 1#6G	10N	4#1 & 1#6G	1 - 1/2"
11	150A	3#1/0 & 1#6G	11N	4#1/0 & 1#6G	1 - 1/2"
12	175A	3#2/0 & 1#6G	12N	4#2/0 & 1#6G	2"
13	200A	3#3/0 & 1#6G	13N	4#3/0 & 1#6G	2"
14	225A	3#4/0 & 1#4G	14N	4#4/0 & 1#4G	2"
15	250A	3#250 & 1#4G	15N	4#250 & 1#4G	2 - 1/2"
16	300A	3#350 & 1#4G	16N	4#350 & 1#4G	2 - 1/2"
17	350A	3#500 & 1#3G	17N	4#500 & 1#3G	3 - 1/2"
18	400A	3#600 & 1#3G	18N	4#600 & 1#3G	4"
19	500A	(2) 3#250 & 1#2G	19N	(2) 4#250 & 1#2G	(2) 3"
20	600A	(2) 3#350 & 1#1G	20N	(2) 4#350 & 1#1G	(2) 3"
21	800A	(2) 3#600 & 1#1/0G	21N	(2) 4#600 & 1#1/0G	(2) 4"
22	1000A	(3) 3#500 & 1#2/0G	22N	(3) 4#500 & 1#2/0G	(3) 3 - 1/2"
23	1200A	(3) 3#600 & 1#3/0G	23N	(3) 4#600 & 1#3/0G	(3) 4"
24	1600A	(4) 3#600 & 1#4/0G	24N	(4) 4#600 & 1#4/0G	(4) 4"
25	2000A	(5) 3#600 & 1#250G	25N	(5) 4#600 & 1#250G	(5) 4"
26	2500A	(6) 3#600 & 1#350G	26N	(6) 4#600 & 1#350G	(6) 4"
27	3000A	(8) 3#600 & 1#400G	27N	(8) 4#600 & 1#400G	(8) 4"
28	4000A	(10) 3#600 & 1#500G	28N	(10) 4#600 & 1#500G	(10) 4"

GENERAL NOTES - RISER

A. REFER TO SHEET E-000 FOR SYMBOLS AND ABBREVIATIONS.

B. REFER TO FEEDER AND BRANCH CIRCUIT SCHEDULE FOR FEEDER AND BRANCH CIRCUIT CONDUCTOR SIZES U.O.N.

C. REFER TO TRANSFORMER SCHEDULE FOR TRANSFORMER PRIMARY AND SECONDARY FEEDER SIZES U.O.N.

D. DASHED LINES INDICATE EQUIPMENT TO BE DEMOLISHED.

E. SOLID LIGHT LINES INDICATE EQUIPMENT TO REMAIN.

F. SOLID HEAVY LINES INDICATE NEW EQUIPMENT.

G. PROVIDE ENGRAVED LAMACOID LABELS FOR ALL POWER DISTRIBUTION EQUIPMENT FURNISHED OR MODIFIED IN THIS PROJECT, LABELS PER DETAILS AND SPECIFICATIONS.

H. SERVICE EQUIPMENT SHALL BE MARKED WITH THE MAXIMUM AVAILABLE FAULT-CURRENT AT THE EQUIPMENT AND THE DATE THE CALCULATION WAS PERFORMED. APPLY A TYPE-WRITTEN ADHESIVE LABEL WITH WHITE BACKGROUND, 1/2" HIGH BLACK LETTERING.

I. CONTRACTOR SHALL INSTALL SEPARATE CONDUITS, PULL BOXES, ETC. FOR EACH EMERGENCY POWER BRANCH AND NORMAL POWER PER NEC FOR COMPLETE SEPARATION OF POWER SERVICES.

J. PROVIDE BUILDING WITH SUBMETERING SYSTEM. PROVIDE E-GAUGE OR SIMILAR FOR EACH PANEL / DISTRIBUTION BOARD LISTED IN THE ELECTRICAL ENERGY USE SUBMETERING DIAGRAM. PROVIDE COMPLETE WITH CTS AND NETWORK CONNECTION.

K. REFER TO SPECIFICATIONS FOR ARC FLASH AND RELATED POWER SYSTEM STUDY REQUIREMENTS.

L. ALL CIRCUIT BREAKERS AND/OR DISCONNECTS SERVING THE PRIMARY SIDE OF A TRANSFORMER WHICH ARE NOT WITHIN SITE OF THE TRANSFORMER SHALL BE PROVIDED WITH PERMANENTLY INSTALLED MEANS TO LOCK THE BREAKER IN THE OFF POSITION. SUCH TRANSFORMERS SHALL HAVE THE ROOM NAME AND NUMBER OF THE PRIMARY DISCONNECTING MEANS ENGRAVED ON THE EQUIPMENT NAMEPLATE.

M. REFER TO SITE PLAN FOR TOTAL NUMBER OF CONDUITS (INCLUDING SPARES) FOR SERVICE FEEDERS AND OTHER FEEDERS ROUTED OUTSIDE THE BUILDING.

N. ALL ELECTRICAL DISTRIBUTION EQUIPMENT SHALL BE DEAD FRONT UL LISTED FOR THE PURPOSE AND APPLICATION. ALL EQUIPMENT SHALL MEET OR EXCEED ALL APPLICABLE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (N.E.C.). ANY DEVICE OR COMPONENT, I.E., SWITCHBOARD, PANEL, BREAKER, SWITCH, ETC., USED AS SERVICE ENTRANCE EQUIPMENT, SHALL BE LISTED FOR USE AT 100% OF THE RATED CAPACITY.

O. REFER TO SPECIFICATION AND ELECTRICAL SUBMETERING SHEET FOR ADDITIONAL INFORMATION ABOUT ADVANCED METERING DATA ACQUISITION SYSTEM.

TAGGED NOTES (##)

E10 PROVIDE SURGE PROTECTION DEVICE (SPD) TYPE 1 FOR MAIN SERVICE SWITCHBOARD. PROVIDE UNIT INTEGRAL TO SWITCHBOARD.

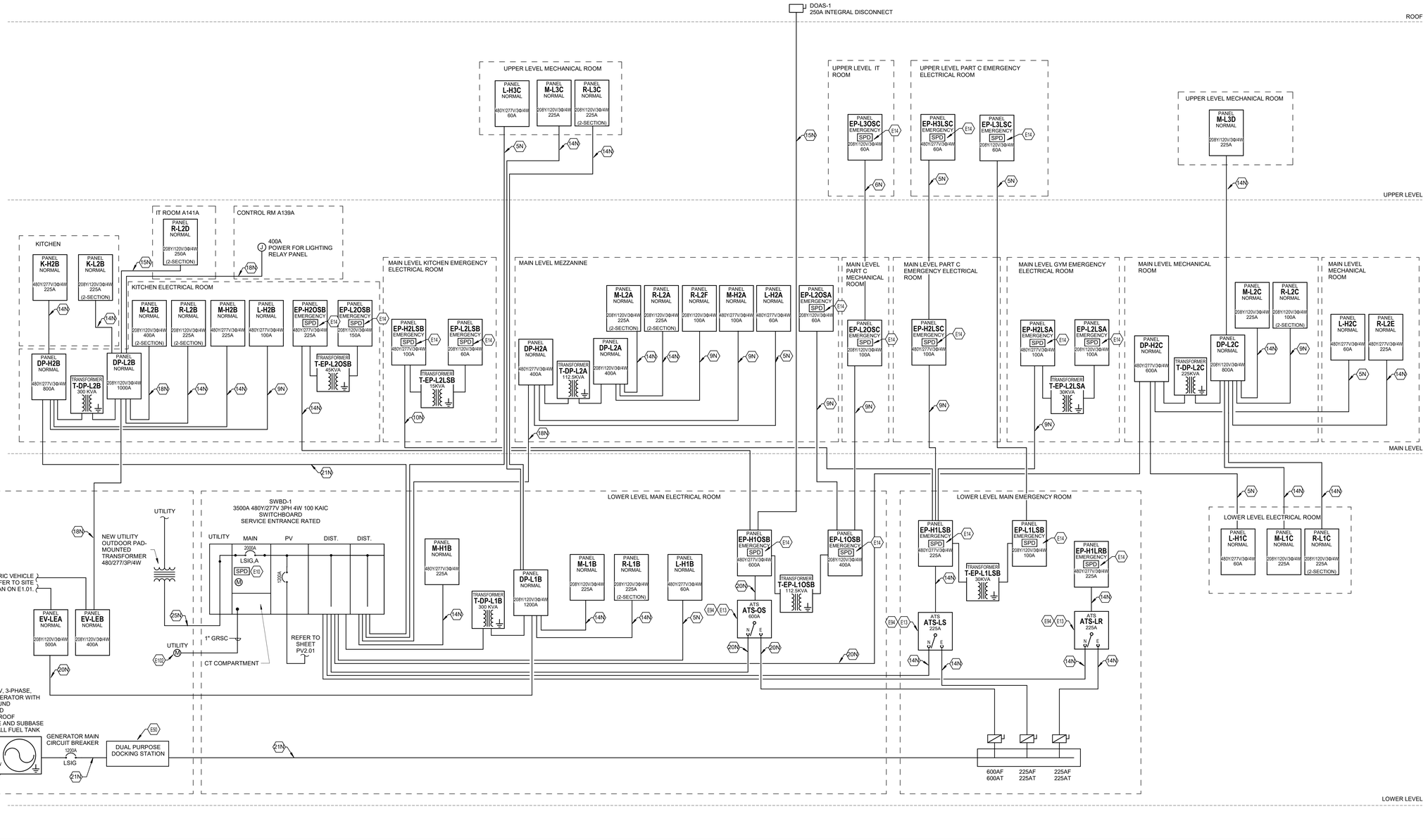
E13 ATS SHALL HAVE A 42 KAIC RATING.

E14 PROVIDE SURGE PROTECTION DEVICE (SPD) TYPE 2 TO UNIT FOR PANELBOARD. PROVIDE UNIT INTEGRAL TO PANELBOARD OR ALIGN COVERS AND INSTALL WITHOUT GAP BETWEEN SPD AND PANELBOARD.

E50 PROVIDE BOD: ESL POWER SYSTEMS DUALCONNECT DUAL PURPOSE DOCKING STATION 8212 SERIES OR APPROVED EQUIVALENT. DUAL PURPOSE DOCKING STATION SHALL BE RATED FOR 480V, 3-PHASE, 4W, 1200A. PROVIDED IN A NEMA 3R ENCLOSURE, AND UL LISTED. REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.

E94 PROVIDE GENERATOR CONTROLS WITH AN OVERLOAD SIGNAL OUTPUT TO THE AUTOMATIC TRANSFER SWITCHES (ATS). UPON DETECTION OF A GENERATOR OVERLOAD, THE CONTROL SYSTEM SHALL AUTOMATICALLY SHED NEC ARTICLE 702 LOADS FIRST FROM ATS-OS. IF THE OVERLOAD CONDITION PERSISTS, THE SYSTEM SHALL THEN SHED NEC ARTICLE 701 LOADS AS NECESSARY FROM ATS-LR, WHILE MAINTAINING ALL NEC ARTICLE 700 LOADS IN SERVICE FROM ATS-LS.

E102 UTILITY METER LOCATED EXTERNAL TO BUILDING. E.C SHALL EXTEND 1" GALVANIZED RIGID STEEL (GRSC) CONDUIT FROM CT COMPARTMENT WITHIN MAIN SWITCHGEAR TO EXTERIOR UTILITY METER.



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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL SINGLE LINE DIAGRAM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E4.01

5/19/2026 11:12:19 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. RECEPTACLES THAT ARE CONTROLLED BY AN AUTOMATIC MEANS SUCH AS OCCUPANCY SENSOR OR ENERGY MANAGEMENT SYSTEM SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3(E).

F. LOCATIONS OF ELECTRICAL CONNECTIONS AND LOCAL DISCONNECTS SHALL BE COORDINATED WITH MECHANICAL AND PLUMBING CONTRACTORS TO ENSURE ACCESS AND WORKING CLEARANCE IS MAINTAINED PER NEC. NOTIFY OTHER TRADES OF REQUIRED CLEARANCE AREAS TO AVOID ROUTING OF OTHER SYSTEMS IN THESE AREAS. DO NOT INSTALL ELECTRICAL EQUIPMENT OVER EQUIPMENT NAMEPLATES OR ACCESS PANELS OR THROUGH ACCESS/MAINTENANCE CLEARANCES OF EQUIPMENT BY OTHER TRADES.

G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES

(##)

E15 PROVIDE (3) 4" CONDUITS FROM PV DISCONNECT OUTSIDE MAIN ELECTRICAL ROOM TO PV PANEL LOCATED ON ROOF AT UPPER LEVEL. CONDUITS TO BE RUN BELOW GRADE FROM DISCONNECT AND STUB UP WITHIN BUILDING. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.

E19 PROVIDE NEW 1200A NEMA 3R RATED UTILITY ACCESSIBLE PV DISCONNECT SWITCH. REFER TO SINGLE LINE DIAGRAM AND PV RISER FOR ELECTRICAL CONNECTIONS AND FURTHER INFORMATION.

E27 CT CABINET CONNECTED TO UTILITY PV PRODUCTION METER. REFER TO PHOTOVOLTAIC SINGLE LINE DIAGRAM ON SHEET PV2.01 FOR FURTHER INFORMATION.

E35 PROVIDE EQUAGE METERING CT FOR INDICATED PANEL. METERING CT SHALL BE HOUSED IN THE METERING ENCLOSURE PROVIDED IN THE SAME ROOM AS METERED PANEL. REFER TO SUBMETERING SCHEDULES SHEET E7.13 FOR METERING SCHEDULE, RISER, AND DETAILS.

E76 PROVIDE METERING ENCLOSURE TO HOUSE EGAUGE MULTI-CIRCUIT METER CT'S. A MAXIMUM OF (9) CT'S MAY BE HOUSED IN 1 METERING ENCLOSURE. EXACT FINAL LOCATION OF METERING ENCLOSURE TO BE DETERMINED IN FIELD.

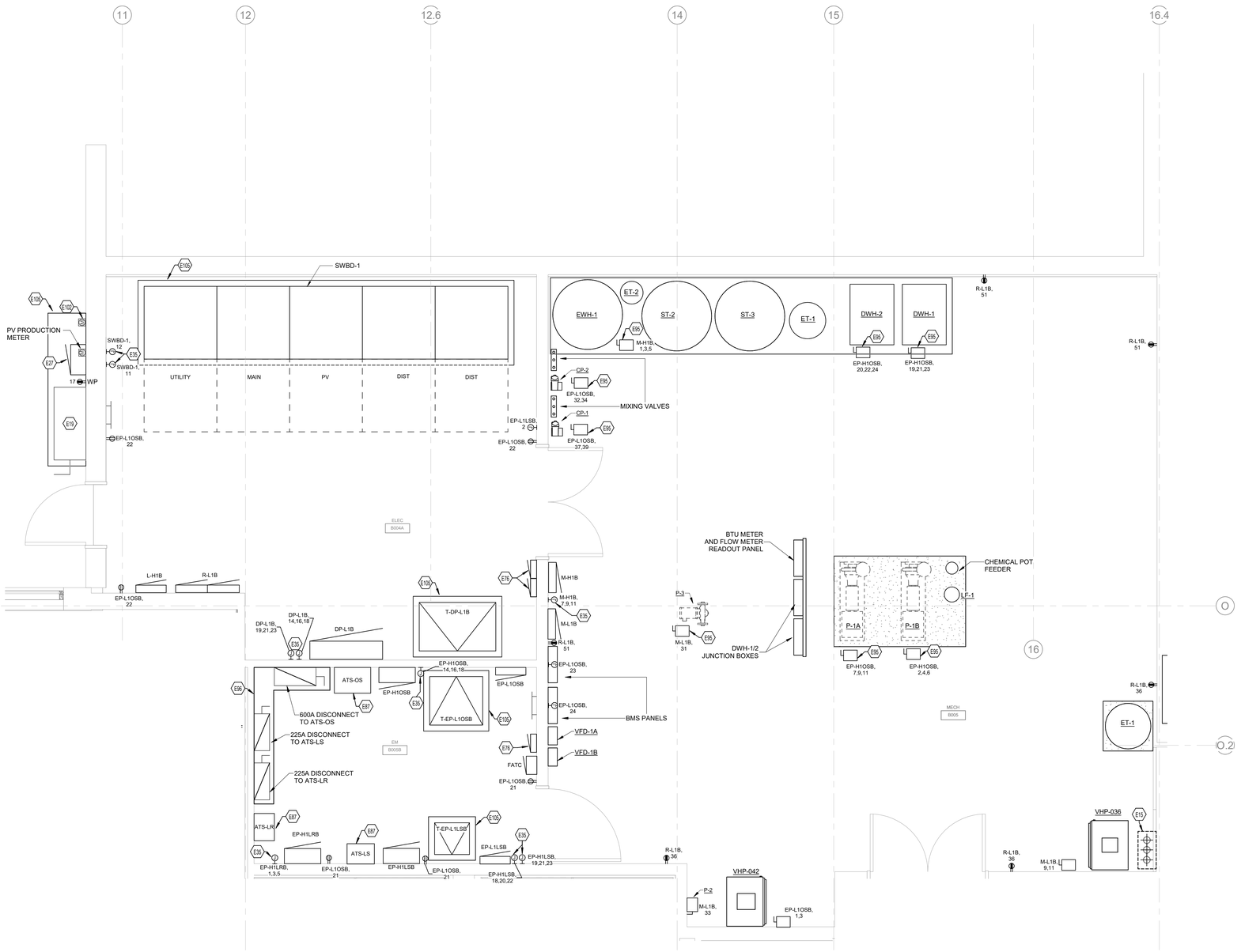
E87 PROVIDE START SIGNAL WIRE FROM ATS TO GENERATOR. WIRING SHALL BE MI CABLE. REFER TO ELECTRICAL DETAILS SHEET FOR GENERATOR INTERCONNECTION DIAGRAM. UTILIZE 1" BELOW-GRADE CONDUIT TO GENERATOR PROVIDED IN PHASE 1 DRAWINGS.

E95 E.C TO PROVIDE UNISTRUT FOR MOUNTING OF DISCONNECT SWITCHES WHERE NECESSARY. ENSURE PROPER CLEARANCES FOR ALL EQUIPMENT. EXACT FINAL LOCATION TO BE DETERMINED IN FIELD.

E96 PROVIDE WIRE TROUGH FOR EMERGENCY FEEDERS TO ATS'S. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.

E102 UTILITY METER LOCATED EXTERNAL TO BUILDING. E.C SHALL EXTEND 1" GALVANIZED RIGID STEEL (GRSC) CONDUIT FROM CT COMPARTMENT WITHIN MAIN SWITCHGEAR TO EXTERIOR UTILITY METER.

E105 CONCRETE PAD FOR EQUIPMENT SHALL BE A MINIMUM OF 4" A.F.F AND EXTEND PAST THE DIMENSIONS OF THE EQUIPMENT BY NOT MORE THAN 6". COORDINATE EXACT FINAL LOCATION AND SIZE WITH STRUCTURAL AND EQUIPMENT MANUFACTURER PRIOR TO STARTING WORK.



1 MAIN ELECTRICAL AND MECHANICAL ROOMS ENLARGED PLAN
3/8" = 1'-0"

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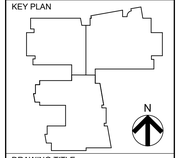
PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL ENLARGED PLANS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/8" = 1'-0"
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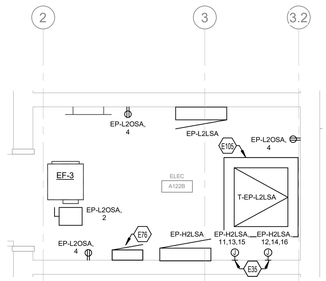
G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING. COORDINATE ALL FINAL LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

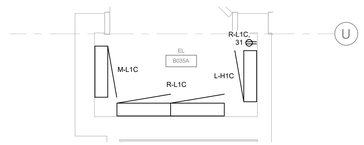
H. E.C SHALL COORDINATE WITH MECHANICAL CONTRACTOR TO MAINTAIN NECESSARY CLEARANCES AROUND ALL MECHANICAL EQUIPMENT FOR ALL ELECTRICAL INSTALLATIONS.

TAGGED NOTES

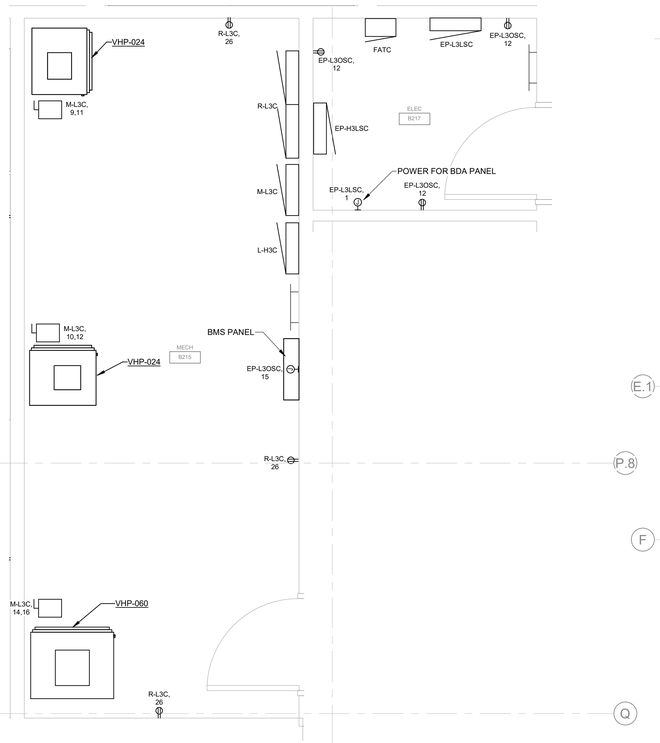
E1	TRANSFORMER T-EP-L2OSB TO BE MOUNTED ON RACK ABOVE TRANSFORMER T-DP-L2B. PROVIDE UNISTRUT AS REQUIRED. COORDINATE FINAL LOCATIONS PRIOR TO STARTING WORK.
E4	PANELS TO BE LOCATED IN SHARED MECHANICAL SPACE. E.C TO BE RESPONSIBLE FOR ENSURING 3' OF WORKING SPACE CLEARANCE IN FRONT OF PANELS IN ACCORDANCE WITH NEC REQUIREMENTS. COORDINATE EXACT FINAL LOCATIONS WITH MECHANICAL CONTRACTOR PRIOR TO INSTALLATION.
E35	PROVIDE EGUAGE METERING CT FOR INDICATED PANEL. METERING CT SHALL BE HOUSED IN THE METERING ENCLOSURE PROVIDED IN THE SAME ROOM AS METERED PANEL. REFER TO SUBMETERING SCHEDULES SHEET E7.13 FOR METERING SCHEDULE, RISER, AND DETAILS.
E76	PROVIDE METERING ENCLOSURE TO HOUSE EGAUGE MULTI-CIRCUIT METER CT'S. A MAXIMUM OF (9) CT'S MAY BE HOUSED IN 1 METERING ENCLOSURE. EXACT FINAL LOCATION OF METERING ENCLOSURE TO BE DETERMINED IN FIELD.
E103	PROVIDE (10) 20A-1P, (4) 20A-2P, AND (4) 20A-3P SPARE CIRCUITS FOR POTENTIAL FUTURE EQUIPMENT FOR GYM FROM PANEL R-L2F.
E105	CONCRETE PAD FOR EQUIPMENT SHALL BE A MINIMUM OF 4" A.F.F AND EXTEND PAST THE DIMENSIONS OF THE EQUIPMENT BY NOT MORE THAN 6". COORDINATE EXACT FINAL LOCATION AND SIZE WITH STRUCTURAL AND EQUIPMENT MANUFACTURER PRIOR TO STARTING WORK.



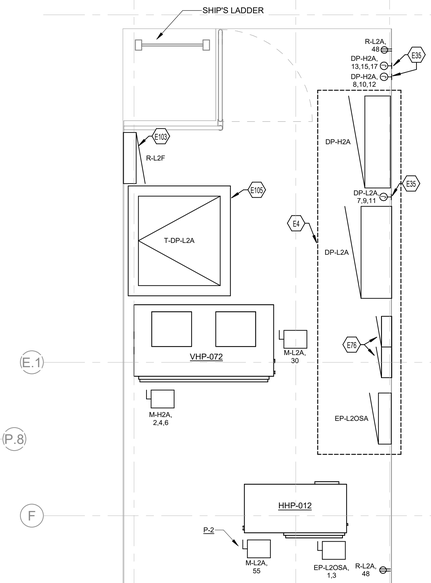
3 MAIN LEVEL ELECTRICAL ROOM - AREA A
1/2" = 1'-0"

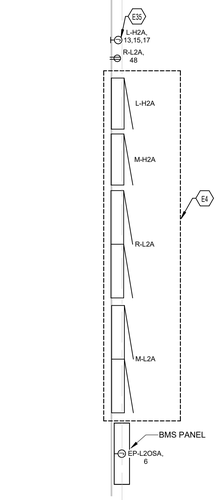


1 LOWER LEVEL ELECTRICAL ROOM - AREA C
1/2" = 1'-0"

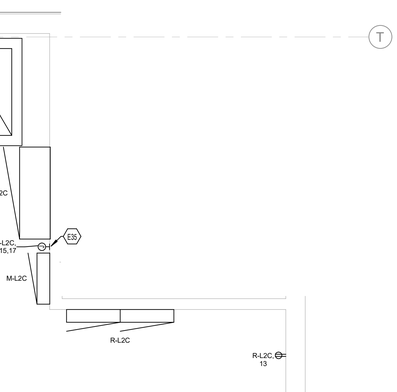


5 UPPER LEVEL ELECTRICAL/MECHANICAL ROOMS
1/2" = 1'-0"

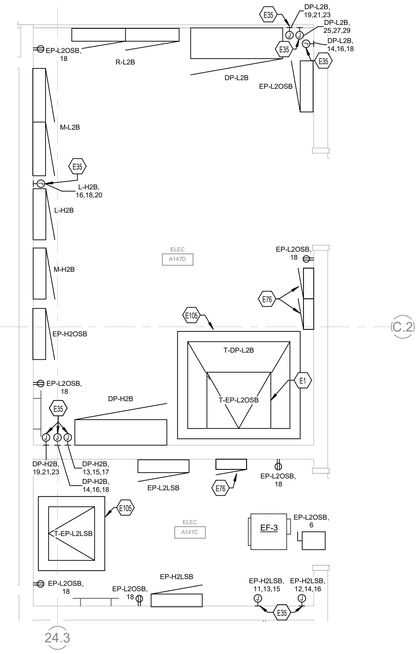




6 UPPER LEVEL MEZZANINE - AREA A
1/2" = 1'-0"



7 MAIN LEVEL MECHANICAL ROOM - AREA C
1/2" = 1'-0"



4 MAIN LEVEL KITCHEN ELECTRICAL ROOMS
1/2" = 1'-0"

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ROBERT A. MAHS, P.E. 47008, STATE OF CONNECTICUT, PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

ELECTRICAL ENLARGED PLANS

STATE PROJ. NO.	144-0108N
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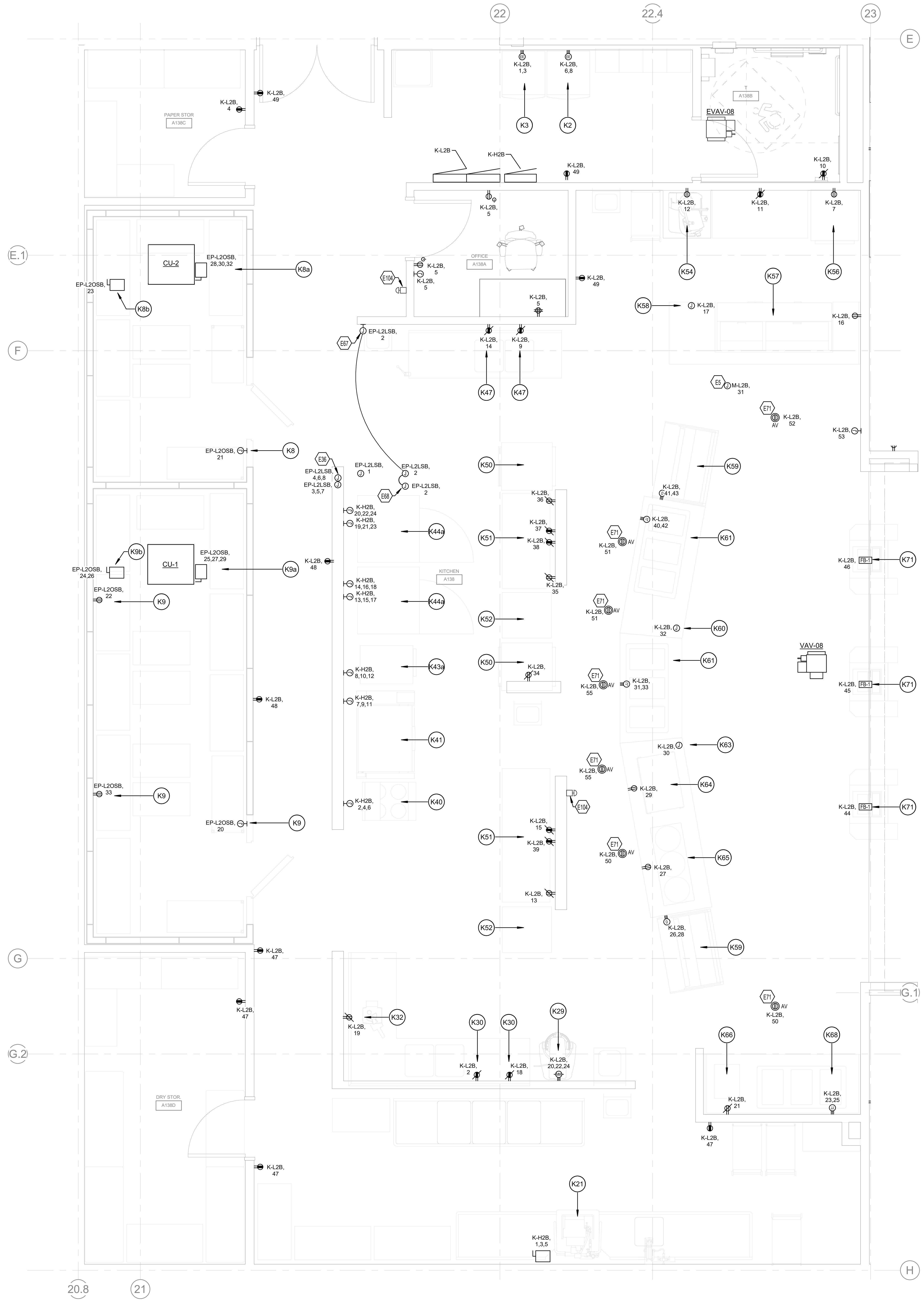

1 KITCHEN ENLARGED PLAN
3/8" = 1'-0"

TAGGED NOTES

E5	120V DEDICATED CIRCUIT TO VAV CONTROLS. COORDINATE INTERCONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. FURNISH AND INSTALL 1" CONDUIT(S) AS REQUIRED FROM POWER SOURCE TO VAV CONTROL PANEL. MAXIMUM OF 6 VAV UNITS CONNECTED TO EACH CIRCUIT.
E36	ELECTRICAL CONTRACTOR TO PROVIDE POWER TO KITCHEN HOOD. PROVIDE (2) 208V, 3-PHASE CIRCUITS WITH 3#12 & 1#12G FOR WIRING TO VFD QUICK CONNECTORS. COORDINATE EXACT FINAL LOCATION WITH KITCHEN ELECTRICAL CONTRACTOR (K.E.C) PRIOR TO STARTING WORK.
E67	PROVIDE DOUBLE GANG JUNCTION BOX FOR MOUNTING OF VENTILATOR CONTROL INTERFACE. POWER TO BE EXTENDED FROM VENTILATOR DEMAND CONTROL SYSTEM POWER. REFER TO FOODSERVICE PLANS FOR FURTHER INFORMATION. COORDINATE MOUNTING HEIGHTS AND EXACT FINAL LOCATIONS WITH KITCHEN ELECTRICAL CONTRACTOR PRIOR TO STARTING WORK.
E68	E.C TO EXTEND POWER TO VENTILATOR LIGHTS.
E71	PROVIDE CEILING RECEPTACLE FOR SOFFIT-MOUNTED DISPLAY. REFER TO AUDIO VISUAL PLANS FOR QUANTITY AND SIZE OF BACKBOXES REQUIRED, MOUNTING HEIGHTS, AND ADDITIONAL INFORMATION. COORDINATE EXACT FINAL LOCATION WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.
E104	PROVIDE EMERGENCY POWER OFF SWITCH FOR KITCHEN EQUIPMENT. COORDINATE EXACT LOCATION WITH KEC PRIOR TO STARTING WORK. EPO SHALL SHUNT MAIN BREAKER TO PANEL K-H2B FEEDING COOKING EQUIPMENT UNDER HOOD. COORDINATE INTERCONNECTIONS FOR FIRE SUPPRESSION SYSTEM WITH KEC PRIOR TO STARTING WORK.

GENERAL NOTES (POWER):

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ELECTRICAL - FOOD SERVICE EQUIPMENT SCHEDULE

EQUIP ID	DESCRIPTION	CONNECTION TYPE	VOLTAGE	POLES	EQUIPMENT RATING AMP	EQUIPMENT RATING POWER (kVA)	WIRE SIZE	PANEL	CIRCUIT #	REMARKS
K2	FRONT LOAD VENTLESS DRYER	NEMA L6-30	208	2	5.76	1.20 kVA	2#12 & 1#12G - 3/4"C	K-L2B	6,8	
K3	FRONT LOAD WASHER	NEMA L6-30	208	2	24.03	5.00 kVA	2#10 & 1#10G - 3/4"C	K-L2B	1,3	
K8	WALK IN COOLER LIGHTS/TEMP/ALARM	HARDWIRED	120	1	8.33	1.00 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	21	
K8a	COOLER CONDENSING UNIT	DISCONNECT	208	3	8	2.80 kVA	3#12 & 1#12G - 3/4"C	EP-L2OSB	28,30,32	B
K8b	COOLER EVAPORATOR COIL	DISCONNECT	120	1	1.8	0.21 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	23	B
K9	WALK IN FREEZER LIGHTS/TEMP/ALARM	HARDWIRED	120	1	16.6	2.00 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	20	
K9	DRAIN HEAT TRACE	DUPLEX RECEPTACLE	120	1	10	1.20 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	22	
K9	DRAIN HEAT TRACE	DUPLEX RECEPTACLE	120	1	10	1.20 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	33	
K9a	FREEZER CONDENSING UNIT	DISCONNECT	208	3	15.5	5.60 kVA	3#12 & 1#12G - 3/4"C	EP-L2OSB	25,27,29	B
K9b	FREEZER EVAPORATOR COIL	DISCONNECT	208	2	4.6	1.00 kVA	2#12 & 1#12G - 3/4"C	EP-L2OSB	24,26	B
K21	VENTLESS WAREWASHER	DISCONNECT	480	3	20	16.60 kVA	3#10 & 1#10G - 3/4"C	K-H2B	1,3,5	B, C
K29	FORTY-QUART MIXER	NEMA L15-20	208	3	5.6	2.00 kVA	3#12 & 1#12G - 3/4"C	K-L2B	20,22,24	
K30	PREP TABLE WITH SINKS	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	18	
K30	PREP TABLE WITH SINKS	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	2	
K32	FOOD PROCESSOR	DUPLEX RECEPTACLE	120	1	12	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	19	
K38a	VENTILATOR DEMAND CONTROL SYSTEM	HARDWIRED	120	1	4.1	0.50 kVA	2#12 & 1#12G - 3/4"C	EP-L2LSB	2	
K39	FIRE SUPRESSION SYSTEM	HARDWIRED	120	1	4.1	0.50 kVA	2#12 & 1#12G - 3/4"C	EP-L2LSB	1	
K40	RANGE WITH OVEN	HARDWIRED	480	3	16.3	13.50 kVA	3#12 & 1#12G - 3/4"C	K-H2B	2,4,6	
K41	FORTY GALLON TILT BRAISING PAN	HARDWIRED	480	3	33.6	27.90 kVA	3#8 & 1#10G - 3/4"C	K-H2B	7,9,11	
K43a	STEAMER - TEN PANS	HARDWIRED	480	3	39.8	33.00 kVA	3#8 & 1#10G - 3/4"C	K-H2B	8,10,12	
K44a	DOUBLE STACKED COMBI OVENS	HARDWIRED	480	3	28.9	24.00 kVA	3#10 & 1#10G - 3/4"C	K-H2B	13,15,17	
K44a	DOUBLE STACKED COMBI OVENS	HARDWIRED	480	3	28.9	24.00 kVA	3#10 & 1#10G - 3/4"C	K-H2B	14,16,18	
K44a	DOUBLE STACKED COMBI OVENS	HARDWIRED	480	3	28.9	24.00 kVA	3#10 & 1#10G - 3/4"C	K-H2B	19,21,23	
K44a	DOUBLE STACKED COMBI OVENS	HARDWIRED	480	3	28.9	24.00 kVA	3#10 & 1#10G - 3/4"C	K-H2B	20,22,24	
K47	PREP TABLE WITH SINKS	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	14	
K47	PREP TABLE WITH SINKS	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	9	
K50	REFRIGERATOR, PASS THRU	DUPLEX RECEPTACLE	120	1	5.5	0.66 kVA	2#12 & 1#12G - 3/4"C	K-L2B	36	
K50	REFRIGERATOR, PASS THRU	DUPLEX RECEPTACLE	120	1	5.5	0.66 kVA	2#12 & 1#12G - 3/4"C	K-L2B	34	
K51	MOBILE WORK TABLE	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	37	
K51	MOBILE WORK TABLE	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	38	
K51	MOBILE WORK TABLE	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	15	
K51	MOBILE WORK TABLE	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	39	
K52	HEATED HOLDING CABINET	DUPLEX RECEPTACLE	120	1	13.8	1.65 kVA	2#12 & 1#12G - 3/4"C	K-L2B	35	
K52	HEATED HOLDING CABINET	DUPLEX RECEPTACLE	120	1	13.8	1.65 kVA	2#12 & 1#12G - 3/4"C	K-L2B	13	
K54	AUTOMATIC SLICER	DUPLEX RECEPTACLE	120	1	5.6	0.67 kVA	2#12 & 1#12G - 3/4"C	K-L2B	12	
K56	REFRIGERATOR, REACH IN	DUPLEX RECEPTACLE	120	1	5.9	0.72 kVA	2#12 & 1#12G - 3/4"C	K-L2B	7	
K57	REFRIGERATED SANDWICH TABLE	DUPLEX RECEPTACLE	120	1	6	0.72 kVA	2#12 & 1#12G - 3/4"C	K-L2B	16	
K58	SERVING COUNTER	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	17	A
K59	REFRIGERATED DISPLAY CASE	NEMA 6-20	208	2	16	3.30 kVA	2#12 & 1#12G - 3/4"C	K-L2B	41,43	
K59	REFRIGERATED DISPLAY CASE	NEMA 6-20	208	2	16	3.30 kVA	2#12 & 1#12G - 3/4"C	K-L2B	26,28	
K60	SERVING COUNTER	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	32	A
K61	DROP IN FOOD WELLS	NEMA L14-20	208	2	12.3	2.50 kVA	2#12 & 1#12G - 3/4"C	K-L2B	31,33	
K61	DROP IN FOOD WELLS	NEMA L14-20	208	2	12.3	2.50 kVA	2#12 & 1#12G - 3/4"C	K-L2B	40,42	
K63	SERVING COUNTER	DUPLEX RECEPTACLE	120	1	1.5	0.18 kVA	2#12 & 1#12G - 3/4"C	K-L2B	30	A
K64	HEATED DISPLAY MERCHANDISER	NEMA 5-20	120	1	15	1.80 kVA	2#12 & 1#12G - 3/4"C	K-L2B	29	
K65	FOOD MERCHANDISER	DUPLEX RECEPTACLE	120	1	5.5	0.66 kVA	2#12 & 1#12G - 3/4"C	K-L2B	27	
K66	CONVEYOR TOASTER	DUPLEX RECEPTACLE	120	1	14.9	1.80 kVA	2#12 & 1#12G - 3/4"C	K-L2B	21	
K68	DROP IN FOOD WELLS	NEMA L14-20	208	2	12.3	2.60 kVA	2#12 & 1#12G - 3/4"C	K-L2B	23,25	
K71	CASHIER TERMINAL	FLOORBOX	120	1	4.1	0.50 kVA	2#12 & 1#12G - 3/4"C	K-L2B	44	
K71	CASHIER TERMINAL	FLOORBOX	120	1	4.1	0.50 kVA	2#12 & 1#12G - 3/4"C	K-L2B	45	
K71	CASHIER TERMINAL	FLOORBOX	120	1	4.1	0.50 kVA	2#12 & 1#12G - 3/4"C	K-L2B	46	

REMARKS:

ITEMS CORRESPOND TO NUMBERING OF FOODSERVICE (FS) EQUIPMENT SCHEDULE. REFER TO FS DRAWINGS, DETAILS, AND ELEVATIONS, NOTES & EQUIPMENT SCHEDULE FOR QUANTITY, LOCATION, MOUNTING HEIGHT & POWER REQUIREMENTS OF ALL EQUIPMENT. COORDINATE EXACT FINAL LOCATIONS WITH KEC PRIOR TO BEGINNING CONSTRUCTION. REFER TO E0.01 FOR SPECIAL-PURPOSE RECEPTACLE SCHEDULE.

A. DUPLEX RECEPTACLE TO BE PROVIDED BY KEC. ELECTRICAL CONTRACTOR SHALL PROVIDE HARDWIRED CONNECTION TO DUPLEX RECEPTACLE THAT IS PART OF TABLE. PROVIDE STUB-UP AT TABLE AND CONNECT TO DUPLEX RECEPTACLE.

B. PROVIDE WIRING FROM DISCONNECT SWITCH TO HARDWIRED CONNECTION TO EQUIPMENT.

C. PROVIDE NEMA-4 RATED ENCLOSURE FOR DISCONNECT SWITCH.

GENERAL NOTES:

1. REFER TO SPECIAL PURPOSE RECEPTACLE SCHEDULE ON DRAWING E0.01 FOR ALL NEMA RECEPTACLES.
2. PROVIDE BREAKER LOCK-OUT PROVISIONS IN PANELS FOR BREAKERS THAT SERVE HARDWIRED CONNECTIONS.
3. KITCHEN PLANS ARE BASED UPON COORDINATION WITH THE KITCHEN DESIGN CONSULTANT'S DRAWINGS. ALL ROUGH-INS AND FINAL CONNECTIONS SHALL BE VERIFIED WITH KITCHEN EQUIPMENT SHOP DRAWINGS AND ARCHITECTURAL PLANS AND ELEVATIONS PRIOR TO CONSTRUCTION. COORDINATE ALL MOUNTING HEIGHTS WITH FOODSERVICE PLANS.
4. FOR ALL CIRCUITS SERVING RECEPTACLES AND OUTLETS OR GFCI EQUIPMENT IN KITCHEN AND SERVING AREAS, PROVIDE GFCI TYPE CIRCUIT BREAKERS FOR THOSE CIRCUITS. FOR ALL RECEPTACLES THAT ARE CONNECTED TO GFCI CIRCUIT BREAKERS, PROVIDE PERMANENT LABELS ON THE RECEPTACLE COVERPLATE INDICATING GFCI PROTECTION.
5. PROVIDE #302 STAINLESS STEEL COVERPLATES ON ALL OUTLETS LOCATED ON A WALL WITH STAINLESS STEEL COVERINGS. VERIFY LOCATIONS OF THESE STAINLESS STEEL WALLS WITH THE KITCHEN VENDOR DRAWINGS / SHOP DRAWINGS.
6. VERIFY EXACT OUTLET NEMA CONFIGURATIONS WITH EQUIPMENT SUPPLIER PRIOR TO CONSTRUCTION.
7. REFER TO FOODSERVICE VENDOR'S SHEETS FOR ALL ADDITIONAL WIRING REQUIREMENTS BETWEEN EQUIPMENT.

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ROBERT A. HANS PE 47889

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

N

DRAWING TITLE

ELECTRICAL ENLARGED PLANS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E5.03

5/18/2026 11:12:25 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (POWER):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. ALL RECEPTACLES WITH STUDENT ACCESS SHALL BE TAMPER-PROOF

C. CONTRACTOR SHALL FOLLOW BRANCH CIRCUITING LAY-OUT, AS INDICATED ON THE FLOOR PLANS, WITH A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN. EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH A DEDICATED NEUTRAL CONDUCTOR. DEDICATED NEUTRAL CONDUCTORS SHALL BE CONSIDERED CURRENT CARRYING. IF ADDITIONAL CONDUCTORS ARE RAN IN THE SAME CONDUIT WITH THOSE INDICATED, CONTRACTOR SHALL DERATE ALL CURRENT CARRYING CONDUCTORS PER NEC 310.15(B)(3), AND UPSIZE CONDUIT AS REQUIRED PER NEC 300.17 AND ANNEX C. MULTIWIRE BRANCH CIRCUITS AS DEFINED IN NEC 100 / 210.4 (CIRCUITS SHARING A COMMON NEUTRAL CONDUCTOR) SHALL NOT BE PERMITTED.

D. IDENTIFY THE PANEL AND CIRCUIT NUMBER FOR ALL RECEPTACLES, SWITCHES, ETC. IN AREA OF CONSTRUCTION. PROVIDE CLEAR ADHESIVE LABELS WITH BLACK LETTERING. MARK INSIDES OF ALL DEVICE BOXES WITH PANEL AND CIRCUIT NUMBER.

E. RECEPTACLES THAT ARE CONTROLLED BY AN AUTOMATIC MEANS SUCH AS OCCUPANCY SENSOR OR ENERGY MANAGEMENT SYSTEM SHALL BE MARKED IN ACCORDANCE WITH NEC 406.3(E).

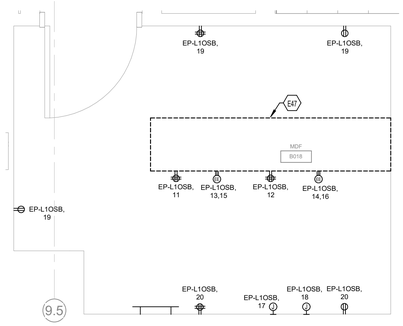
F. LOCATIONS OF ELECTRICAL CONNECTIONS AND LOCAL DISCONNECTS SHALL BE COORDINATED WITH MECHANICAL AND PLUMBING CONTRACTORS TO ENSURE ACCESS AND WORKING CLEARANCE IS MAINTAINED PER NEC. NOTIFY OTHER TRADES OF REQUIRED CLEARANCE AREAS TO AVOID ROUTING OF OTHER SYSTEMS IN THESE AREAS. DO NOT INSTALL ELECTRICAL EQUIPMENT OVER EQUIPMENT NAMEPLATES OR ACCESS PANELS OR THROUGH ACCESS/MAINTENANCE CLEARANCES OF EQUIPMENT BY OTHER TRADES.

G. REFER TO TELECOM DRAWINGS. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL BACKBOXES, CONDUITS, AND ALL NECESSARY ACCESSORIES TO EXTEND LOW-VOLTAGE CABLES TO ABOVE-CEILING LOCATIONS WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.

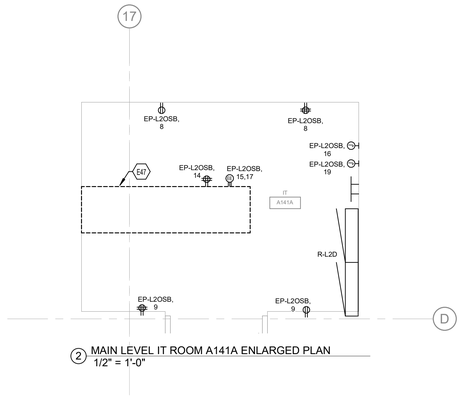
TAGGED NOTES

##

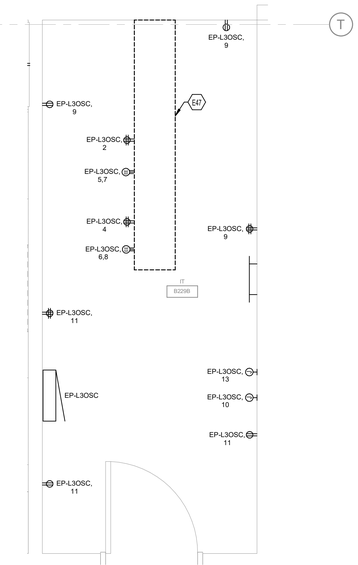
E47 APPROXIMATE LOCATION OF DATA RACKS. WHERE INDICATED, PROJECT CONTRACTOR SHALL COORDINATE WITH TELECOM CONTRACTOR TO MAINTAIN NECESSARY ELECTRICAL DESIGN CLEARANCES AND MILLWORK CONTRACT FOR ALL INSTALLATION WITH TELECOM CONTRACTOR PRIOR TO STARTING WORK.



1 LOWER LEVEL MDF ENLARGED PLAN
1/2" = 1'-0"



2 MAIN LEVEL IT ROOM A141A ENLARGED PLAN
1/2" = 1'-0"



3 UPPER LEVEL IT ROOM B229B ENLARGED PLAN
1/2" = 1'-0"

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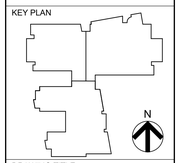
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL ENLARGED PLANS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/2" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E5.04

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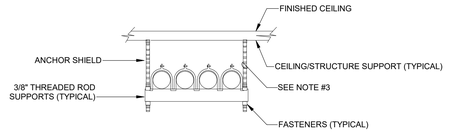


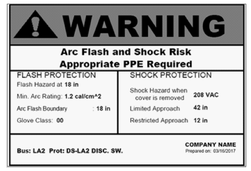
CONDUIT RACK "C-C"

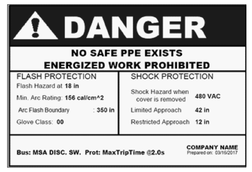
NOTE:

1. E.C. SHALL COORDINATE INSTALLATION AND ROUTING IN FIELD.
2. E.C. SHALL VERIFY EXACT LENGTH OF THREADED ROD IN FIELD WITH BUILDING CONDITIONS.
3. E.C. SHALL PROVIDE CHANNEL HOLE UNISTRUT SIMILAR TO B-LINE TYPE SH WITH ALL NECESSARY NUTS, RODS, SCREWS, CLAMPS, BOLTS ETC. FOR A COMPLETE INSTALLATION.

P0-004 - REV 09/19/2023

CONDUIT RACK DETAIL — NTS



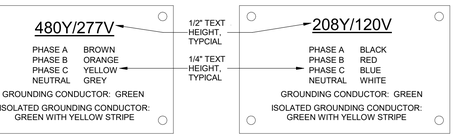


ARC FLASH LABEL NOTES:

1. ARC FLASH WARNING LABELS SHALL BE PROVIDED FOR EACH TRANSFORMER. DISCONNECT SWITCH AND SWITCHBOARD ETC. INCLUDED IN THIS WORK REFER TO SPECIFICATION COORDINATED POWER SYSTEM PROTECTION FOR FURTHER REQUIREMENTS.
2. LABELS SHALL BE 4INCH X 6INCH THERMAL TRANSFER TYPE OF HIGH ADHESIVE POLYESTER FOR EACH WORK LOCATION ANALYZED AND SHALL BE MACHINE PRINTED WITH NO FIELD MARKING. THESE LABELS ARE SHOWN AS EXAMPLE ONLY AND DO NOT REFLECT THE ACTUAL DATA FOR THIS PROJECT.
3. THE LABEL SHALL HAVE AN ORANGE HEADER WITH THE WORDING "WARNING SHOCK & ARC FLASH HAZARD." OR RED HEADER WITH THE WORDING "DANGER" IF CAL/CM2/ IS>40 .

E-005 - REV 07/20/22

ARC FLASH LABELS — NTS

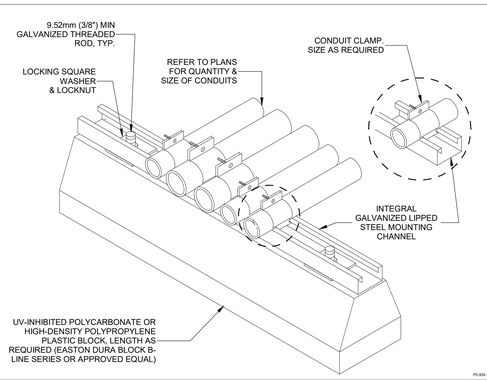


NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. WITH CONDUCTORS LARGER THAN NO. 6AWG, WRAP TWO FULL TURNS OF 1" WIDE COLORED TAPE AT TWO LOCATIONS (MIN OF 12" APART).
3. SECURE NAMEPLATE TO SURFACES WITH (2) FLAT HEAD BRASS SCREWS.

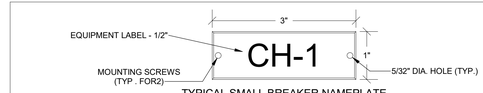
E-004 - REV 07/19/17

CONDUCTOR COLOR CODING NAMEPLATE — NTS

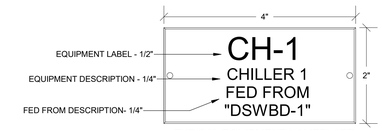


P0-009 - REV 01/01/17

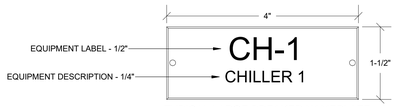
ROOF CONDUIT SUPPORT DETAIL — NTS



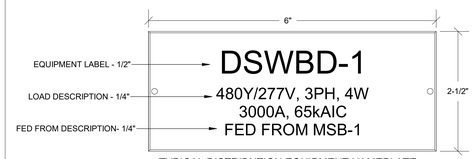
TYPICAL SMALL BREAKER NAMEPLATE
SCALE: N.T.S.
TYPICAL AT CB ON DISTRIBUTION SWITCHBOARDS, PANEL, ETC.



TYPICAL EQUIPMENT NAMEPLATE
SCALE: N.T.S.
TYPICAL AT EQUIPMENT, VARIABLE SPEED DRIVES, DISCONNECTS, ETC.



TYPICAL LARGE BREAKER NAMEPLATE
SCALE: N.T.S.
TYPICAL AT CB ON DISTRIBUTION SWITCHBOARDS, PANEL, ETC.



TYPICAL DISTRIBUTION EQUIPMENT NAMEPLATE
SCALE: N.T.S.
TYPICAL FOR EACH SECTION OF SWITCHBOARD, DISTRIBUTION PANELBOARDS, PANELBOARDS, ETC.

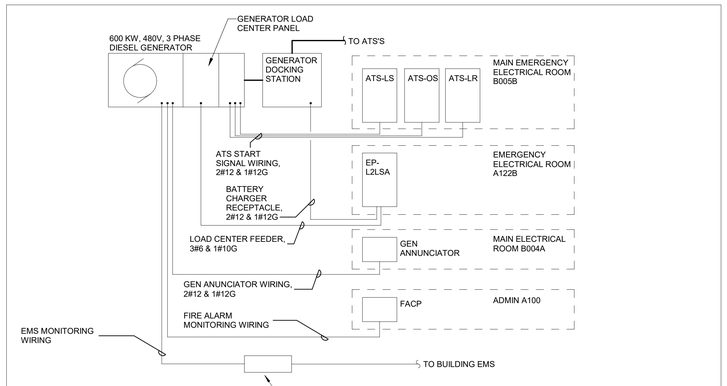
NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITIONAL NAMEPLATE REQUIREMENTS.
2. REFER TO NAMEPLATE COLOR CODE TABLE FOR LETTERING AND FACE COLORS.
3. SECURE NAMEPLATE TO SURFACES WITH (2) FLAT HEAD BRASS SCREWS.

NAMEPLATE COLOR CODES		
USE	BACKGROUND	LETTERING
NORMAL	WHITE	BLACK
LIFE SAFETY	RED	WHITE
STANDBY	WHITE	RED

E-001 - REV 09/26/23

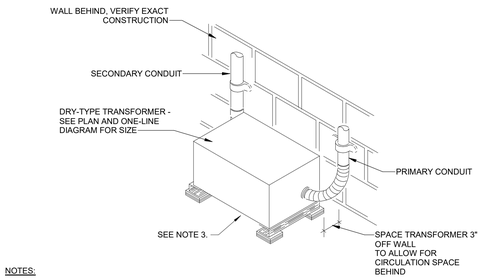
TYPICAL NAMEPLATE DETAIL — NTS



NOTES:

1. GENERATOR BASIS OF DESIGN: CAT C18 600 KW DIESEL STANDBY GENERATOR.
2. LOCATE AUXILIARY WIRING (ATS START SIGNAL WIRING, LOAD CENTER FEEDER, AND ANUNCIATOR WIRING) IN 1" BELOW-GRADE CONDUITS. REFER TO SITE ENABLING PACKAGE FOR FURTHER INFORMATION. COORDINATE WITH GENERATOR MANUFACTURER FOR STUB-UP LOCATIONS OF MAIN POWER & AUXILIARY FEEDERS.
3. ATS START SIGNAL WIRING SHALL BE MI CABLE.
4. THE CONTROLLER SHALL MONITOR THE GENERATOR. GENERATOR STATUS AND GENERAL FAULT SHALL BE HARDWIRED POINTS, AND THE BAS SHALL MONITOR ALL OTHER POINTS VIA BACNET INTERFACE. THE ATC SHALL CARRY SCOPE TO MAP UP TO (25) SERIAL INTERFACE POINTS (BACNET MSTP OR IP OR MODBUS, TO BE FINALIZED WITH GENERATOR SELECTION) WITH THE ATC TO PROVIDE ANY NECESSARY GATEWAY. ATC SHALL COORDINATE WITH THE GENERATOR MANUFACTURER FOR FULL POINTS LIST REQUIRED AND MAPPED POINTS TO BE REVIEWED BY ENGINEER AND OWNER DURING SUBMITTAL PHASE.

GENERATOR INTERCONNECTION DIAGRAM — NTS

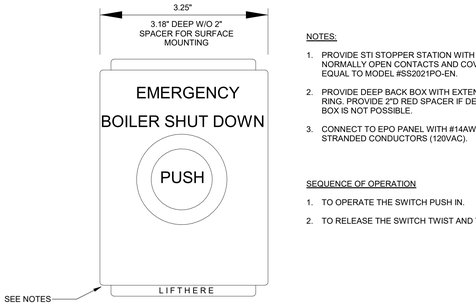


NOTES:

1. THE FINAL 12" TO 18" OF RACEWAY CONNECTION TO BOTH PRIMARY AND SECONDARY SIDES SHALL BE "SEALITE" TYPE UA FLEXIBLE CONDUIT OR EQUAL, FOR VIBRATION ISOLATION.
2. ALL FLOOR MOUNTED TRANSFORMERS 75KVA AND HIGHER SHALL BE PROVIDED WITH A 4" HIGH REINFORCED CONCRETE PAD.
3. PROVIDE 4"X4"X3/4" (NOMINAL) THICK VIBRATION ISOLATION PADS WITH GALVANIZED STEEL PLATE BONDED IN BETWEEN MULTIPLE NRC PADS (OVERALL 2" THICK), FOUR TIER TRANSFORMER MANUFACTURED BY KORFUND CO OR APPROVED EQUAL.

M0-026 - REV 09/08/22

FLOOR MOUNTED TRANSFORMER DETAIL — NTS



NOTES:

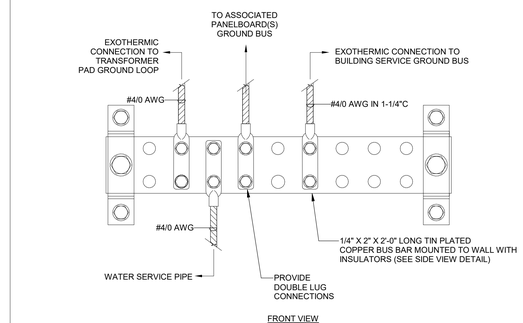
1. PROVIDE STI STOPPER STATION WITH 2 - 120V, NORMALLY OPEN CONTACTS AND COVER EQUAL TO MODEL #SS2021PO-EN.
2. PROVIDE DEEP BACK BOX WITH EXTENSION RING. PROVIDE 2"D RED SPACER IF DEEP BACK BOX IS NOT POSSIBLE.
3. CONNECT TO EPO PANEL WITH #14AWG STRANDED CONDUCTORS (120VAC).

SEQUENCE OF OPERATION

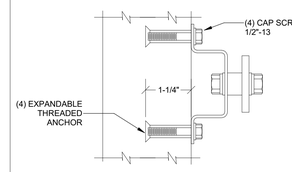
1. TO OPERATE THE SWITCH PUSH IN.
2. TO RELEASE THE SWITCH TWIST AND TURN.

P0-025 - REV 09/11/23

TYPICAL REMOTE EPO STATION — NTS



FRONT VIEW



SIDE VIEW

NOTES:

1. BUS BAR ASSEMBLY SHALL BE EQUAL TO ERICO #TGB-A25L14P.
2. BOND PANELBOARD(S) WHICH SERVICES EQUIPMENT WITHIN ROOM.
3. CONDUCTORS ILLUSTRATED REPRESENT MINIMUM SIZES. CONDUCTORS SHALL BE INCREASED AS REQUIRED TO MATCH SOURCE PANELBOARDS' FEEDER GROUNDING CONDUCTOR SIZE.

G0-001 - REV 01/01/16

TYPICAL GROUND BUS BAR INSTALLATION DETAIL — NTS

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TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
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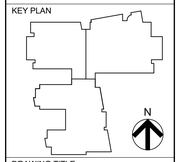
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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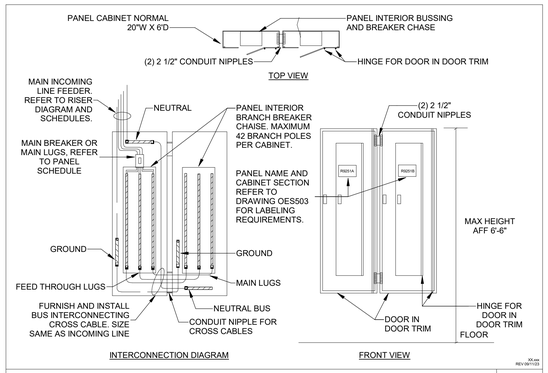
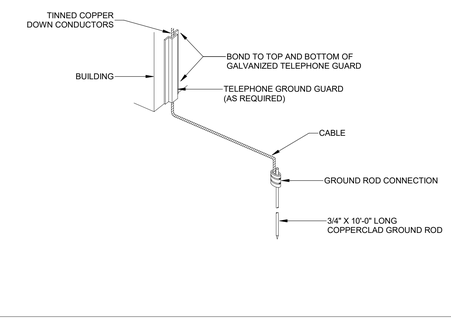
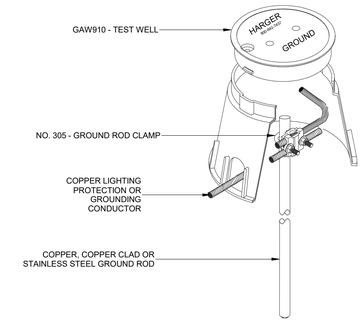
5/18/2026 11:12:28 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt



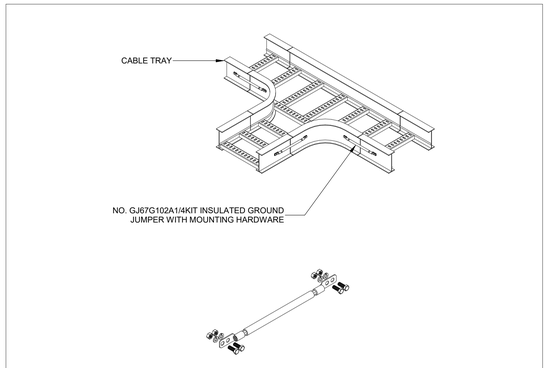
TYPICAL MULTIPLE SELECTION PANELBOARD DETAIL | NTS



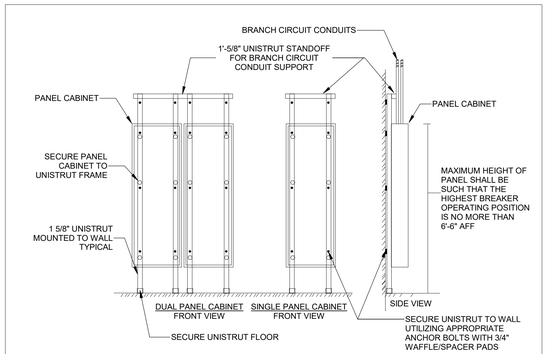
GROUND ROD DETAIL | NTS



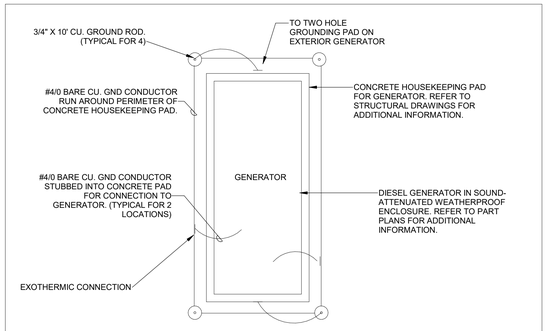
GROUND ROD DETAIL | NTS



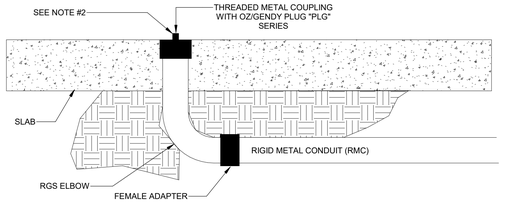
GROUND JUMPER | NTS



TYPICAL DISTRIBUTION AND BRANCH
CIRCUIT PANELBOARD MOUNTING DETAIL | NTS



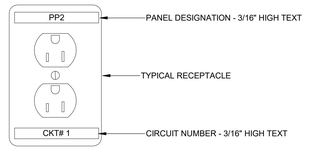
TYPICAL GENERATOR GROUNDING DETAIL | NTS



NOTES:

1. COORDINATE VAPOR BARRIER REQUIREMENTS WITH STRUCTURAL DRAWINGS.
2. CONDUIT ENTERING FROM THE EXTERIOR OR BELOW GRADE SHALL HAVE WATERTIGHT FITTINGS ON THE OUTSIDE AND INSIDE OF THE CONDUIT PER NEC REQUIREMENTS.

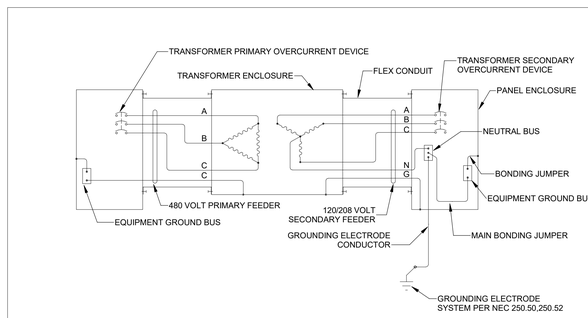
CONDUIT STUB -UP DETAIL | NTS



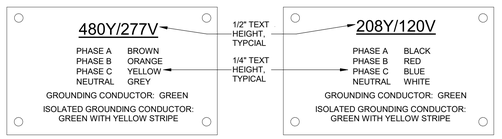
NOTE:

1. THE GROUNDING TERMINAL OF EACH RECEPTACLE SHALL BE CONNECTED TO AND INSULATED COPPER EQUIPMENT GROUNDING CONDUCTOR SIZED AS REQUIRED PER NEC.
2. ALL FACEPLATES SHALL BE STAINLESS STEEL UNLESS OTHERWISE NOTED WITH THE PANEL NAME AND CIRCUIT NUMBER. THE PANEL NAME SHALL BE LABELED IN 3/16" HIGH LETTERING 1/4" ABOVE THE WIRING DEVICE AND THE CIRCUIT NUMBER IN 3/16" HIGH LETTERING 1/4" BELOW THE WIRING DEVICE USING P-TOUCH CLEAR LABELS OR APPROVED EQUAL.
3. RECEPTACLE BACK-BOXES SHALL ALSO BE MARKED WITH THE CIRCUIT NUMBER IN THE EVENT THAT THE FACEPLATE IS REMOVED AND LOST.

TYPICAL DEVICE PLATE DETAIL | NTS



DRY TYPE TRANSFORMER SCHEDULE AND CONNECTION DIAGRAM | NTS



NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. WITH CONDUCTORS LARGER THAN NO. 6AWG, WRAP TWO FULL TURNS OF 1" WIDE COLORED TAPE AT TWO LOCATIONS (MIN OF 12" APART).
3. SECURE NAMEPLATE TO SURFACES WITH (2) FLAT HEAD BRASS SCREWS.

CONDUCTOR COLOR CODING NAMEPLATE | NTS

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PROFESSIONAL SEAL

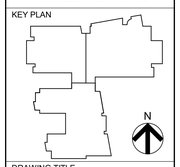


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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APPROVED BY	MA

ISSUE DATES

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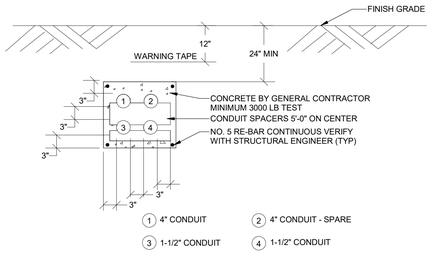


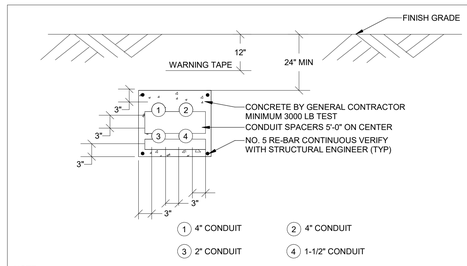
NOTE:

1. STEEL REINFORCING RODS SHALL BE INTERFACED WITH BUILDING FOUNDATION AND MANHOLE WALLS TO MINIMIZE SHEARING
2. CONDUITS SHALL BE RMC (RIGID METAL CONDUIT). PROVIDE GALVANIZED RIGID STEEL FOR LONG RADIUS ELBOWS.
3. REFER TO SINGLE LINE DIAGRAM FOR CONDUCTOR SIZES AND ADDITIONAL INFORMATION.
4. SPARE EMPTY CONDUITS SHALL BE PROVIDED WITH PULLSTRINGS AND CAPPED (PLUGGED)
5. THE CONTRACTOR SHALL FIELD COORDINATE EXACT FINAL LOCATIONS OF AREAWAY AND BUILDING PENETRATIONS WITH THE OWNER AND ENGINEER.
6. THERE SHALL BE A MINIMUM OF 12" SEPARATION FOR UTILITY CROSSINGS AT APPROXIMATELY RIGHT ANGLES.
7. THERE SHALL BE A MINIMUM OF 12" MAINTAINED BETWEEN PARALLEL UTILITIES AND THE ELECTRICAL CONDUITS WITH APPROPRIATE RED MARKER TAPE 12" ABOVE.

PS 006 - REV 01/01/16

DUCTBANK SECTION "FF" DETAIL	NTS

1 DUCTBANK SECTION "AA"
1/4" = 1'-0"



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PS 006 - REV 01/01/16

DUCTBANK SECTION "FF" DETAIL	NTS

2 DUCTBANK SECTION "BB"
1/4" = 1'-0"

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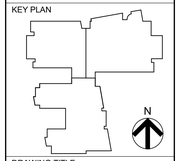
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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APPROVED BY	MA

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GENERAL NOTES:

ALL WIRING, INCLUDING CONTROL & NETWORK WIRING/CABLINGNOT PROVIDED BY SIGNIFY UNLESS NOTED OTHERWISE. ENCLOSURES for CONTROLLERS/INTERFACES NOT by SIGNIFY. (Optional Separate or Assembled Enclosure Available for Additonal Cost).

1) ONE-LINE DIAGRAMS INDICATE THE REQUIRED GROUPING OF WIRES, NOT THE NUMBER OR SIZE OF CONDUITS. ONE-LINE SYMBOLS ARE FOR REFERENCE ONLY AND MAY NOT REFLECT INSTALLED CONFIGURATION.

2) THESE DRAWINGS MAY ILLUSTRATE DEVICE MOUNTING LOCATIONS. THE LOCATIONS SHOWN SHOULD BE ADJUSTED IN THE FIELD BASED ON AESTHETICS/CLIENT DIRECTION, SITE CONDITIONS, WIRING METHODS, AND APPLICABLE CODES AND STANDARDS.

3) THIS SYSTEM SHOULD BE REVIEWED AND INSTALLED BY A QUALIFIED PERSON/ENTITY.

4) INSTALL PER EQUIPMENT LABELING AND INSTALLATION INSTRUCTIONS, INCLUDING TORQUE INFORMATION AND TEMPERATURE & HUMIDITY REQUIREMENTS PER DATA & INSTALLATION SHEETS. UNLESS RATED OTHERWISE, SIGNIFY EQUIPMENT MUST BE INSTALLED, MAINTAINED, AND OPERATED IN "OFFICE CLEAN" INDOOR DRY LOCATIONS ONLY.

5) WIRING & USE OF JUNCTION BOXES, RACEWAYS, ETC., SHALL CONFORM TO NATIONAL & LOCAL ELECTRICAL CODES, INCLUDING PROVISION OF EQUIPMENT GROUNDING AS REQUIRED, AND INCLUDING BUT NOT LIMITED TO NEC® 110.3(B) & 110.26.

6) POWER CONDUCTORS SHALL BE SIZED PER THE NEC ® AMPACITY TABLES (ARTICLE 310), INCLUDING ADJUSTMENT FACTOR AND NEUTRAL CONDUCTOR REQUIREMENTS - FEED & BRANCH NEUTRAL CONDUCTORS MUST BE COUNTED AS CURRENT CARRYING CONDUCTORS. RUN SEPARATE NEUTRAL CONDUCTORS FOR EACH LOAD CIRCUIT .

7) ALL CONTROL WIRING SHOULD* BE RUN IN METAL CONDUIT OR EMT AND MUST NOT SHARE THE SAME RACEWAY OR CONDUIT WITH POWER, AUDIO, OR VIDEO CONDUCTORS. SPARES RECOMMENDED. CONTRACTOR RESPONSIBLE FOR TERMINATIONS. NO SPLICES PERMITTED.
* - Preferred, but Not Required

8) SIGNIFY IS NOT RESPONSIBLE FOR DAMAGE TO EQUIPMENT CAUSED BY PAINT, DUST, SOLVENTS, OR CLEANING SUPPLIES.

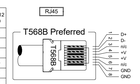
1. 120 or 277 VAC SWITCHED OUTPUT (NOT by Signify)
2. CONTROLLER INPUT POWER : 1□ 2 WIRE w/ GND 120 VAC 60 Hz (NOT by Signify)
2a. CONTROLLER INPUT POWER : 1□ 2 WIRE w/ GND 120 or 277 VAC 60 Hz (NOT by Signify)
3. POWER (From Panelboard) : 1□ 2 WIRE w/ GND 120 or 277 VAC 60 Hz (NOT by Signify)
4. CLASS 2 10V CONTROL PAIRS (NOT by Signify)

RJ45 (T568B)

Signal Name	Cat 5e/6 Hard-Wire - RJ45 T568B Color Scheme	DMX512 Conn.
+ VDC	Blue (4) / Blue-White (5)	N/C
Data -	Orange (2)	D-
Data +	Orange-White (1)	D+
Signal Gnd	Brown-White (7) / Brown (8)	GND
SHIELD	Shield	N/C
No Connection	Green (3) / Green-White (6)	N/C

RJ45

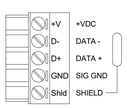
T568B Preferred



DyNet Networks:

DyNet

Signal Name	Belden 1502R or P Wire Color
+ VDC	Red
Data -	White
Data +	Blue
Signal Gnd	Black
SHIELD	Shield



DyNet RS-485 NETWORK
CARRIES COMMANDS FROM USER INPUT DEVICES AND CARRIES FEEDBACK TO INPUT DEVICES (SENSORS, KEYPADS, COMPUTER, A/V, BMS)

DyNet CABLE RUNS MUST BE ROUTED IN A "DAISY-CHAIN" CONFIGURATION. CAT 5e / CAT 6 CABLE IS PERMITTED IN SMALL INSTALLATIONS, BUT MAY REQUIRE ADDITIONAL POWER SUPPLIES.

DALI — (2) CLASS 1 CONDUCTORS for DALI DRIVERS/DEVICES

10V — (2) CLASS 2 CONDUCTORS for 0(1) -10V DRIVERS

Enet — ETHERNET CABLING (Cat 5e or Better or Fiber - per Facility IT)

TYPICAL KEYPAD LAYOUT

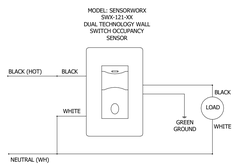


DYNALITE
DD2SRA-W-ON
MOUNTED IN 1-Gang Masonry Back Box

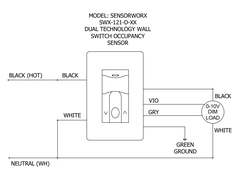
DYNALITE
DD1S2ZEA-W-ON
MOUNTED IN 1-Gang Masonry Back Box

DYNALITE
DADPA
w/ DACM COMM MODULE
MOUNTED IN 1-Gang Masonry Back Box

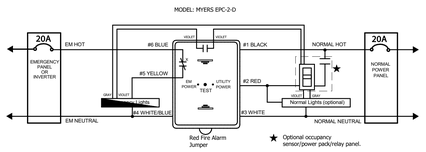
LINE VOLTAGE WALL SWITCH SENSOR



LINE VOLTAGE WALL SWITCH SENSOR w/0-10V DIM

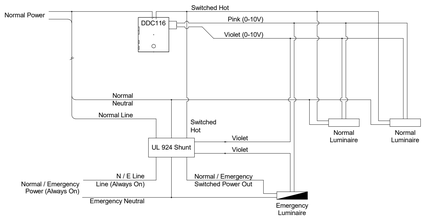


UL924 - EMERGENCY BYPASS

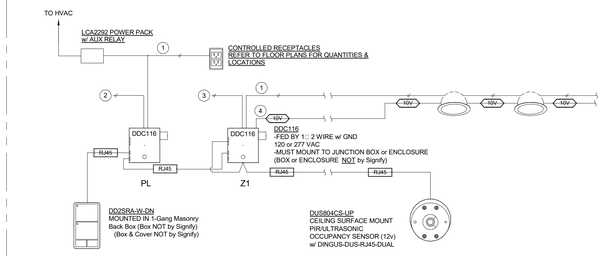


1. Wires #1 & #3 supervise utility power, indicated by green LED.
2. Wires #6 & #4 supervise emergency power, indicated by red LED.
3. During normal operation, relay contact "X" follows switch leg (#2) position. Automatic diagnostic feature is initiated when room switch is turned off.
4. Upon utility power interruption, contact between #6 and #5 closes, automatically energizing emergency lights.
5. Isolated 0-10V Relay Contact ensures full brightness during utility power interruption, regardless of dimmer model.

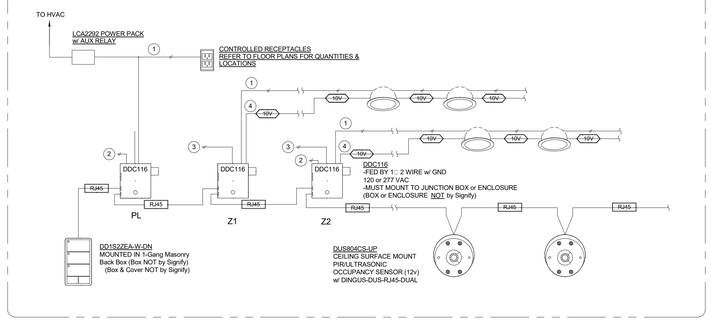
ZONE CONTROLLER EMERGENCY WIRING DIAGRAM



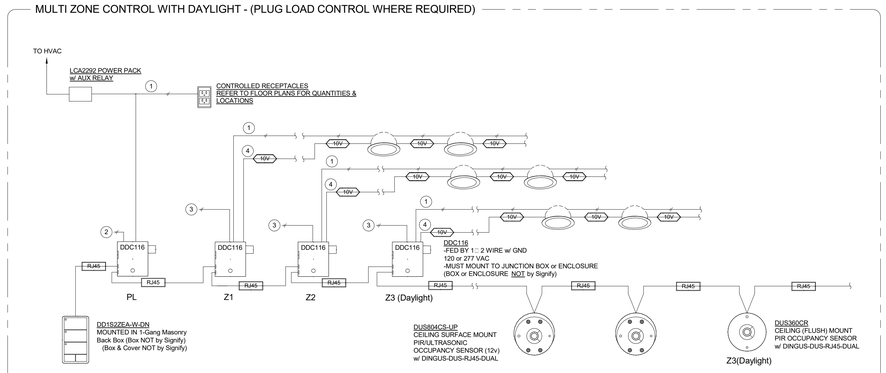
SINGLE ZONE CONTROLLER- (PLUG LOAD CONTROL WHERE REQUIRED)



DUAL ZONE CONTROL - (PLUG LOAD CONTROL WHERE REQUIRED)



MULTI ZONE CONTROL WITH DAYLIGHT - (PLUG LOAD CONTROL WHERE REQUIRED)



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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL LIGHTING CONTROL SCHEMATICS

STATE PROJ. NO.	144-0108N
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1) ONE-LINE DIAGRAMS INDICATE THE REQUIRED GROUPING OF WIRES, NOT THE NUMBER OR SIZE OF CONDUITS. ONE-LINE SYMBOLS ARE FOR REFERENCE ONLY AND MAY NOT REFLECT INSTALLED CONFIGURATION.

2) THESE DRAWINGS MAY ILLUSTRATE DEVICE MOUNTING LOCATIONS. THE LOCATIONS SHOWN SHOULD BE ADJUSTED IN THE FIELD BASED ON AESTHETICS/CLIENT DIRECTION, SITE CONDITIONS, WIRING METHODS, AND APPLICABLE CODES AND STANDARDS.

3) THIS SYSTEM SHOULD BE REVIEWED AND INSTALLED BY A QUALIFIED PERSON/ENTITY.

4) INSTALL PER EQUIPMENT LABELING AND INSTALLATION INSTRUCTIONS, INCLUDING TORQUE INFORMATION AND TEMPERATURE & HUMIDITY REQUIREMENTS PER DATA & INSTALLATION SHEETS. UNLESS RATED OTHERWISE, SIGNIFY EQUIPMENT MUST BE INSTALLED, MAINTAINED, AND OPERATED IN "OFFICE CLEAN" INDOOR DRY LOCATIONS ONLY.

5) WIRING & USE OF JUNCTION BOXES, RACEWAYS, ETC., SHALL CONFORM TO NATIONAL & LOCAL ELECTRICAL CODES, INCLUDING PROVISION OF EQUIPMENT GROUNDING AS REQUIRED, AND INCLUDING BUT NOT LIMITED TO NEC® 110.3(B) & 110.26.

6) POWER CONDUCTORS SHALL BE SIZED PER THE NEC ® AMPACITY TABLES (ARTICLE 310), INCLUDING ADJUSTMENT FACTOR AND NEUTRAL CONDUCTOR REQUIREMENTS - FEED & BRANCH NEUTRAL CONDUCTORS MUST BE COUNTED AS CURRENT CARRYING CONDUCTORS. RUN SEPARATE NEUTRAL CONDUCTORS FOR EACH LOAD CIRCUIT .

7) ALL CONTROL WIRING SHOULD* BE RUN IN METAL CONDUIT OR EMT AND MUST NOT SHARE THE SAME RACEWAY OR CONDUIT WITH POWER, AUDIO, OR VIDEO CONDUCTORS.
~~RECOMMENDED~~ CONTRACTOR
~~RESPONSIBLE FOR~~ ALL NO SPLICES PERMITTED.
* - Preferred, but Not Required

8) SIGNIFY IS NOT RESPONSIBLE FOR DAMAGE TO EQUIPMENT CAUSED BY PAINT, DUST, SOLVENTS, OR CLEANING SUPPLIES.

(1) 120 or 277 VAC 20A BRANCH CIRCUITS *** (NOT by Signify)

(2) CONTROLLER INPUT POWER : 1⏚ 2 WIRE w/ GND 120 VAC 60 Hz (NOT by Signify)

(2a) CONTROLLER INPUT POWER : 1⏚ 2 WIRE w/ GND 120 or 277 VAC 60 Hz (NOT by Signify)

(3) POWER (From Panelboard) : 1⏚ 2 WIRE w/ GND 120 or 277 VAC 60 Hz (NOT by Signify)

(4) CLASS 1 DALI or CLASS 2 10V CONTROL PAIRS (NOT by Signify)

*** - BRANCH CIRCUIT WIRING NOTES :

(120-277VAC 16A - PER CIRCUIT)

DALI BRANCH CIRCUITS SHOULD ROUTE THROUGH LOAD CONTROLLER FOR MAXIMUM ENERGY SAVINGS, BUT MAY ROUTE DIRECTLY TO LUMINAIRES, BYPASSING THE DALI LOAD CONTROLLERS.

10V BRANCH CIRCUITS MUST BE ROUTED THROUGH THE LOAD CONTROLLERS

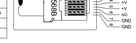
DIRECT ROUTING REQUIRED FOR 347VAC; 347VAC LOADS DO NOT CONNECT TO LOAD CONTROLLERS EXCEPT w/ DMC DMD316FR MODULES)

RJ45 (T568B)

Signal Name	Cut Sw/t Hand-Wire - RJ45 T568B Color Scheme	DMX512 Conn
+ VDC	Blue (4) / Blue-White (5)	N/C
Data -	Orange (2)	D-
Data +	Orange-White (1)	D+
Signal Gnd	Brown-White (7) / Brown (8)	GND
SHIELD	Shield	N/C
No Connection	Green (3) / Green-White (6)	N/C

RJ45

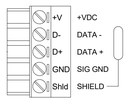
T568B Preferred



DyNet Networks:

Signal Name	Belden 1502R or P Wire Color
+ VDC	Red
Data -	White
Data +	Blue
Signal Gnd	Black
SHIELD	Shield

DyNet



DyNet RS-485 NETWORK
CARRIES COMMANDS FROM USER INPUT DEVICES AND CARRIES FEEDBACK TO INPUT DEVICES (SENSORS/KEYPADS, COMPUTER, A/V, BMS)

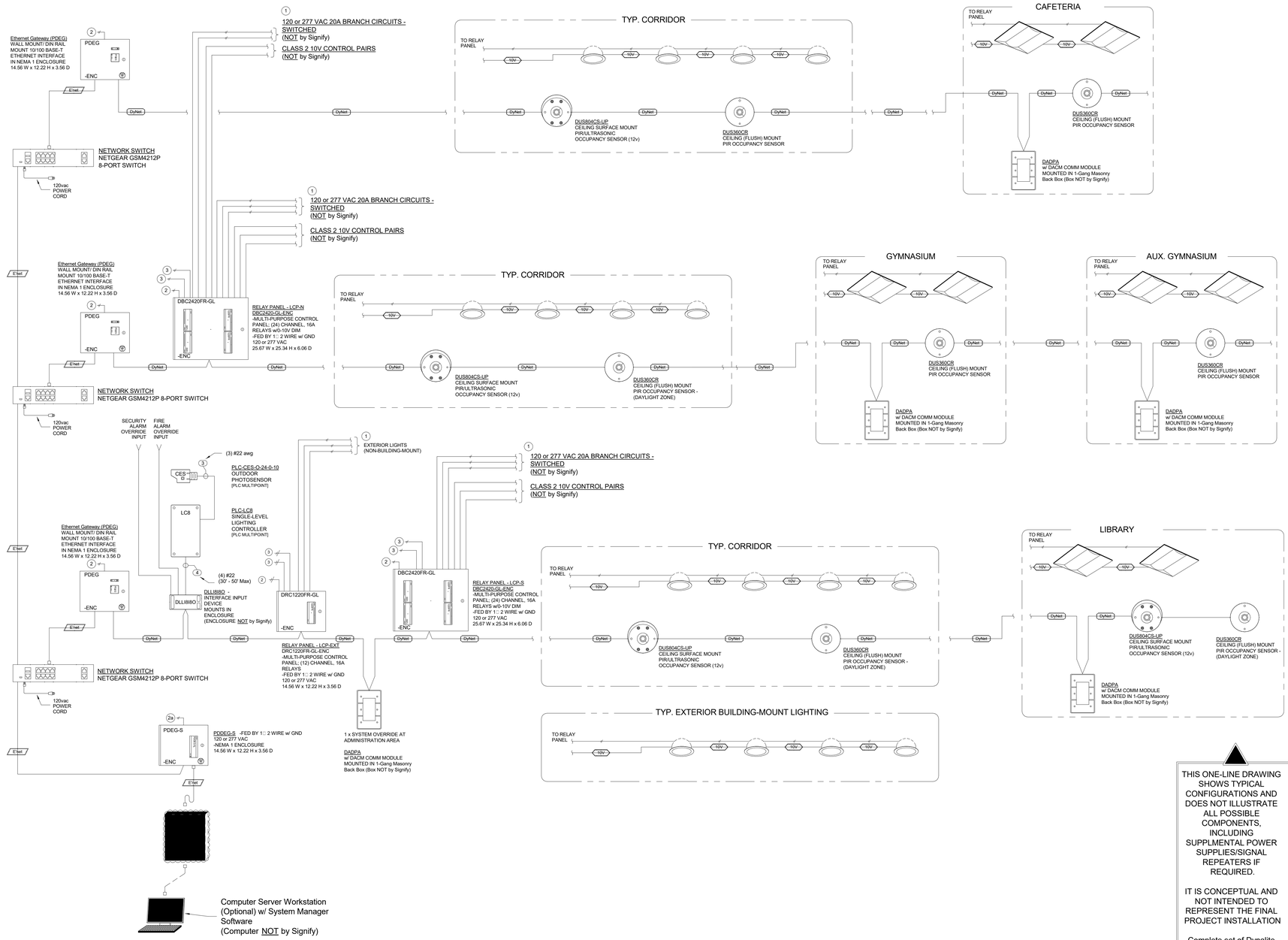
DyNet CABLE RUNS MUST BE ROUTED IN A "DAISY-CHAIN" CONFIGURATION. CAT 5e / CAT 6 CABLE IS PERMITTED IN SMALL INSTALLATIONS, BUT MAY REQUIRE ADDITIONAL POWER SUPPLIES.

DALI (2) CLASS 1 CONDUCTORS for DALI DRIVERS/DEVICES

10V (2) CLASS 2 CONDUCTORS for 0(1) -10V DRIVERS

ETHERNET CABLING (Cat 5e or Better or Fiber - per Facility IT)

DMX512 DMX512 CABLING (CLASS 2)



THIS ONE-LINE DRAWING SHOWS TYPICAL CONFIGURATIONS AND DOES NOT ILLUSTRATE ALL POSSIBLE COMPONENTS, INCLUDING SUPPLMENTAL POWER SUPPLIES/SIGNAL REPEATERS IF REQUIRED.

IT IS CONCEPTUAL AND NOT INTENDED TO REPRESENT THE FINAL PROJECT INSTALLATION

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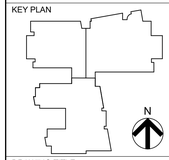
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL LIGHTING CONTROL SCHEMATICS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E6.05

5/18/2026 11:12:31 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

SWITCHBOARD AND WIRING SCHEDULE

SWITCHBOARD: SWBD-1 | **VOLTAGE:** 480Y/277V,3P,4W | **AMPERES:** 3500 A | **MAINS TYPE:** MCB | **SPD:** Yes | **MOUNTING:** SURFACE | **kAIC VALUE:** | **kAIC RATING:** 100 KAIC | **LOCATION:** ELEC B004A | **SUPPLY FROM:** UTILITY

CKT	CIRCUIT DESCRIPTION	SETS	WIRE	GND	COND	POLES	FRAME	TRIP	Load	REMARKS
1	T-DP-L1B					3	600 A	600 A	273.6	
2	M-H1B					3	225 A	225 A	72.5	
3	DP-H2C					3	600 A	600 A	236.9	
4	DP-H2B					3	800 A	800 A	554.2	
5	DP-H2A					3	400 A	400 A	167.8	
6	L-H1B					3	100 A	60 A	4.8	
7	ATS-OS					3	600 A	600 A	342.7	
8	ATS-LS					3	225 A	225 A	49.1	
9	ATS-LR					3	225 A	225 A	54.5	
10	L-H3C					3	100 A	60 A	7.6	
11	M-SWBD-1-HVAC - PANEL METERING					3	20 A	20 A	0.5	
12	M-L-H1B-PL - PANEL METERING					3	20 A	20 A	0.5	
13	SPARE					1	400 A	400 A	0.0	
14	SPARE					1	250 A	250 A	0.0	
15	SPARE					1	100 A	100 A	0.0	
16										
17										
18										
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LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	189323 VA	90.00%	170391 VA	TOTAL CONN. LOAD:	1765 kVA
HVAC	780639 VA	85.00%	663543 VA	TOTAL EST. DEMAND:	1469 kVA
KITCH	225050 VA	65.00%	146283 VA	TOTAL CONN. CURRENT:	2123 A
LTNG	65854 VA	100.00%	65854 VA	TOTAL EST. DEMAND CURRENT:	1767 A
REC	201540 VA	52.48%	105770 VA		
Lighting	9072 VA	100.00%	9072 VA		
Receptacle	41220 VA	62.13%	25610 VA		
Continuous Load	144000 VA	125.00%	180000 VA		

NOTES:
PROVIDE LSIG, ARMS ON MCB AND ANY BREAKER WITH A FRAME SIZE GREATER THAN OR EQUAL TO 1000A. MAIN BREAKER SHALL BE 100% RATED, SERVICE ENTRANCE RATED. MCB SHALL BE METERED. SWITCHBOARD TO BE RATED FOR 3500A, MAIN BREAKER TO BE RATED FOR 2000A.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-H2A | **VOLTAGE:** 480Y/277V,3P,4W | **AMPERES:** 400 A | **MAINS TYPE:** MCB | **SPD:** | **MOUNTING:** SURFACE | **PANEL INTERRUPTING RATING:** 42 KAIC | **LOCATION:** Room 356 | **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				33.2	5.0								2	
	3	T-DP-L2A	250 A	3			33.9	3.3			3	60 A	L-H2A	4	
	5								32.5	3.1				6	
	7				18.6	0.2								8	
	9	M-H2A	100 A	3			18.6	0.2			3	20 A	M-DP-H2A-HVAC - PANEL METERING	10	
	11								18.6	0.2				12	
	13				0.2	0.0								14	
	15	M-DP-H2A-LTG - PANEL METERING	20 A	3			0.2	0.0			3	100 A	SPARE	16	
	17								0.2	0.0				18	
	19				0.0	--								20	
	21	SPARE	100 A	3			0.0	--			3	--	SPACE	22	
	23								0.0	--				24	
					57.1 kVA		56.2 kVA		54.5 kVA						
					207 A		204 A		197 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	24500 VA	90.00%	22050 VA	TOTAL CONNECTED LOAD:	167813 VA
HVAC	98588 VA	85.00%	83800 VA	TOTAL ESTIMATED DEMAND:	139704 VA
LTNG	5113 VA	100.00%	5113 VA	TOTAL CONNECTED CURRENT:	202 A
REC	31740 VA	65.75%	20870 VA	TOTAL ESTIMATED DEMAND CURRENT:	168 A
Lighting	5712 VA	100.00%	5712 VA	10 % ADDITIONAL CAPACITY:	17 A
Receptacle	2160 VA	100.00%	2160 VA	TOTAL PANEL CURRENT:	185 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-H2C | **VOLTAGE:** 480Y/277V,3P,4W | **AMPERES:** 600 A | **MAINS TYPE:** MCB | **SPD:** | **MOUNTING:** SURFACE | **PANEL INTERRUPTING RATING:** 42 KAIC | **LOCATION:** Space 143 | **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				68.6	3.4								2	
	3	T-DP-L2C	450 A	3			75.8	0.0			3	60 A	L-H1C	4	
	5								65.5	0.0				6	
	7				0.2	5.3								8	
	9	M-DP-H2C-LTG - PANEL METERING	20 A	3			0.2	1.4			3	60 A	L-H2C	10	
	11								0.2	3.1				12	
	13				4.2	0.2								14	
	15	MECH B121 - VHP	20 A	3			4.2	0.2			3	20 A	M-DP-H2C-HVAC - PANEL METERING	16	
	17								4.2	0.2				18	
	19				0.0	0.0								20	
	21	SPARE	100 A	3			0.0	0.0			3	100 A	SPARE	22	
	23								0.0	0.0				24	
	25				--	--								26	
	27	SPACE	--	3			--	--			3	--	SPACE	28	
	29								--	--				30	
	31				--	--								32	
	33	SPACE	--	3			--	--			3	--	SPACE	34	
	35								--	--				36	
	37				--	--								38	
	39	SPACE	--	3			--	--			3	--	SPACE	40	
	41								--	--				42	
					81.9 kVA		81.8 kVA		73.2 kVA						
					300 A		300 A		264 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	34304 VA	90.00%	30874 VA	TOTAL CONNECTED LOAD:	236895 VA
HVAC	123887 VA	85.00%	105389 VA	TOTAL ESTIMATED DEMAND:	191366 VA
LTNG	13324 VA	100.00%	13324 VA	TOTAL CONNECTED CURRENT:	285 A
REC	57000 VA	58.77%	33500 VA	TOTAL ESTIMATED DEMAND CURRENT:	230 A
Receptacle	8280 VA	100.00%	8280 VA	10 % ADDITIONAL CAPACITY:	23 A
				TOTAL PANEL CURRENT:	253 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-H2B | **VOLTAGE:** 480Y/277V,3P,4W | **AMPERES:** 800 A | **MAINS TYPE:** MCB | **SPD:** | **MOUNTING:** SURFACE | **PANEL INTERRUPTING RATING:** 42 KAIC | **LOCATION:** Space 155 | **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				97.6	25.4								2	
	3	T-DP-L2B	600 A	3			94.2	25.4			3	225 A	M-H2B	4	
	5								83.7	25.4				6	
	7				5.4	62.3								8	
	9	L-H2B	100 A	3			5.2	62.3			3	225 A	K-H2B	10	
	11								3.5	62.3				12	
	13				0.2	0.2								14	
	15	M-DP-H2B-HVAC - PANEL METERING	20 A	3			0.2	0.2			3	20 A	M-DP-H2B-PROC - PANEL METERING	16	
	17								0.2	0.2				18	
	19				0.2	0.0								20	
	21	M-DP-H2B-LTG - PANEL METERING	20 A	3			0.2	0.0			3	225 A	SPARE	22	
	23								0.2	0.0				24	
	25				0.0	--								26	
	27	SPARE	100 A	3			0.0	--			3	--	SPACE	28	
	29								0.0	--				30	
	31				--	--								32	
	33	SPACE	--	3			--	--			3	--	SPACE	34	
	35								--	--				36	
	37				--	--								38	
	39	SPACE	--	3			--	--			3	--	SPACE	40	
	41								--	--				42	
					191.2 kVA		187.6 kVA		175.4 kVA						
					697 A		684 A		633 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	81900 VA	90.00%	73710 VA	TOTAL CONNECTED LOAD:	554191 VA
HVAC	135396 VA	85.00%	115087 VA	TOTAL ESTIMATED DEMAND:	454338 VA
LTNG	13558 VA	100.00%	13558 VA	TOTAL CONNECTED CURRENT:	667 A
REC	33780 VA	64.80%	21890 VA	TOTAL ESTIMATED DEMAND CURRENT:	546 A
KITCH	211440 VA	65.00%	137436 VA	10 % ADDITIONAL CAPACITY:	55 A
Receptacle	13320 VA	87.54%	11660 VA	TOTAL PANEL CURRENT:	601 A
Continuous Load	64800 VA	125.00%	81000 VA		

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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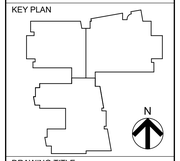
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL PANEL SCHEDULES 480V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.01

5/18/2026 11:12:33 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H1B** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** ELEC B004A
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	LOWER LEVEL AREA C S. CORR. LTG	20 A	1	0.6	0.5					1	20 A	LCP-C1	2	
	3	LOWER LEVEL AREA C N. CORR. LTG	20 A	1			0.4	1.8			1	20 A	LOWER LEVEL AREA C NORTHWEST LTG	4	
	5	LOWER LEVEL AREA C NORTHEAST LTG	20 A	1					1.6	0.0	1	20 A	SPARE	6	
	7	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					1.1 kVA		2.2 kVA		1.6 kVA						
					4 A		8 A		6 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	4810 VA	100.00%	4810 VA	TOTAL CONNECTED LOAD:	4810 VA
				TOTAL ESTIMATED DEMAND:	4810 VA
				TOTAL CONNECTED CURRENT:	6 A
				TOTAL ESTIMATED DEMAND CURRENT:	6 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	6 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H1C** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** EL 246
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** DP-H2C

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	LOWER LEVEL AREA C SOUTHWEST LTG	20 A	1	1.9	1.5					1	20 A	LOWER LEVEL AREA C SOUTHEAST LTG	2	
	3	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	4	
	5	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	6	
	7	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					3.4 kVA		0.0 kVA		0.0 kVA						
					12 A		0 A		0 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	3445 VA	100.00%	3445 VA	TOTAL CONNECTED LOAD:	3445 VA
				TOTAL ESTIMATED DEMAND:	3445 VA
				TOTAL CONNECTED CURRENT:	4 A
				TOTAL ESTIMATED DEMAND CURRENT:	4 A
				10 % ADDITIONAL CAPACITY:	0 A
				TOTAL PANEL CURRENT:	5 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H2A** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** Room 356
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** DP-H2A

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MAIN LEVEL AREA A CORR. LTG	20 A	1	0.6	1.5					1	20 A	MAIN LEVEL AREA A OFFICE LTG	2	
	3	MAIN LEVEL AREA A SOUTH LTG	20 A	1			1.1	0.5			1	20 A	MAIN CORR. & MEZZENANINE LTG	4	
	5	AUX GYM LTG	20 A	1					0.5	1.3	1	20 A	GYM NORTHWEST LTG	6	
	7	GYM NORTHEAST LTG	20 A	1	1.3	1.3					1	20 A	GYM SOUTHWEST LTG	8	
	9	GYM SOUTHEAST LTG	20 A	1			1.2	0.4			1	20 A	LL AREA C EXT. WALL PACKS	10	1
1	11	MAIN LEVEL AREA A EXT. WALL PACKS	20 A	1					0.5	0.5	1	20 A	LCP-A2	12	
	13				0.2	0.0					1	20 A	SPARE	14	
	15	M-L-H2A-LTG	20 A	3			0.2	0.0			1	20 A	SPARE	16	
	17								0.2	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					5.0 kVA		3.3 kVA		3.1 kVA						
					18 A		12 A		11 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	500 VA	90.00%	450 VA	TOTAL CONNECTED LOAD:	11325 VA
LTNG	5113 VA	100.00%	5113 VA	TOTAL ESTIMATED DEMAND:	11275 VA
Lighting	5712 VA	100.00%	5712 VA	TOTAL CONNECTED CURRENT:	14 A
				TOTAL ESTIMATED DEMAND CURRENT:	14 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	15 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. PROVIDE SUBMETERING OF BREAKER FOR EXTERIOR LIGHTING.

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H2B** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** Space 155
AMPERES: 100 A **MOUNTING:** SURFACE **SUPPLY FROM:** DP-H2B

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MAIN LEVEL AREA B NORTH LTG	20 A	1	1.7	1.3					1	20 A	MAIN LEVEL AREA B CAF. LTG	2	
	3	MAIN LEVEL AREA B SOUTHWEST LTG	20 A	1			1.1	1.1			1	20 A	MAIN LEVEL AREA B PLANETARIUM LTG	4	
	5	MAIN LEVEL AREA B CORR LTG	20 A	1					0.8	0.8	1	20 A	MAIN LEVEL AREA B KITCHEN LTG	6	
	7	MAIN LEVEL AREA B SOUTHEAST LTG	20 A	1	0.8	0.2					1	20 A	AREA B MEZZ. MECH SPACE LTG	8	
	9	AREA B BLACKBOX LTG	20 A	1			1.6	0.9			1	20 A	N. SITE LTG	10	1
1	11	N. SITE LIGHTING	20 A	1					0.9	0.8	1	20 A	N. SITE LIGHTING	12	1
1	13	N. SITE LIGHTING	20 A	1	0.7	0.5					1	20 A	LCP-B2	14	
1	15	MAIN LEVEL AREA B EXT. LTG	20 A	1			0.2	0.2						16	
1	17	EXT. FLAGPOLE LTG	20 A	1					0.1	0.2	3	20 A	M-L-H2B-LTG	18	
	19	SPARE	20 A	1	0.0	0.2								20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
	25	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	26	
	27	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					5.4 kVA		5.2 kVA		3.5 kVA						
					20 A		20 A		13 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	500 VA	90.00%	450 VA	TOTAL CONNECTED LOAD:	14057 VA
LTNG	13558 VA	100.00%	13558 VA	TOTAL ESTIMATED DEMAND:	14007 VA
				TOTAL CONNECTED CURRENT:	17 A
				TOTAL ESTIMATED DEMAND CURRENT:	17 A
				10 % ADDITIONAL CAPACITY:	2 A
				TOTAL PANEL CURRENT:	19 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. PROVIDE SUBMETERING OF BREAKER FOR EXTERIOR LIGHTING.

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H2C** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** Space 79
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** DP-H2C

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MAIN LEVEL AREA C SOUTHWEST LTG	20 A	1	1.4	1.5					1	20 A	MAIN LEVEL AREA C NE. LTG	2	
	3	MAIN LEVEL AREA C N. CORR. LTG	20 A	1			0.8	0.6			1	20 A	MAIN LEVEL AREA C S.CORR. LTG	4	
	5	MAIN LEVEL AREA C SOUTHEAST LTG	20 A	1					1.9	1.3	1	20 A	MAIN LEVEL AREA C MEDIA CENTER LTG	6	
	7	MAIN LEVEL AREA C NW. LTG	20 A	1	1.9	0.5					1	20 A	LCP-C2	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					5.3 kVA		1.4 kVA		3.1 kVA						
					20 A		5 A		12 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	9879 VA	100.00%	9879 VA	TOTAL CONNECTED LOAD:	9879 VA
				TOTAL ESTIMATED DEMAND:	9879 VA
				TOTAL CONNECTED CURRENT:	12 A
				TOTAL ESTIMATED DEMAND CURRENT:	12 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	13 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: **L-H3C** **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W **SPD:** **LOCATION:** MECH 220
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	UPPER LEVEL AREA C SW LTG	20 A	1	1.5	1.4					1	20 A	UPPER LEVEL AREA C SE LTG	2	
	3	UPPER LEVEL AREA C S. CORR. LTG	20 A	1			0.4	0.6			1	20 A	UPPER LEVEL AREA C N. CORR. LTG	4	
	5	UPPER LEVEL AREA C NE LTG	20 A	1					1.6	1.6	1	20 A	UPPER LEVEL AREA C NW LTG	6	
	7	LCP-C3	20 A	1	0.5	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					3.5 kVA		1.0 kVA		3.2 kVA						
					14 A		4 A		13 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	7638 VA	100.00%	7638 VA	TOTAL CONNECTED LOAD:	7638 VA
				TOTAL ESTIMATED DEMAND:	7638 VA
				TOTAL CONNECTED CURRENT:	9 A
				TOTAL ESTIMATED DEMAND CURRENT:	9 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	10 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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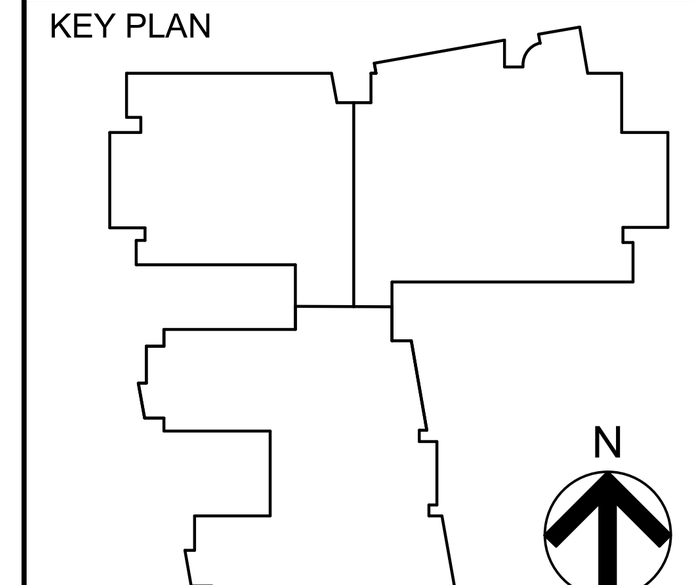
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL PANEL SCHEDULES 480V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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PANELBOARD AND WIRING SCHEDULE

PANEL: M-H1B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W — **SPD:** — **LOCATION:** MECH 369
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** SWBD-1

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				6.0	18.0					2	
	3	MECH B005 - EWH-1	30 A	3		6.0	18.0				4	
	5						6.0	18.0	3	90 A	ELEVATOR 2 - MAIN POWER	6	
	7				0.2	0.0					8	
	9	M-M-H1B-ELEV - PANEL METERING	20 A	3		0.2	0.0				10	
	11						0.2	0.0	3	30 A	SPARE	12	
	13				0.0	0.0					14	
	15	SPARE	20 A	3		0.0	0.0				16	
	17						0.0	0.0	3	20 A	SPARE	18	
	19				0.0	0.0					20	
	21	SPARE	20 A	3		0.0	0.0				22	
	23						0.0	0.0	3	20 A	SPARE	24	
					24.2 kVA	24.2 kVA	24.2 kVA					
					87 A	87 A	87 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	500 VA	90.00%	450 VA	TOTAL CONNECTED LOAD:	72500 VA
HVAC	18000 VA	85.00%	15300 VA	TOTAL ESTIMATED DEMAND:	69750 VA
				TOTAL CONNECTED CURRENT:	87 A
				TOTAL ESTIMATED DEMAND CURRENT:	84 A
				10 % ADDITIONAL CAPACITY:	8 A
				TOTAL PANEL CURRENT:	92 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-H2B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W — **SPD:** — **LOCATION:** Space 155
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-H2B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				3.4	11.0					2	
	3	MEZZ M140 - VHP	20 A	3		3.4	11.0				4	
	5						3.4	11.0	3	60 A	MEZZ M140 - VHP	6	
	7				11.0	0.0					8	
	9	MEZZ M140 - VHP	80 A	3		11.0	0.0				10	
	11						11.0	0.0	3	20 A	SPARE	12	
	13				0.0	--					14	
	15	SPARE	20 A	3		0.0	--				16	
	17						0.0	--	3	--	SPACE	18	
	19				--	--					20	
	21	SPACE	--	3		--	--				22	
	23						--	--	3	--	SPACE	24	
					25.4 kVA	25.4 kVA	25.4 kVA					
					92 A	92 A	92 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	76071 VA	85.00%	64660 VA	TOTAL CONNECTED LOAD:	76071 VA
				TOTAL ESTIMATED DEMAND:	64660 VA
				TOTAL CONNECTED CURRENT:	91 A
				TOTAL ESTIMATED DEMAND CURRENT:	78 A
				10 % ADDITIONAL CAPACITY:	8 A
				TOTAL PANEL CURRENT:	86 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: K-H2B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W — **SPD:** — **LOCATION:** Space 184
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-H2B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				5.5	4.5					2	
	3	VENTLESS WAREWASHER	30 A	3		5.5	4.5				4	
	5						5.5	4.5	3	30 A	RANGE WITH OVEN	6	
	7				9.3	11.0					8	
	9	FORTY GALLON TILT BRAISING PAN	50 A	3		9.3	11.0				10	
	11						9.3	11.0	3	50 A	STEAMER - TEN PANS	12	
	13				8.0	8.0					14	
	15	DOUBLE STACKED COMBI OVENS	40 A	3		8.0	8.0				16	
	17						8.0	8.0	3	40 A	DOUBLE STACKED COMBI OVENS	18	
	19				8.0	8.0					20	
	21	DOUBLE STACKED COMBI OVENS	40 A	3		8.0	8.0				22	
	23						8.0	8.0	3	40 A	DOUBLE STACKED COMBI OVENS	24	
	25				0.0	0.0					26	
	27	SPARE	40 A	3		0.0	0.0				28	
	29						0.0	0.0	3	40 A	SPARE	30	
	31				--	--					32	
	33	SPACE	--	3		--	--				34	
	35						--	--	3	--	SPACE	36	
	37				--	--					38	
	39	SPACE	--	3		--	--				40	
	41						--	--	3	--	SPACE	42	
					62.3 kVA	62.3 kVA	62.3 kVA					
					225 A	225 A	225 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
KITCH	187000 VA	65.00%	121550 VA	TOTAL CONNECTED LOAD:	187000 VA
				TOTAL ESTIMATED DEMAND:	121550 VA
				TOTAL CONNECTED CURRENT:	225 A
				TOTAL ESTIMATED DEMAND CURRENT:	146 A
				10 % ADDITIONAL CAPACITY:	15 A
				TOTAL PANEL CURRENT:	161 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
PROVIDE STAINLESS STEEL COVER FOR ALL PANELBOARDS WITHIN KITCHEN.
PROVIDE SHUNT TRIP ACCESSORY TO MAIN CIRCUIT BREAKER. CONNECT TO EPO(S) LOCATED WITHIN AREA SERVED BY PANEL.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-H2A — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W — **SPD:** — **LOCATION:** Room 356
AMPERES: 100 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-H2A

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				15.3	3.4					2	
	3	3 - MECH MEZZANINE - VHP	80 A	3			15.3	3.4			4	
	5								15.3	3.4	6	
	7				0.0	0.0					8	
	9	SPARE	20 A	3			0.0	0.0			10	
	11								0.0	0.0	12	
	13				--	--					14	
	15	SPACE	--	3			--	--			16	
	17								--	--	18	
	19				--	--					20	
	21	SPACE	--	3			--	--			22	
	23								--	--	24	
					18.6 kVA	18.6 kVA	18.6 kVA					
					67 A	67 A	67 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	55868 VA	85.00%	47488 VA	TOTAL CONNECTED LOAD:	55868 VA
				TOTAL ESTIMATED DEMAND:	47488 VA
				TOTAL CONNECTED CURRENT:	67 A
				TOTAL ESTIMATED DEMAND CURRENT:	57 A
				10 % ADDITIONAL CAPACITY:	6 A
				TOTAL PANEL CURRENT:	63 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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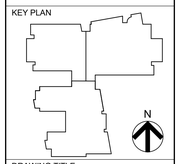
ROBERT A. MAHS
PE.47708
STATE OF CONNECTICUT
PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL PANEL SCHEDULES 480V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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PANELBOARD AND WIRING SCHEDULE

PANEL: DP-L1B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** ELEC B004A
AMPERES: 1200 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** T-DP-L1B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				25.5	13.8					2	
	3	M-L1B	225 A	3		17.4	13.0	3	225 A	R-L1B	4	
	5						20.4	12.7			6	
	7				15.7	17.2					8	
	9	R-L3C	225 A	3		14.6	13.7	3	225 A	M-L3C	10	
	11						17.7	11.7			12	
	13				28.8	0.2					14	
	15	EV-LEA	500 A	3		25.2	0.2	3	20 A	M-DP-L1B-PL - PANEL METERING	16	
	17						25.2	0.2			18	
	19				0.2	0.0					20	
	21	M-DP-L1B-PROC - PANEL METERING	20 A	3		0.2	0.0	3	100 A	SPARE	22	
	23						0.2	0.0			24	
	25				0.0	--					26	
	27	SPARE	225 A	3		0.0	--	3	--	SPACE	28	
	29						0.0	--			30	
	31				--	--					32	
	33	SPACE	--	3		--	--	3	--	SPACE	34	
	35						--	--			36	
	37				--	--					38	
	39	SPACE	--	3		--	--	3	--	SPACE	40	
	41				--	--	--				42	
					101.4 kVA	84.2 kVA	88.0 kVA					
					850 A	702 A	738 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	13300 VA	90.00%	11970 VA	TOTAL CONNECTED LOAD:	273563 VA
HVAC	104383 VA	85.00%	88726 VA	TOTAL ESTIMATED DEMAND:	248036 VA
REC	64080 VA	57.80%	37040 VA	TOTAL CONNECTED CURRENT:	759 A
Receptacle	12600 VA	89.68%	11300 VA	TOTAL ESTIMATED DEMAND CURRENT:	688 A
Continuous Load	79200 VA	125.00%	99000 VA	10 % ADDITIONAL CAPACITY:	69 A
				TOTAL PANEL CURRENT:	757 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. MAIN BREAKER AND PANEL ASSEMBLY SHALL BE 100% RATED. MAIN BREAKER SHALL BE PROVIDED WITH LSIG AND ARMS.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-L1C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 143
AMPERES: 800 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** T-DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				8.5	11.2					2	
	3	R-L1C	225 A	3		7.4	10.5	3	225 A	M-L1C	4	
	5						7.6	9.5			6	
	7				7.7	18.9					8	
	9	R-L2C	100 A	3		9.1	20.9	3	225 A	M-L2C	10	
	11						7.4	20.0			12	
	13				0.2	9.7					14	
	15	M-DP-L2C-PL - ENERGY METER	20 A	3		0.2	13.0	3	225 A	R-L2E	16	
	17						0.2	10.8			18	
	19				12.5	0.0					20	
	21	M-L3D	225 A	3		14.7	0.0	3	225 A	SPARE	22	
	23						10.0	0.0			24	
	25				0.0	--					26	
	27	SPARE	100 A	3		0.0	--	3	--	SPACE	28	
	29						0.0	--			30	
	31				--	--					32	
	33	SPACE	--	3		--	--	3	--	SPACE	34	
	35						--	--			36	
	37				--	--					38	
	39	SPACE	--	3		--	--	3	--	SPACE	40	
	41				--	--	--				42	
					68.6 kVA	75.8 kVA	65.5 kVA					
					575 A	636 A	546 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	33304 VA	90.00%	29974 VA	TOTAL CONNECTED LOAD:	209934 VA
HVAC	111350 VA	85.00%	94648 VA	TOTAL ESTIMATED DEMAND:	166401 VA
REC	57000 VA	58.77%	33500 VA	TOTAL CONNECTED CURRENT:	583 A
Receptacle	8280 VA	100.00%	8280 VA	TOTAL ESTIMATED DEMAND CURRENT:	462 A
				10 % ADDITIONAL CAPACITY:	46 A
				TOTAL PANEL CURRENT:	508 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-L2A — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Room 356
AMPERES: 400 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** T-DP-L2A

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				14.0	12.8					2	
	3	M-L2A	225 A	3		13.9	14.7	3	225 A	R-L2A	4	
	5						14.8	13.4			6	
	7				0.2	6.2					8	
	9	M-DP-L2A-PL - ENERGY METER	20 A	3		0.2	5.2	3	100 A	R-L2F	10	
	11						0.2	4.2			12	
	13				0.0	0.0					14	
	15	SPARE	225 A	3		0.0	0.0	3	100 A	SPARE	16	
	17						0.0	0.0			18	
	19				--	--					20	
	21	SPACE	--	3		--	--	3	--	SPACE	22	
	23						--	--			24	
					33.2 kVA	33.9 kVA	32.5 kVA					
					277 A	284 A	271 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	23000 VA	90.00%	20700 VA	TOTAL CONNECTED LOAD:	99620 VA
HVAC	42720 VA	85.00%	36312 VA	TOTAL ESTIMATED DEMAND:	80042 VA
REC	31740 VA	65.75%	20870 VA	TOTAL CONNECTED CURRENT:	277 A
Receptacle	2160 VA	100.00%	2160 VA	TOTAL ESTIMATED DEMAND CURRENT:	222 A
				10 % ADDITIONAL CAPACITY:	22 A
				TOTAL PANEL CURRENT:	244 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: DP-L2B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 155
AMPERES: 1000 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** T-DP-L2B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1				21.6	10.0					2	
	3	M-L2B	400 A	3		21.0	11.0	3	225 A	R-L2B	4	
	5						17.7	11.2			6	
	7				12.8	25.2					8	
	9	K-L2B	225 A	3		10.5	21.6	3	400 A	EV-LEB	10	
	11						9.5	18.0			12	
	13				20.4	0.2					14	
	15	R-L2D	250 A	3		22.7	0.2	3	20 A	M-DP-L2B-PROC - ENERGY METER	16	
	17						19.8	0.2			18	
	19				0.2	7.0					20	
	21	M-DP-L2B-PL - ENERGY METER	20 A	3		0.2	7.0	3	400 A	THEATER LIGHTING RELAY PANEL	22	
	23						0.2	7.0			24	
	25				0.2	0.0					26	
	27	EQUIP Space 155	20 A	3		0.2	0.0	3	100 A	SPARE	28	
	29						0.2	0.0			30	
	31				0.0	--					32	
	33	SPARE	225 A	3		0.0	--	3	--	SPACE	34	
	35						0.0	--			36	
	37				--	--					38	
	39	SPACE	--	3		--	--	3	--	SPACE	40	
	41						--	--			42	
					97.6 kVA	94.2 kVA	83.7 kVA					
					827 A	799 A	698 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	79900 VA	90.00%	71910 VA	TOTAL CONNECTED LOAD:	275585 VA
HVAC	59325 VA	85.00%	50426 VA	TOTAL ESTIMATED DEMAND:	252772 VA
LTNG	0 VA	0.00%	0 VA	TOTAL CONNECTED CURRENT:	765 A
REC	33780 VA	64.80%	21890 VA	TOTAL ESTIMATED DEMAND CURRENT:	702 A
KITCH	24440 VA	65.00%	15886 VA	10 % ADDITIONAL CAPACITY:	70 A
Receptacle	13320 VA	87.54%	11660 VA	TOTAL PANEL CURRENT:	772 A
Continuous Load	64800 VA	125.00%	81000 VA		

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. MAIN BREAKER AND PANEL ASSEMBLY SHALL BE 100% RATED. PROVIDE MAIN BREAKER WITH LSIG AND ARMS.

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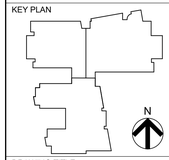
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL PANEL SCHEDULES 208V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.04

5/18/2026 11:12:41 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L1B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** MECH 369
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L1B

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH CLOSET B011A - VHP	25 A	2	1.0	2.7					2	40 A	MECH CLOSET B011A - VHP	2	
	3						1.0	2.7						4	
	5	MECH CLOSET B009A - VHP	40 A	2					2.7	3.1	2	50 A	MECH CLOSET B009A - VHP	6	
	7				2.7	3.1								8	
	9	MECH B005 - VHP	40 A	2			2.1	0.7			2	20 A	TECH STOR B019A - HHP	10	
	11								2.1	0.7				12	
	13	MECH B110A - VHP	40 A	2	2.7	1.0					2	25 A	MECH B110A - VHP	14	
	15						2.7	1.0						16	
	17	MECH B108A - VHP	40 A	2					2.7	3.1	2	40 A	MECH B108A - VHP	18	
	19				2.7	3.1								20	
	21	STAIR #3 S001 - EUH	30 A	3			2.2	2.9						22	
	23								2.2	2.9	3	30 A	CORRIDOR C001 - EUH	24	
	25				2.2	2.9								26	
	27	CORRIDOR C002 - VAV POWER	20 A	1			0.5	0.5			1	20 A	LIBRARY B020 - MOTORIZED SHADES	28	
	29	CORRIDOR C002 - VAV POWER	20 A	1					0.5	0.5	1	20 A	LIBRARY B020 - MOTORIZED SHADES	30	
	31	MECH B005 - P-3	20 A	1	1.0	0.5					1	20 A	CLASSROOM B009 - VAV	32	
	33	MECH B005 - P-2	20 A	1			0.5	0.5			1	20 A	BO B023 - P-2	34	
	35	SPARE	40 A	2					0.0	0.0	2	40 A	SPARE	36	
	37				0.0	0.0								38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					25.5 kVA		17.4 kVA		20.4 kVA						
					217 A		145 A		174 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	1500 VA	90.00%	1350 VA	TOTAL CONNECTED LOAD:	63299 VA
HVAC	61799 VA	85.00%	52529 VA	TOTAL ESTIMATED DEMAND:	53879 VA
				TOTAL CONNECTED CURRENT:	176 A
				TOTAL ESTIMATED DEMAND CURRENT:	150 A
				10 % ADDITIONAL CAPACITY:	15 A
				TOTAL PANEL CURRENT:	165 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L2B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 155
AMPERES: 400 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2B

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH A150B - VHP	40 A	2	2.7	0.4					2	20 A	T A147 - RECEPTACLE	2	
	3						2.7	0.4						4	
	5	JAN A149 - TP-1	20 A	1					0.2	0.5	1	20 A	MEZZ M140 - P-2	6	
	7	CAFETERIA A137 - MOTORIZED SHADES	20 A	1	0.5	1.4					2	25 A	MECH A142B - VHP	8	
	9	MECH A142B - VHP	30 A	2			1.7	1.4						10	
	11								1.7	1.4	2	25 A	MECH A141B - VHP	12	
	13	MECH A135B - VHP	30 A	2	1.7	1.4								14	
	15						1.7	1.0			2	25 A	MECH A135B - VHP	16	
	17	MECH A134B - VHP	30 A	2					1.7	1.0				18	
	19				1.7	1.4					2	25 A	MECH A134B - VHP	20	
	21	3 - ROOF - KEF-2	20 A	3			0.4	1.4						22	
	23								0.4	0.6	3	20 A	3 - ROOF - KEF-1	24	
	25				0.4	0.6								26	
	27	CORRIDOR C104 - VAV POWER	20 A	1			0.5	0.6						28	
	29	CORRIDOR C105 - P-2	20 A	1					0.5	0.5	1	20 A	CORRIDOR C105 - VAV POWER	30	
	31	KITCHEN A138 - VAV POWER	20 A	1	0.5	0.5					1	20 A	CORRIDOR C105 - VAV POWER	32	
	33						2.9	0.5			1	20 A	CORRIDOR C104 - VAV POWER	34	
	35	CORRIDOR C106 - EUH	30 A	3					2.9	0.5	1	20 A	LOAD A147 - P-2	36	
	37				2.9	2.9								38	
	39	ROOF - EF	20 A	1			0.2	2.9			3	30 A	CORRIDOR C104 - EUH	40	
	41								0.0	2.9				42	
	43	SPARE	20 A	3	0.0	2.9								44	
	45						0.0	2.9			3	30 A	PLANETARIUM A150 - EUH	46	
	47	SPARE	30 A	2					0.0	2.9				48	
	49				0.0	0.0								50	
	51	SPARE	30 A	2			0.0	0.0			2	25 A	SPARE	52	
	53								0.0	0.0				54	
	55	SPARE	20 A	1	0.0	0.0					2	25 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
	61	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	62	
	63	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	64	
	65	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	66	
	67	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	68	
	69	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	70	
	71	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	74	
	75	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	76	
	77	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	80	
	81	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	82	
	83	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	84	
					21.6 kVA		21.0 kVA		17.7 kVA						
					185 A		179 A		147 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	1000 VA	90.00%	900 VA	TOTAL CONNECTED LOAD:	60325 VA
HVAC	59325 VA	85.00%	50426 VA	TOTAL ESTIMATED DEMAND:	51326 VA
				TOTAL CONNECTED CURRENT:	167 A
				TOTAL ESTIMATED DEMAND CURRENT:	142 A
				10 % ADDITIONAL CAPACITY:	14 A
				TOTAL PANEL CURRENT:	157 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L1C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** EL 246
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH B033A - VHP	40 A	2	2.7	1.7					2	30 A	MECH B033A - VHP	2	
	3						2.7	1.7						4	
	5	MECH B031A - VHP	40 A	2					2.7	1.0	2	25 A	MECH B031A - VHP	6	
	7				2.7	1.0								8	
	9	CORRIDOR C003 - VAV POWER	20 A	1			0.5	3.1			2	50 A	MECH B038B - VHP	10	
	11	CORRIDOR C002 - VAV POWER	20 A	1					0.5	3.1				12	
	13	IT OFF B024 - HHP	20 A	2	0.4	0.5					1	20 A	CORRIDOR C003 - VAV POWER	14	
	15						0.4	0.0			2	40 A	SPARE	16	
	17								2.2	0.0				18	
	19	STAIR #2 S002 - EUH	30 A	3	2.2	0.0					2	40 A	SPARE	20	
	21						2.2	0.0						22	
	23	SPARE	40 A	2					0.0	0.0	1	20 A	SPARE	24	
	25				0.0	0.0					1	20 A	SPARE	26	
	27	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					11.2 kVA		10.5 kVA		9.5 kVA						
					94 A		89 A		79 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	31146 VA	85.00%	26474 VA	TOTAL CONNECTED LOAD:	31146 VA
				TOTAL ESTIMATED DEMAND:	26474 VA
				TOTAL CONNECTED CURRENT:	86 A
				TOTAL ESTIMATED DEMAND CURRENT:	73 A
				10 % ADDITIONAL CAPACITY:	7 A
				TOTAL PANEL CURRENT:	81 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L2C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 143
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH B131A - VHP	25 A	2	1.0	2.7					2	40 A	MECH B131A - VHP	2	
	3						1.0	2.7						4	
	5	MECH B133A - VHP	40 A	2					1.7	2.7	2	40 A	MECH B133A - VHP	6	
	7				1.7	2.7								8	
	9	MECH B123 - VHP	40 A	2			3.1	2.1			2	40 A	MECH B123 - VHP	10	
	11								3.1	2.1				12	
	13	MECH B123 - VHP	25 A	2	1.4	2.7					2	50 A	MECH B123 - HHP	14	
	15						1.4	2.7						16	
	17	MECH B123 - HHP	25 A	2					1.4	2.1	2	40 A	MECH B102 - VHP	18	
	19				1.4	2.1								20	
	21	MECH B102 - VHP	25 A	2			1.4	1.4			2	25 A	MECH B121 - VHP	22	
	23								1.4	1.4				24	
	25	MECH B121 - VHP	25 A	2	1.4	0.5					1	20 A	CORRIDOR C107 - VAV POWER	26	
	27						1.4	0.5			1	20 A	CORRIDOR C107 - VAV POWER	28	
	29	MECH B123 - P-2	20 A	1					0.5	0.5	1	20 A	CORRIDOR C108 - VAV POWER	30	
	31	CLASSROOM B133 - EF-1	20 A	1	0.2	0.5					1	20 A	CORRIDOR C108 - VAV POWER	32	
	33	CORRIDOR C101S - VAV POWER	20 A	1			0.5	2.1			2	40 A	MECH B123 - HHP	34	
	35	CORRIDOR C108 - VAV POWER	20 A	1					0.5	2.1				36	
	37	MECH B123 - HHP	20 A	2	0.7	0.0					2	40 A	SPARE	38	
	39						0.7	0.0						40	
	41	MECHANICAL MEZZANINE VAV POWER	20 A	1					0.5	0.0	2	25 A	SPARE	42	
	43	SPARE	40 A	2	0.0	0.0								44	
	45						0.0	0.0			1	20 A	SPARE	46	
	47	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	48	
	49	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	50	
	51	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	52	
	53	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	54	
	55	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
					18.9 kVA		20.9 kVA		20.0 kVA						
					157 A		176 A		168 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	59798 VA	85.00%	50828 VA	TOTAL CONNECTED LOAD:	59798 VA
				TOTAL ESTIMATED DEMAND:	50828 VA
				TOTAL CONNECTED CURRENT:	166 A
				TOTAL ESTIMATED DEMAND CURRENT:	141 A
				10 % ADDITIONAL CAPACITY:	14 A
				TOTAL PANEL CURRENT:	155 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L3D — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** <ENGINEER TO SPECIFY>
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** MECH 338
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH B225A - VHP	20 A	2	0.7	0.5					1	20 A	CORRIDOR C203 - VAV POWER	2	
	3						0.7	2.7			2	40 A	3 - MECH CLOSET - VHP	4	
	5	VAV POWER	20 A	1					0.5	2.7				6	
	7	3 - MECH CLOSET - VHP	40 A	2	2.7	1.4					2	25 A	3 - MECH CLOSET - VHP	8	
	9						2.7	1.4						10	
	11	CORRIDOR C203 - VAV POWER	20 A	1					0.5	5.6				12	
	13	MECH B220A - VHP	40 A	2	1.7	5.6					3	60 A	KILN B228A - KILN	14	
	15						1.7	5.6						16	
	17	PREP B229A - P-2	20 A	1					0.5	0.2	1	20 A	CLASSROOM B227 - EF	18	
	19	SPARE	20 A	2	0.0	0.0					2	20 A	SPARE	20	
	21						0.0	0.0						22	
	23	SPARE	20 A	2					0.0	0.0	2	20 A	SPARE	24	
	25				0.0	0.0								26	
	27	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					12.5 kVA		14.7 kVA		10.0 kVA						
					107 A		126 A		83 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	16804 VA	90.00%	15124 VA	TOTAL CONNECTED LOAD:	37210 VA
HVAC	20406 VA	85.00%	17345 VA	TOTAL ESTIMATED DEMAND:	32469 VA
				TOTAL CONNECTED CURRENT:	103 A
				TOTAL ESTIMATED DEMAND CURRENT:	90 A
				25 % ADDITIONAL CAPACITY:	23 A
				TOTAL PANEL CURRENT:	113 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L2A — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Room 356
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2A

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	NURSE A118 - HHP	20 A	2	0.7	0.4					2	20 A	STOR A113 - HHP	2	
	3						0.7	0.4						4	
	5	ADMIN A100 - HHP	20 A	2					0.7	0.4	2	20 A	ADMIN A100 - HHP	6	
	7				0.7	0.4								8	
	9	ADMIN A100 - HHP	20 A	2			0.7	0.4			2	20 A	ADMIN A100 - HHP	10	
	11								0.7	0.4				12	
	13	ADMIN A100 - HHP	20 A	2	0.4	0.7					2	20 A	ADMIN A100 - HHP	14	
	15						0.4	0.7						16	
	17	ADMIN A100 - HHP	20 A	2					0.4	0.7	2	20 A	OFFICE A125 - HHP	18	
	19				0.4	0.7								20	
	21	OFFICE A124 - HHP	20 A	2			0.7	1.4			2	25 A	MECH A130A - VHP	22	
	23								0.7	1.4				24	
	25	ADMIN A100 - HHP	20 A	2	0.4	0.5					1	20 A	ADMIN A100 - VAV POWER	26	
	27						0.4	0.1			1	20 A	GYM MEZZANINE - CP-1	28	
	29	MECH A130A - VHP	25 A	2					1.0	0.1	1	20 A	GYM MEZZANINE - CP-1	30	
	31				1.0	0.4					2	20 A	SE ADMIN A129 - HHP	32	
	33	MECH MEZZANINE - VHP	25 A	2			1.4	0.4						34	
	35								1.4	0.5	1	20 A	ADMIN A100 - VAV POWER	36	
	37	SPEECH A127 - HHP	20 A	2	0.4	0.5					1	20 A	CORRIDOR C103 - VAV POWER	38	
	39						0.4	0.1			1	20 A	SE ADMIN A129 - CP-1	40	
	41	CORRIDOR C103 - VAV POWER	20 A	1					0.5	0.1	1	20 A	ADMIN A100 - CP-1	42	
	43	SPEECH A127 - CP-1	20 A	1	0.1	2.9								44	
	45	ADMIN 100 - CP-1	20 A	1			0.1	2.9			3	30 A	CORRIDOR C103 - EUH	46	
	47	ADMIN A100 - CP-1	20 A	1					0.1	2.9				48	
	49				2.9	0.1					1	20 A	GYM STOR A121B - CP-1	50	
	51	CORRIDOR C102 - EUH	30 A	3			2.9	0.0			1	20 A	SPARE	52	
	53								2.9	0.0	1	20 A	SPARE	54	
	55	MECHANICAL MEZZANINE - P-2	20 A	1	0.5	0.0					2	20 A	SPARE	56	
	57	SPARE	20 A	2			0.0	0.0						58	
	59				0.0	0.0								60	
	61	SPARE	20 A	2					0.0	0.0	2	20 A	SPARE	62	
	63				0.0	0.0								64	
	65	SPARE	20 A	2					0.0	0.0	2	20 A	SPARE	66	
	67				0.0	0.0								68	
	69	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	70	
	71	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	74	
	75	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	76	
	77	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	80	
	81	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	82	
	83	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	84	
					14.0 kVA		13.9 kVA		14.8 kVA						
					117 A		116 A		123 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	42720 VA	85.00%	36312 VA	TOTAL CONNECTED LOAD:	42720 VA
				TOTAL ESTIMATED DEMAND:	36312 VA
				TOTAL CONNECTED CURRENT:	119 A
				TOTAL ESTIMATED DEMAND CURRENT:	101 A
				10 % ADDITIONAL CAPACITY:	10 A
				TOTAL PANEL CURRENT:	111 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: M-L3C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** MECH 220
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L1B

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MECH B206B - VHP	20 A	2	0.7	2.7					2	40 A	MECH B206B - VHP	2	
	3						0.7	2.7						4	
	5	MECH B204A - VHP	50 A	2					3.1	2.7	2	40 A	MECH B204A - VHP	6	
	7				3.1	2.7								8	
	9	MECH B215 - VHP	25 A	2			1.4	1.4			2	25 A	MECH B215 - VHP	10	
	11								1.4	1.4				12	
	13	MECH/ELEC B203A - VHP	40 A	2	2.1	3.3					2	60 A	MECH B215 - VHP	14	
	15						2.1	3.3						16	
	17	CORRIDOR C202 - VAV POWER	20 A	1					0.5	0.5	1	20 A	CORRIDOR C202 - VAV POWER	18	
	19	CORRIDOR C202 - VAV POWER	20 A	1	0.5	2.2								20	
	21	SPARE	40 A	2			0.0	2.2			3	30 A	MECH/ELEC B203A - EUH	22	
	23								0.0	2.2				24	
	25	SPARE	25 A	2	0.0	0.0					2	40 A	SPARE	26	
	27						0.0	0.0						28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					17.2 kVA		13.7 kVA		11.7 kVA						
					146 A		117 A		97 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
HVAC	42584 VA	85.00%	36196 VA	TOTAL CONNECTED LOAD:	42584 VA
				TOTAL ESTIMATED DEMAND:	36196 VA
				TOTAL CONNECTED CURRENT:	118 A
				TOTAL ESTIMATED DEMAND CURRENT:	100 A
				10 % ADDITIONAL CAPACITY:	10 A
				TOTAL PANEL CURRENT:	111 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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PANELBOARD AND WIRING SCHEDULE

PANEL: R-L1B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** ELEC B004A
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L1B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1	CLASSROM B012 - RECEPTACLE	20 A	1	0.7 0.8			1	20 A	CLASSROM B012 - RECEPTACLE	2	
	3	CLASSROM B011 - RECEPTACLE	20 A	1		0.7 0.8		1	20 A	CLASSROM B011 - RECEPTACLE	4	
	5	SGI B014 - RECEPTACLE	20 A	1			1.2 1.2	1	20 A	SGI B014 - RECEPTACLE	6	
	7	CLASSROM B016 - RECEPTACLE	20 A	1	0.7 1.2			1	20 A	CLASSROM B016 - RECEPTACLE	8	
	9	T B017 - RECEPTACLE	20 A	1		0.2 1.0		1	20 A	BO B023 - RECEPTACLE	10	
	11	BO B022 - RECEPTACLE	20 A	1			1.0 1.0	1	20 A	BO B012 - RECEPTACLE	12	
	13	MAKER B019 - RECEPTACLE	20 A	1	0.9 0.7			1	20 A	MAKER B019 - RECEPTACLE	14	
	15	SCIENCE B001 - RECEPTACLE	20 A	1		1.2 0.5		1	20 A	SCIENCE B001 - RECEPTACLE	16	
	17	MAIN ELECTRICAL - VIP RECEPTACLE	20 A	1			0.2 0.5	1	20 A	T B008 - RECEPTACLE	18	
	19	JAN B002 - RECEPTACLE	20 A	1	0.2 0.4			1	20 A	MECH CLOSET B011A - RECEPTACLE	20	
	21	CORRIDOR C002 - RECEPTACLE	20 A	1		0.5 0.2		1	20 A	STOR B003 - RECEPTACLE	22	
	23	FLEX CLASSROOM B041 - RECEPTACLE	20 A	1			0.6 0.2	1	20 A	CORRIDOR C002 - WATER FOUNTAIN	24	GFCI
	25	SCIENCE B003 - RECEPTACLE	20 A	1	0.7 0.7			1	20 A	FLEX CLASSROOM B041 - RECEPTACLE	26	
	27	LIBRARY B020 - RECEPTACLE	20 A	1		1.4 0.5		1	20 A	CORRIDOR C002 - RECEPTACLE	28	
	29	LIBRARY B020 - FLOORBOX	20 A	1			0.7 0.7	1	20 A	LIBRARY B020 - FLOORBOX	30	
	31	LIBRARY B020 - FLOORBOX	20 A	1	0.4 0.4			1	20 A	LIBRARY B020 - FLOORBOX	32	
	33	LIBRARY B020 - FLOORBOX	20 A	1		0.4 0.4		1	20 A	LIBRARY B020 - FLOORBOX	34	
	35	MAKER B019 - FLOORBOX	20 A	1			0.4 0.5	1	20 A	MECH B005 - RECEPTACLE	36	
	37	SCIENCE B001 - RECEPTACLE	20 A	1	1.0 0.4			1	20 A	MAKER B019 - FLOORBOX	38	
	39	MAKER B019 - FLOORBOX	20 A	1		0.4 0.4		1	20 A	MAKER B019 - FLOORBOX	40	
	41	FLEX CLASSROOM B041 - FLOORBOX	20 A	1			0.7 0.4	1	20 A	LIBRARY B020 - FLOORBOX	42	
	43	FLEX CLASSROOM B041 - FLOORBOX	20 A	1	0.7 0.7			1	20 A	LIBRARY B020 - FLOORBOX	44	
	45	BO B022 - FLOORBOX	20 A	1		0.4 0.4		1	20 A	BO B023 - FLOORBOX	46	
	47	LIBRARY B020 - FLOORBOX	20 A	1			0.4 0.4	1	20 A	BO B021 - FLOORBOX	48	
	49	LIBRARY B020 - FLOORBOX	20 A	1	0.7 1.2			1	20 A	LIBRARY B020 - RECEPTACLE	50	
	51	MECH B005 - RECEPTACLE	20 A	1		0.5 0.7		1	20 A	BO B013 - RECEPTACLE	52	
	53	CLASSROM B012 - CEILING RECEPTACLE	20 A	1			0.7 0.2	1	20 A	CLASSROM B016 - CEILING RECEPTACLE	54	
	55	B.O B013 - DISPLAY RECEPTACLE	20 A	1	0.2 0.7			1	20 A	CLASSROM B015 - RECEPTACLE	56	
	57	CLASSROM B010 - RECEPTACLE	20 A	1		1.2 0.7		1	20 A	CLASSROM B009 - RECEPTACLE	58	
	59	CLASSROM B009 - RECEPTACLE	20 A	1			1.2 0.4	1	20 A	SCIENCE B001 - CELING RECEPTACLE	60	
	61	CORRIDOR C001 - TV RECEPTACLE	20 A	1	0.2 0.2			1	20 A	CLASSROM B027 - CEILING RECEPTACLE	62	
	63	EXTERIOR - RECEPTACLE	20 A	1		0.4 0.2		1	20 A	EXTERIOR - RECEPTACLE	64	
	65	SPARE	20 A	1			0.0 0.2	1	20 A	EXTERIOR - RECEPTACLE	66	
	67	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	68	
	69	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	70	
	71	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	74	
	75	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	76	
	77	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	80	
	81	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	82	
	83	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	84	
					13.8 kVA	13.0 kVA	12.7 kVA					
					116 A	109 A	106 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	3900 VA	90.00%	3510 VA	TOTAL CONNECTED LOAD:	39540 VA
REC	29340 VA	67.04%	19670 VA	TOTAL ESTIMATED DEMAND:	29480 VA
Receptacle	6300 VA	100.00%	6300 VA	TOTAL CONNECTED CURRENT:	110 A
				TOTAL ESTIMATED DEMAND CURRENT:	82 A
				10 % ADDITIONAL CAPACITY:	8 A
				TOTAL PANEL CURRENT:	90 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L1C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** EL 246
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1	CORRIDOR C003 - RECEPTACLE	20 A	1	0.4 0.7			1	20 A	SCIENCE B038 - RECEPTACLE	2	
	3	SCIENCE B038 - RECEPTACLE	20 A	1		0.9 1.1		1	20 A	SCIENCE B038 - RECEPTACLE	4	
	5	STRIDE B036 - RECEPTACLE	20 A	1			1.6 0.5	1	20 A	T B035 - RECEPTACLE	6	
GFCI	7	CORRIDOR C003 - WATER FOUNTAIN	20 A	1	0.2 0.8			1	20 A	CLASSROOM B033 - RECEPTACLE	8	
	9	CLASSROOM B033 - RECEPTACLE	20 A	1		0.7 0.7		1	20 A	CLASSROOM B032 - RECEPTACLE	10	
	11	CLASSROOM B032 - RECEPTACLE	20 A	1			0.8 0.7	1	20 A	CLASSROOM B031 - RECEPTACLE	12	
	13	CLASSROOM B031 - RECEPTACLE	20 A	1	0.8 0.7			1	20 A	CLASSROOM B030 - RECEPTACLE	14	
	15	CLASSROOM B030 - RECEPTACLE	20 A	1		0.8 0.6		1	20 A	MATH B028 - RECEPTACLE	16	
	17	MATH B028 - RECEPTACLE	20 A	1			0.5 0.7	1	20 A	CLASSROOM B027 - RECEPTACLE	18	
	19	CLASSROOM B027 - RECEPTACLE	20 A	1	0.8 1.2			1	20 A	GRN SCR B026A - RECEPTACLE	20	
	21	IT OFF B024 - RECEPTACLE	20 A	1		0.6 0.6		1	20 A	OFF/WR B025 - RECEPTACLE	22	
	23	MULTIMEDIA B026 - AV RECEPTACLE	20 A	1			0.9 0.4	1	20 A	TEACHER B040 - RECEPTACLE	24	
	25	CORRIDOR 371 - RECEPTACLE	20 A	1	0.5 0.8			1	20 A	TEACHER B040 - RECEPTACLE	26	
	27	MECH B038B - RECEPTACLE	20 A	1		0.2 0.4		1	20 A	BO B029 - RECEPTACLE	28	
GFCI	29	TEACHER B040 - MICROWAVE	20 A	1			0.2 0.4	1	20 A	BO B029 - RECEPTACLE	30	
	31	EL B035A - RECEPTACLE	20 A	1	0.2 1.0			1	20 A	MULTIMEDIA B026 - RECEPTACLE	32	
	33	TEACHER B040 - COPIER	20 A	1		0.2 0.4		1	20 A	MECH B031A - RECEPTACLE	34	
	35	CLASSROOM - CEILING RECEPTACLE	20 A	1			0.7 0.2	1	20 A	SCIENCE B038 - CEILING RECEPTACLE	36	
	37	ELEV 2 E002 - GFI RECEPTACLE	20 A	1	0.2 0.2			1	20 A	MULTIMEDIA B026 - SOUND BOOTH	38	
	39	MULTIMEDIA B026 - SOUND BOOTH	20 A	1		0.2 0.0		1	20 A	SPARE	40	
	41	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	42	
	43	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	44	
	45	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	46	
	47	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	48	
	49	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	50	
	51	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	52	
	53	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	54	
	55	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	56	
	57	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	58	
	59	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	60	
	61	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	62	
	63	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	64	
	65	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	66	
	67	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	68	
	69	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	70	
	71	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	74	
	75	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	76	
	77	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	80	
	81	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	82	
	83	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	84	
					8.5 kVA	7.4 kVA	7.6 kVA					
					71 A	62 A	64 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	1800 VA	90.00%	1620 VA	TOTAL CONNECTED LOAD:	23580 VA
REC	17640 VA	78.34%	13820 VA	TOTAL ESTIMATED DEMAND:	19580 VA
Receptacle	4140 VA	100.00%	4140 VA	TOTAL CONNECTED CURRENT:	65 A
				TOTAL ESTIMATED DEMAND CURRENT:	54 A
				10 % ADDITIONAL CAPACITY:	5 A
				TOTAL PANEL CURRENT:	60 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L2A — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Room 356
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2A

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1	EXAM A120 - RECEPTACLE	20 A	1	0.6 0.2			1	20 A	EXAM A120 - RECEPTACLE	2	
	3	COTS A115 - RECEPTACLE	20 A	1		1.1 0.6		1	20 A	NURSE A118 - RECEPTACLE	4	
	5	T A118B - RECEPTACLE	20 A	1			0.7 0.8	1	20 A	PSY A109 - RECEPTACLE	6	
	7	COUNS. A108 - RECEPTACLE	20 A	1	1.0 1.0			1	20 A	COUNS. A107 - RECEPTACLE	8	
	9	COUNSEL A106 - RECEPTACLE	20 A	1		1.0 1.0		1	20 A	SW A105 - RECEPTACLE	10	
	11	SW A104 - RECEPTACLE	20 A	1			1.0 1.4	1	20 A	PRIN. A103 - RECEPTACLE	12	
	13	ASSIST PRIN. A102 - RECEPTACLE	20 A	1	1.2 1.2			1	20 A	ASSIST PRIN. A101 - RECEPTACLE	14	
	15	ADMIN A100 - RECEPTACLE	20 A	1		1.0 0.4		1	20 A	ADMIN A100 - RECEPTACLE	16	
	17	CORRIDOR C102 - RECEPTACLE	20 A	1			0.4 0.9	1	20 A	CORRIDOR C103 - RECEPTACLE	18	
	19	ADMIN A100 - RECEPTACLE	20 A	1	0.8 1.0			1	20 A	ISS A114 - RECEPTACLE	20	
	21	CONF A115 - RECEPTACLE	20 A	1		1.4 1.6		1	20 A	CONF A116 - RECEPTACLE	22	
	23	WKRKM A117 - RECEPTACLE	20 A	1			0.4 1.1	1	20 A	CONF A115 - FLOORBOX	24	
	25	ADMIN A100 - RECEPTACLE	20 A	1	0.9 0.4			1	20 A	T A123A - RECEPTACLE	26	
	27	OFF A124 - RECEPTACLE	20 A	1		0.8 0.5		1	20 A	CHANGING A123 - RECEPTACLE	28	
	29	OFF A125 - RECEPTACLE	20 A	1			0.8 0.7	1	20 A	CHANGING A126 - RECEPTACLE	30	
	31	SPEECH A127 - RECEPTACLE	20 A	1	0.8 0.8			1	20 A	SE OFF A128 - RECEPTACLE	32	
	33	SE ADMIN A129 - RECEPTACLE	20 A	1		0.8 1.0		1	20 A	OT/PT A130 - RECEPTACLE	34	
	35	MEN A132 - RECEPTACLE	20 A	1			0.5 1.0	1	20 A	SKILLS B104 - RECEPTACLE	36	
	37	SKILLS B104 - RECEPTACLE	20 A	1	0.7 0.4			1	20 A	OUTDOOR RECEPTACLE	38	
	39	CORRIDOR C101B - RECEPTACLE	20 A	1		0.4 1.2		1	20 A	WR B103 - RECEPTACLE	40	
	41	WKRKM A117 - PRINTER	20 A	1			0.2 0.9	1	20 A	WKRKM A117 - RECEPTACLE	42	
	43	ADMIN A100 - PRINTER	20 A	1	0.2 0.2			1	20 A	EXAM A120 - REFRIGERATOR	44	
	45	OUTDOOR GENERATOR RECEPTACLE	20 A	1		0.2 0.2		1	20 A	OUTDOOR UTILITY XFMR RECEPTACLE	46	
	47	ROAS OUTDOOR RECEPTACLE	20 A	1			0.4 0.7	1	20 A	MECHANICAL MEZZANINE - RECEPTACLE	48	
GFCI	49	CORRIDOR C103 - WATER FOUNTAIN	20 A	1	0.2 0.2			1	20 A	CORRIDOR C102 - WATER FOUNTAIN	50	GFCI
	51	JAN A125A - RECEPTACLE	20 A	1		0.2 0.2		1	20 A	CONF A115 - AV RECEPTACLE	52	
GFCI	53	WR B103 - REFRIGERATOR	20 A	1			0.6 0.2	1	20 A	ADMIN A100 - AV RECEPTACLE	54	
	55	CONF A116 - AV RECEPTACLE	20 A	1	0.2 0.2			1	20 A	CORRIDOR C102 - WATER FOUNTAIN	56	GFCI
	57	MAIN CORRIDOR C101 - MARQUEE SIGN	20 A	1		0.5 0.5		1	20 A	MAIN CORRIDOR C101 - MARQUEE SIGN	58	
GFCI	59	NURSE A118 - ICE MAKER	20 A	1			0.2 0.5	1	20 A	MAIN CORRIDOR C101 - MARQUEE SIGN	60	
	61	SPARE	20 A	1	0.0 0.5			1	20 A	MAIN CORRIDOR C101 - DISPLAY	62	
	63	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	64	
	65	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	66	
	67	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	68	
	69	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	70	
	71	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	74	
	75	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	76	
	77	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	80	
	81	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	82	
	83	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	84	
					12.8 kVA	14.7 kVA	13.4 kVA					
					106 A	123 A	112 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	10500 VA	90.00%	9450 VA	TOTAL CONNECTED LOAD:	40800 VA
REC	29040 VA	67.22%	19520 VA	TOTAL ESTIMATED DEMAND:	30230 VA
Receptacle	1260 VA	100.00%	1260 VA	TOTAL CONNECTED CURRENT:	113 A
				TOTAL ESTIMATED DEMAND CURRENT:	84 A
				10 % ADDITIONAL CAPACITY:	8 A
				TOTAL PANEL CURRENT:	92 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L2B — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 155
AMPERES: 225 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2B

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1	BAND A134 - AV RECEPTACLE	20 A	1	0.2 0.2			1	20 A	CHORAL A133 - AV RECEPTACLE	2	
	3	MECH A150B - LIGHTING CONTROL PANEL	20 A	1		0.2 0.2		1	20 A	FAM. CONS. SCI. A143 - DISHWASHER	4	GFCI
	5	ORCHESTRA A135 - AV RECEPTACLE	20 A	1			0.2 0.7	1	20 A	PLANETARIUM A150 - RECEPTACLE	6	
	7	PLANETARIUM A150 - RECEPTACLE	20 A	1	0.7 0.2			1	20 A	ROOF - IKEF OUTDOOR RECEPTACLE	8	
	9	STOR A143A - RECEPTACLE	20 A	1		0.2 0.2		1	20 A	CORRIDOR C106 - RECEPTACLE	10	
	11	PLANETARIUM A150 - RECEPTACLE	20 A	1			0.7 1.0	1	20 A	PLANETARIUM A150 - RECEPTACLE	12	
	13	PLANETARIUM A150 - RECEPTACLE	20 A	1	1.1 0.2			1	20 A	FACULTY DINING A136 - MICROWAVE	14	GFCI
	15	OFF A147B - RECEPTACLE	20 A	1		0.6 0.9		1	20 A	T A145 - RECEPTACLE	16	
	17	BAND A134 - RECEPTACLE	20 A	1			0.2 0.2	1	20 A	CHORAL A133 - RECEPTACLE	18	
	19	T A136A - RECEPTACLE	20 A	1	0.5 1.8			1	20 A	CHORAL A133 - RECEPTACLE	20	
	21	BAND A134 - RECEPTACLE	20 A	1		1.4 0.5		1	20 A	STOR A134A - RECEPTACLE	22	
	23	2-MUSIC ROOM-RECEPTACLE	20 A	1			0.2 0.5	1	20 A	STOR A135A - RECEPTACLE	24	
	25	FACULTY DINING A136 - RECEPTACLE	20 A	1	0.4 1.6			1	20 A	ORCHESTRA A135 - RECEPTACLE	26	
	27	CORRIDOR C104 - RECEPTACLE	20 A	1		0.7 1.4		1	20 A	FACULTY DINING A136 - RECEPTACLE	28	
	29	CAFETERIA A137 - RECEPTACLE	20 A	1			1.4 0.7	1	20 A	CAFETERIA A137 - RECEPTACLE	30	
	31	CAFETERIA A137 - RECEPTACLE	20 A	1	0.5 0.7			1	20 A	CAFETERIA A137 - RECEPTACLE	32	
	33	CORRIDOR C105 - RECEPTACLE	20 A	1		1.1 0.8		1	20 A	PLATFORM A139 - RECEPTACLE	34	
	35	PLATFORM A139 - RECEPTACLE	20 A	1			0.7 0.4	1	20 A	2 - BLACK BOX - FLOORBOX	36	
	37	FACULTY DINING A136 - MICROWAVE	20 A	1	0.2 0.2			1	20 A	2-OUTSIDE-RECEPTACLE	38	
GFCI	39	FACULTY DINING A136 - DISHWASHER	20 A	1		0.2 0.2		1	20 A	CAFETERIA A137 - WATER FOUNTAIN	40	GFCI
	41	PLANETARIUM A150 - RECEPTACLE	20 A	1			0.4 0.4	1	20 A	BLACK BOX A140 - RECEPTACLE	42	
	43	BLACK BOX A140 - RECEPTACLE	20 A	1	0.4 0.2			1	20 A	BLACK BOX A140 - RECEPTACLE	44	
	45	CONTROL A139A - AV RECEPTACLE	20 A	1		0.2 0.2		1	20 A	CONTROL A139A - AV RECEPTACLE	46	
	47	BLACK BOX - PROJECTOR	20 A	1			1.0 0.8	1	20 A	BLACK BOX A140 - RECEPTACLE	48	
	49	MEZZ MISC - RECEPTACLE	20 A	1	0.2 0.0			1	20 A	DIGITAL SITE SIGNAGE	50	
	51	MAIN LEVEL CLASSROOM - SOUND...	20 A	1		0.5 0.5		1	20 A	PLATFORM A139 - PROJECTOR SCREEN	52	
	53	LOAD A147 - COILING DOOR	20 A	1			1.0 0.8	2	30 A	CONTROL A139A - AV RACK	54	
	55	CAFETERIA A137 - FIBER BROADCAST	20 A	1	0.2 0.8						56	
	57	CAFETERIA A137 - PROJECTION SCREEN	20 A	1		0.5 0.5		1	20 A	CAFETERIA A137 - PROJECTOR	58	
	59	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	60	
	61	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	62	
	63	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	64	
	65	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	66	
	67	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	68	
	69	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	70	
	71	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	74	
	75	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	76	
	77	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0 0.0			1	20 A	SPARE	80	
	81	SPARE	20 A	1		0.0 0.0		1	20 A	SPARE	82	
	83	SPARE	20 A	1			0.0 0.0	1	20 A	SPARE	84	
					10.0 kVA	11.0 kVA	11.2 kVA					
					84 A	93 A	94 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	7900 VA	90.00%	7110 VA	TOTAL CONNECTED LOAD:	32200 VA
LTNG	0 VA	0.00%	0 VA	TOTAL ESTIMATED DEMAND:	27590 VA
REC	17640 VA	78.34%	13820 VA	TOTAL CONNECTED CURRENT:	89 A
Receptacle	6660 VA	100.00%	6660 VA	TOTAL ESTIMATED DEMAND CURRENT:	77 A
				10 % ADDITIONAL CAPACITY:	8 A
				TOTAL PANEL CURRENT:	84 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L2C — **MAINS TYPE:** MCB — **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W — **SPD:** — **LOCATION:** Space 143
AMPERES: 100 A — **MOUNTING:** SURFACE — **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	Notes
	1	FLEX LAB B138 - SOUND REINFORCEMENT	20 A	1	0.2 1.2			1	20 A	SPEC ED SELF CONS B105 - RECEPTACLE	2	
	3	FLEX LAB B138 - RECEPTACLE	20 A	1		0.9 1.2		1	20 A	FLEX LAB B138 - RECEPTACLE	4	
	5	CORRIDOR C101S - RECPTACLE	20 A	1			0.5 0.7	1	20 A	CORRIDOR C108 - RECEPTACLE	6	
	7	MATH B128 - RECEPTACLE	20 A	1	1.0 0.5			1	20 A	MATH B128 - RECEPTACLE	8	
	9	CLASSROOM B127 - RECEPTACLE	20 A	1		0.7 1.0		1	20 A	CLASSROOM B127 - RECEPTACLE	10	
	11	T B125 - RECEPTACLE	20 A	1			0.5 0.2	1	20 A	STOR B126 - RECEPTACLE	12	
	13	MECH B123 - RECEPTACLE	20 A	1	0.5 0.5			1	20 A	T B122 - RECEPTACLE	14	
	15	SCIENCE B135 - RECEPTACLE	20 A	1		0.7 0.2		1	20 A	TEACHER B13 - COPIER	16	
	17	SCIENCE B135 - RECEPTACLE	20 A	1			0.7 1.2	1	20 A	SCIENCE B135 - RECEPTACLE	18	
	19	CHORAL A133 - RECEPTACLE	20 A	1	0.8 0.7			1	20 A	ART B134 - RECEPTACLE	20	
	21	CORRIDOR C108 - RECEPTACLE	20 A	1		0.5 0.9		1	20 A	CLASSROOM B133 - RECEPTACLE	22	
	23	CLASSROOM B133 - RECEPTACLE	20 A	1			0.8 0.9	1	20 A	CLASSROOM B132 - RECEPTACLE	24	
	25	CLASSROOM B132 - RECEPTACLE	20 A	1	0.6 0.9			1	20 A	CLASS

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L2E | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** <ENGINEER TO SPECIFY>
VOLTAGE: 208Y/120V,3P,4W | **SPD:** | **LOCATION:** Space 79
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** DP-L2C

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	CLASSROOM B111 - RECEPTACLE	20 A	1	0.9	0.8					1	20 A	CLASSROOM B111 - RECEPTACLE	2	
	3	MAIN LEVEL C - SOUND REINFORCEMENT	20 A	1			0.7	0.5			1	20 A	CORRIDOR C107 - RECEPTACLE	4	
	5	BO B112 - RECEPTACLE	20 A	1					0.4	0.2	1	20 A	L B105A - RECEPTACLE	6	
	7	SGI B113 - RECEPTACLE	20 A	1	1.0	0.5					1	20 A	READING B114 - RECEPTACLE	8	
	9	READING B114 - RECEPTACLE	20 A	1			0.6	0.9			1	20 A	CLASSROOM B110 - RECEPTACLE	10	
	11	CLASSROOM B110 - RECEPTACLE	20 A	1					0.6	0.8	1	20 A	CLASSROOM B109 - RECEPTACLE	12	
	13	CLASSROOM B109 - RECEPTACLE	20 A	1	1.1	0.9					1	20 A	CLASSROOM B108 - RECEPTACLE	14	
	15	CLASSROOM B108 - RECEPTACLE	20 A	1			0.6	0.5			1	20 A	CLASSROOM B115 - RECEPTACLE	16	
	17	CLASSROOM B115 - RECEPTACLE	20 A	1					0.8	0.4	1	20 A	T B116 - RECEPTACLE	18	
GFCI	19	CORRIDOR C107 - WATER FOUNTAIN	20 A	1	0.2	1.2					1	20 A	STRIDE B118 - RECEPTACLE	20	
	21	STRIDE B118 - RECEPTACLE	20 A	1			0.7	0.4			1	20 A	T B119 - RECEPTACLE	22	
	23	MECH B121 - RECEPTACLE	20 A	1					0.4	0.4	1	20 A	2 - CORRIDOR - INTERACTIVE DISPLAY	24	
	25	SCIENCE B101 - RECEPTACLE	20 A	1	1.0	0.7					1	20 A	SCIENCE B101 - RECEPTACLE	26	
	27	SCIENCE B101 - RECEPTACLE	20 A	1			0.5	1.0			1	20 A	SCIENCE B101 - RECEPTACLE	28	
	29	SCIENCE B101 - SOUND REINFORCEMENT	20 A	1					0.2	0.9	1	20 A	L B105A - RECEPTACLE	30	
	31	BED PREP B105C - RECEPTACLE	20 A	1	0.7	0.2					1	20 A	T B105B - RECEPTACLE	32	
	33	SPEC ED B105 - RECIRC. HOOD	20 A	1			0.5	4.4			2	40 A	SPEC ED B105 - RANGE	34	
GFCI	35	SPEC ED B105 - MICROWAVE	20 A	1					0.2	4.4				36	
	37	SPEC ED B105 - RECEPTACLE	20 A	1	0.2	0.2					1	20 A	SPEC ED B105 - DISHWASHER	38	GFCI
GFCI	39	L B105A - DRYER	30 A	2			1.3	0.2			1	20 A	L B105A - WASHER	40	GFCI
	41								1.3	0.0	1	20 A	SPARE	42	
	43	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	44	
	45	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	46	
	47	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	48	
	49	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	50	
	51	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	52	
	53	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	54	
	55	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
					9.7 kVA		13.0 kVA		10.8 kVA						
					81 A		109 A		92 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	11000 VA	90.00%	9900 VA	TOTAL CONNECTED LOAD:	33440 VA
REC	20100 VA	74.88%	15050 VA	TOTAL ESTIMATED DEMAND:	27290 VA
Receptacle	2340 VA	100.00%	2340 VA	TOTAL CONNECTED CURRENT:	93 A
				TOTAL ESTIMATED DEMAND CURRENT:	76 A
				25 % ADDITIONAL CAPACITY:	19 A
				TOTAL PANEL CURRENT:	95 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: K-L2B | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W | **SPD:** | **LOCATION:** Space 184
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** DP-L2B

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
GFCI	1	FRONT LOAD WASHER	30 A	2	2.5	0.2					1	20 A	PREP TABLE WITH SINKS	2	
	3						2.5	0.2			1	20 A	PAPER STOR - RECEPTACLE	4	
	5	OFFICE - RECEPTACLE	20 A	1					1.0	0.6	2	30 A	FRONT LOAD VENTLESS DRYER	6	GFCI
GFCI	7	REFRIGERATOR, REACH IN	20 A	1	0.2	0.6								8	
	9	PREP TABLE WITH SINKS	20 A	1			0.2	0.2			1	20 A	2-BATHROOM-RECEPTACLE	10	
	11	KITCHEN - RECEPTACLE	20 A	1					0.2	0.2	1	20 A	AUTOMATIC SLICER	12	GFCI
GFCI	13	HEATED HOLDING CABINET	20 A	1	0.2	0.2					1	20 A	PREP TABLE WITH SINKS	14	
	15	MOBILE WORK TABLE	20 A	1			0.2	0.2			1	20 A	REFRIGERATED SANDWICH TABLE	16	GFCI
GFCI	17	SERVING COUNTER	20 A	1					0.2	0.2	1	20 A	PREP TABLE WITH SINKS	18	
GFCI	19	FOOD PROCESSOR	20 A	1	0.2	0.7					3	20 A	FORTY-QUART MIXER	20	GFCI
GFCI	21	CONVEYOR TOASTER	20 A	1			0.2	0.7						22	
GFCI	23	DROP IN FOOD WELLS	20 A	2					1.3	0.7				24	
	25				1.3	1.7					2	20 A	REFRIGERATED DISPLAY CASE	26	GFCI
GFCI	27	FOOD MERCHANDISER	20 A	1			0.2	1.7						28	
GFCI	29	HEATED DISPLAY MERCHANDISER	20 A	1					0.2	0.2	1	20 A	SERVING COUNTER	30	GFCI
GFCI	31	DROP IN FOOD WELLS	20 A	2	1.3	0.2					1	20 A	SERVING COUNTER	32	GFCI
	33						1.3	0.2			1	20 A	REFRIGERATOR, PASS THRU	34	GFCI
GFCI	35	HEATED HOLDING CABINET	20 A	1					0.2	0.2	1	20 A	REFRIGERATOR, PASS THRU	36	GFCI
	37	MOBILE WORK TABLE	20 A	1	0.2	0.2					1	20 A	MOBILE WORK TABLE	38	
	39	MOBILE WORK TABLE	20 A	1			0.2	1.3			2	20 A	DROP IN FOOD WELLS	40	GFCI
GFCI	41	REFRIGERATED DISPLAY CASE	20 A	2					1.7	1.3				42	
	43				1.7	0.5					1	20 A	CASHIER TERMINAL	44	GFCI
GFCI	45	CASHIER TERMINAL	20 A	1			0.5	0.5			1	20 A	CASHIER TERMINAL	46	GFCI
	47	KITCHEN - RECEPTACLE	20 A	1					0.7	0.4	1	20 A	KITCHEN - RECEPTACLE	48	
	49	KITCHEN - RECEPTACLE	20 A	1	0.5	0.4					1	20 A	KITCHEN A138 - CEILING RECEPTACLE	50	GFCI
GFCI	51	KITCHEN A138 - CEILING RECEPTACLE	20 A	1			0.4	0.2			1	20 A	KITCHEN A138 - CEILING RECEPTACLE	52	GFCI
GFCI	53	KITCHEN - CLOCK	20 A	1					0.5	0.0	1	20 A	SPARE	54	
	55	KITCHEN A138 - CEILING RECEPTACLE	20 A	1	0.4	0.0					1	20 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
	61	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	62	
	63	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	64	
	65	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	66	
	67	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	68	
	69	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	70	
	71	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	74	
	75	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	76	
	77	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	80	
	81	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	82	
	83	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	84	
					12.8 kVA		10.5 kVA		9.5 kVA						
					108 A		89 A		79 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	1000 VA	90.00%	900 VA	TOTAL CONNECTED LOAD:	32820 VA
REC	2160 VA	100.00%	2160 VA	TOTAL ESTIMATED DEMAND:	24166 VA
KITCH	24440 VA	65.00%	15886 VA	TOTAL CONNECTED CURRENT:	91 A
Receptacle	5220 VA	100.00%	5220 VA	TOTAL ESTIMATED DEMAND CURRENT:	67 A
				10 % ADDITIONAL CAPACITY:	7 A
				TOTAL PANEL CURRENT:	74 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
PROVIDE STAINLESS STEEL COVER FOR ALL PANELBOARDS WITHIN KITCHEN.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L3C | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W | **SPD:** | **LOCATION:** MECH 220
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** DP-L1B

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	CORRIDOR C202 - RECEPTACLE	20 A	1	0.9	0.6					1	20 A	CLASSROOM B207 - RECEPTACLE	2	
	3	CLASSROOM B207 - RECEPTACLE	20 A	1			1.1	0.6			1	20 A	CLASSROOM B206 - RECEPTACLE	4	
	5	CLASSROOM B206 - RECEPTACLE	20 A	1					0.9	0.7	1	20 A	CLASSROOM B205 - RECEPTACLE	6	
	7	CLASSROOM B205 - RECEPTACLE	20 A	1	1.0	0.7					1	20 A	CLASSROOM B204 - RECEPTACLE	8	
	9	CLASSROOM B204 - RECEPTACLE	20 A	1			0.8	0.7			1	20 A	FLEX CLASSROOM B203 - RECEPTACLE	10	
	11	FLEX CLASSROOM B203 - RECEPTACLE	20 A	1					0.8	0.4	1	20 A	OUTDOOR RECEPTACLE	12	
	13	MECH/ELEC B203A - RECEPTACLE	20 A	1	0.5	0.9					1	20 A	SCIENCE B201 - RECEPTACLE	14	
	15	SCIENCE B201 - RECEPTACLE	20 A	1			1.0	0.7			1	20 A	SCIENCE B201 - RECEPTACLE	16	
	17	SCIENCE B201 - RECEPTACLE	20 A	1					1.2	0.8	1	20 A	SGI B209 - RECEPTACLE	18	
	19	READING B210 - RECEPTACLE	20 A	1	0.6	0.5					1	20 A	READING B210 - RECEPTACLE	20	
	21	CLASSROOM B211 - RECEPTACLE	20 A	1			0.8	0.5			1	20 A	CLASSROOM B211 - RECEPTACLE	22	
	23	T B212 - RECEPTACLE	20 A	1					0.4	0.6	1	20 A	STRIDE B214 - RECEPTACLE	24	
	25	STRIDE B214 - RECEPTACLE	20 A	1	0.7	0.9					1	20 A	CORRIDOR C201 - RECEPTACLE	26	
	27	T B216 - RECEPTACLE	20 A	1			0.2	0.2			1	20 A	TEACHER B232 - MICROWAVE	28	GFCI
	29	MATH B222 - RECEPTACLE	20 A	1					1.0	0.5	1	20 A	MATH B222 - RECEPTACLE	30	
	31	CLASSROOM B221 - RECEPTACLE	20 A	1	0.5	1.4					1	20 A	CLASSROOM B221 - RECEPTACLE	32	
	33	T B219 - RECEPTACLE	20 A	1			0.5	0.4			1	20 A	CORRIDOR C203 - RECEPTACLE	34	
	35	T B230 - RECEPTACLE	20 A	1					0.4	1.4	1	20 A	TEACHER B232 - RECEPTACLE	36	
	37	BO B208 - RECEPTACLE	20 A	1	0.4	1.0					1	20 A	SCIENCE B229 - RECEPTACLE	38	
	39	SCIENCE B229 - RECEPTACLE	20 A	1			0.7	0.7			1	20 A	SCIENCE B229 - RECEPTACLE	40	
	41	SCIENCE B229 - RECEPTACLE	20 A	1					1.0	1.6	1	20 A	ART B228 - RECEPTACLE	42	
	43	TEACHER B232 - RECEPTACLE	20 A	1	0.2	0.7					1	20 A	CORRIDOR C203 - RECEPTACLE	44	
	45	ART B228 - RECEPTACLE	20 A	1			0.5	0.7			1	20 A	CLASSROOM B227 - RECEPTACLE	46	
	47	CLASSROOM B227 - RECEPTACLE	20 A	1					1.4	0.7	1	20 A	CLASSROOM B226 - RECEPTACLE	48	
	49	CLASSROOM B226 - RECEPTACLE	20 A	1	1.2	0.7					1	20 A	CLASSROOM B225 - RECEPTACLE	50	
	51	CLASSROOM B225 - RECEPTACLE	20 A	1			1.4	0.7			1	20 A	CLASSROOM B224 - RECEPTACLE	52	
	53	CLASSROOM B224 - RECEPTACLE	20 A	1					1.2	0.2	1	20 A	CORRIDOR C202 - WATER FOUNTAIN	54	
	55	MECH B220A - RECEPTACLE	20 A	1	0.2	0.2					1	20 A	TEACHER B232 - COPIER	56	
GFCI	57	CORRIDOR C203 - WATER FOUNTAIN	20 A	1			0.2	0.7			1	20 A	FLEX CLASSROOM B203 - FLOORBOX	58	
	59	UPPER LEVEL CLASSROOM - SOUND...	20 A	1					0.5	0.9	1	20 A	CORRIDOR C201 - RECEPTACLE	60	
	61	FLEX CLASSROOM B203 - FLOORBOX	20 A	1	0.7	0.5					1	20 A	BO B223 - FLOORBOX	62	
	63	UPPER LEVEL CLASSROOM - SOUND...	20 A	1			0.5	0.5			1	20 A	CLASSROOM - SOUND REINFORCEMENT	64	
	65	SCIENCE B201 - SOUND REINFORCEMENT	20 A	1					0.2	0.7	1	20 A	CLASSROOM - SOUND REINFORCEMENT	66	
	67	ART B228 - POTTERY WHEEL	20 A	1	0.2	0.2					1	20 A	ART B228 - POTTERY WHEEL	68	
	69	ART B228 - POTTERY WHEEL	20 A	1			0.2	0.0			1	20 A	SPARE	70	
	71	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	72	
	73	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	74	
	75	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	76	
	77	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	78	
	79	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	80	
	81	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	82	
	83	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	84	
					15.7 kVA		14.6 kVA		17.7 kVA						
					132 A		122 A		149 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	6900 VA	90.00%	6210 VA	TOTAL CONNECTED LOAD:	47940 VA
REC	34740 VA	64.39%	22370 VA	TOTAL ESTIMATED DEMAND:	34880 VA
Receptacle	6300 VA	100.00%	6300 VA	TOTAL CONNECTED CURRENT:	133 A
				TOTAL ESTIMATED DEMAND CURRENT:	97 A
				10 % ADDITIONAL CAPACITY:	10 A
				TOTAL PANEL CURRENT:	106 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: R-L2F | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** <ENGINEER TO SPECIFY>
VOLTAGE: 208Y/120V,3P,4W | **SPD:** | **LOCATION:** Room 356
AMPERES: 100 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** DP-L2A

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	AUX GYM A122 - RECEPTACLE	20 A	1	1.4	0.9					1	20 A	WEIGHT RM A112C - RECEPTACLE	2	
	3	WEIGHT RM A112C - RECEPTACLE	20 A	1			0.2	0.2			1	20 A	WEIGHT RM A112C - RECEPTACLE	4	
	5	WEIGHT RM A112C - RECEPTACLE	20 A	1					0.2	0.2	1	20 A	WEIGHT RM A112C - RECEPTACLE	6	
	7	STOR A112A - RECEPTACLE	20 A	1	0.5	1.0					1	20 A	CORRIDOR C102 - RECEPTACLE	8	
	9	GYM A121 - MOTORIZED HOOPS	20 A	1			1.5	0.5			1	20 A	GYM A121 - PROJECTOR	10	
	11	GYM A121 - PROJECTOR	20 A	1					0.5	1.5	1	20 A	GYM A121 - MOTORIZED HOOPS	12	
	13	GYM A121 - RECEPTACLE	20 A	1	0.5	0.5					1	20 A	GYM A121 - PROJECTION SCREEN	14	
	15	GYM A121 - SCOREBOARD	20 A	1			0.5	0.3			3	20 A	GYM A121 - BLEACHERS	16	
	17	GYM A121 - PROJECTION SCREEN	20 A	1					0.5	0.3				18	
	19	GYM A121 - BLEACHERS	20 A	3	0.3	0.3								20	
	21						0.3	1.0			1	20 A	GYM A121 - PARTITION	22	
	23								0.3	0.3	3	20 A	GYM A121 - BLEACHERS	24	
	25	GYM A121 - BLEACHERS	20 A	3	0.3	0.3								26	
	27						0.3	0.3						28	
	29								0.3	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	2					0.0	0.0	2	20 A	SPARE	42	
	43				0.0	0.0								44	
	45	SPARE	20 A	2			0.0	0.0			2	20 A	SPARE	46	
	47								0.0	0.0				48	
	49	SPARE	20 A	3	0.0	0.0					3	20 A	SPARE	50	
	51						0.0	0.0						52	
	53								0.0	0.0				54	
	55	SPARE	20 A	3	0.0	0.0					3	20 A	SPARE	56	
	57						0.0	0.0						58	
	59								0.0	0.0				60	
					6.2 kVA		5.2 kVA		4.2 kVA						
					53 A		45 A		35 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	12000 VA	90.00%	10800 VA	TOTAL CONNECTED LOAD:	15600 VA
REC	2700 VA	100.00%	2700 VA	TOTAL ESTIMATED DEMAND:	14400 VA
Receptacle	900 VA	100.00%	900 VA	TOTAL CONNECTED CURRENT:	43 A
				TOTAL ESTIMATED DEMAND CURRENT:	40 A
				25 % ADDITIONAL CAPACITY:	10 A
				TOTAL PANEL CURRENT:	50 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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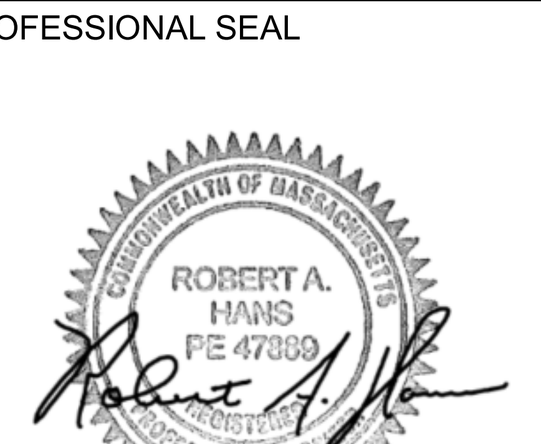
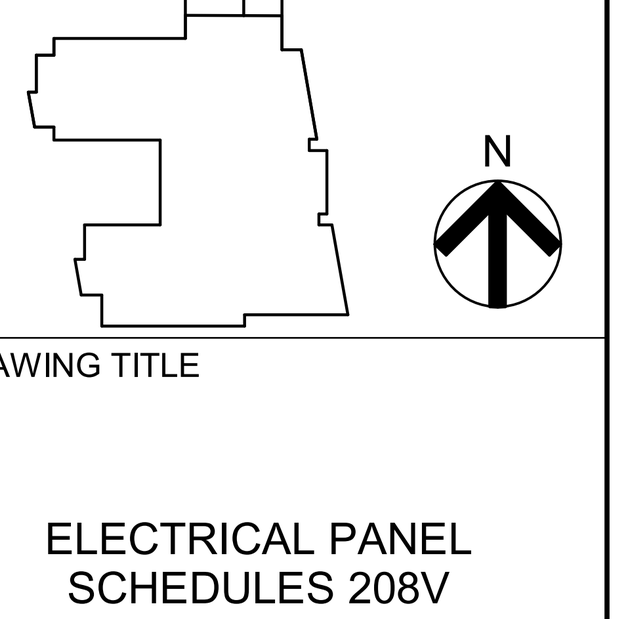


TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL PANEL SCHEDULES 208V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.07

5/18/2026 11:13:02 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

E51 MAIN CIRCUIT BREAKER FOR PANELBOARD SHALL BE PROVIDED WITH LSIG TRIP UNIT.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H1LRB | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** EM 256
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** ATS-LR

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				0.2	18.0								2	
	3	M-EP-H1LRB-ELEV	20 A	3			0.2	18.0			3	90 A	ELEVATOR 1 - MAIN POWER	4	
	5								0.2	18.0				6	
	7				0.0	0.0								8	
	9	SPARE	20 A	3			0.0	0.0			3	20 A	SPARE	10	
	11								0.0	0.0				12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					18.2 kVA		18.2 kVA		18.2 kVA						
					66 A		66 A		66 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	500 VA	90.00%	450 VA	TOTAL CONNECTED LOAD:	54500 VA
				TOTAL ESTIMATED DEMAND:	54450 VA
				TOTAL CONNECTED CURRENT:	66 A
				TOTAL ESTIMATED DEMAND CURRENT:	65 A
				10 % ADDITIONAL CAPACITY:	7 A
				TOTAL PANEL CURRENT:	72 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H2OSB | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** Space 155
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** EP-H1OSB

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				13.6	0.0								2	
	3	T-EP-L2OSB	90 A	3			13.4	0.0			3	100 A	SPARE	4	
	5								11.4	0.0				6	
	7				--	--								8	
	9	SPACE	--	3			--	--			3	--	SPACE	10	
	11								--	--				12	
	13				--	--								14	
	15	SPACE	--	3			--	--			3	--	SPACE	16	
	17								--	--				18	
	19				--	--								20	
	21	SPACE	--	3			--	--			3	--	SPACE	22	
	23								--	--				24	
					13.6 kVA		13.4 kVA		11.4 kVA						
					50 A		50 A		41 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	2500 VA	90.00%	2250 VA	TOTAL CONNECTED LOAD:	38480 VA
HVAC	17370 VA	85.00%	14765 VA	TOTAL ESTIMATED DEMAND:	31211 VA
REC	4740 VA	100.00%	4740 VA	TOTAL CONNECTED CURRENT:	46 A
KITCH	12610 VA	65.00%	8197 VA	TOTAL ESTIMATED DEMAND CURRENT:	38 A
Receptacle	1260 VA	100.00%	1260 VA	10 % ADDITIONAL CAPACITY:	4 A
				TOTAL PANEL CURRENT:	41 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H1OSB | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** EM 256
AMPERES: 600 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** ATS-OS

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				13.6	0.0								2	
	3	EP-H2OSB	225 A	3			13.4	0.0			3	60 A	MECH B005 - P-1B	4	
	5								11.4	0.0				6	
	7				5.8	17.3								8	
	9	MECH B005 - P-1A	60 A	3			5.8	16.5			3	250 A	T-EP-L1OSB	10	
	11								5.8	13.5				12	
	13				59.4	0.2								14	
	15	DOAS-1	250 A	3			59.4	0.2			3	20 A	M-EP-H1OSB-HVAC	16	
	17								59.4	0.2				18	
	19				10.1	10.1								20	
	21	MECH B005 - DWH-1	70 A	3			10.1	10.1			3	70 A	MECH B005 - DWH-2	22	
	23								10.1	10.1				24	
	25				0.0	0.0								26	
	27	SPARE	225 A	3			0.0	0.0			3	100 A	SPARE	28	
	29								0.0	0.0				30	
	31				--	--								32	
	33	SPACE	--	3			--	--			3	--	SPACE	34	
	35								--	--				36	
	37				--	--								38	
	39	SPACE	--	3			--	--			3	--	SPACE	40	
	41								--	--				42	
					116.6 kVA		115.6 kVA		110.6 kVA						
					424 A		420 A		399 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	10000 VA	90.00%	9000 VA	TOTAL CONNECTED LOAD:	342695 VA
HVAC	300285 VA	85.00%	255242 VA	TOTAL ESTIMATED DEMAND:	289769 VA
REC	14940 VA	83.47%	12470 VA	TOTAL CONNECTED CURRENT:	412 A
KITCH	12610 VA	65.00%	8197 VA	TOTAL ESTIMATED DEMAND CURRENT:	349 A
Receptacle	4860 VA	100.00%	4860 VA	10 % ADDITIONAL CAPACITY:	35 A
				TOTAL PANEL CURRENT:	383 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H1LSB | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** EM 256
AMPERES: 225 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** ATS-LS

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				1.5	5.3								2	
1	3	T-EP-L1LSB	50 A	3			1.5	4.3			3	100 A	EP-H2LSB	4	1
	5								1.0	1.5				6	
	7				3.9	5.3								8	
1	9	EP-H2LSA	100 A	3			9.8	3.1			3	100 A	EP-H2LSC	10	1
	11								5.1	1.3				12	
	13	LL AREA C NORTHWEST EM LTG	20 A	1	1.1	1.0					1	20 A	LL AREA C NORTHEAST EM LTG	14	
	15	LL AREA C SOUTHEAST EM LTG	20 A	1			1.2	0.3			1	20 A	SOUTH EXT. EM WALL PACKS	16	
	17	LL AREA C SOUTHWEST EM LTG	20 A	1					1.1	0.2				18	
	19				0.2	0.2					3	20 A	M-EP-H1LSB-LTG-1	20	
	21	M-EP-H1LSB-LTG-2	20 A	3			0.2	0.2						22	
	23								0.2	0.0				24	
	25				0.0	0.0					3	60 A	SPARE	26	
	27	SPARE	100 A	3			0.0	0.0						28	
	29								0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					18.4 kVA		20.5 kVA		10.2 kVA						
					71 A		79 A		37 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	23319 VA	90.00%	20987 VA	TOTAL CONNECTED LOAD:	49094 VA
LTNG	21415 VA	100.00%	21415 VA	TOTAL ESTIMATED DEMAND:	46762 VA
KITCH	1000 VA	100.00%	1000 VA	TOTAL CONNECTED CURRENT:	59 A
Lighting	3360 VA	100.00%	3360 VA	TOTAL ESTIMATED DEMAND CURRENT:	56 A
				10 % ADDITIONAL CAPACITY:	6 A
				TOTAL PANEL CURRENT:	62 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. PROVIDE BREAKER WITH LSIG TRIP UNIT.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H2LSB | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** Space 115
AMPERES: 100 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** EP-H1LSB

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				2.9	0.6					1	20 A	MAIN LEVEL AREA B NORTHEAST EM LTG	2	
	3	T-EP-L2LSB	30 A	3			1.9	1.2			1	20 A	AREA B KITCHEN/CAF EM LTG	4	
	5								0.9	0.3	1	20 A	MAIN LEVEL AREA B EXT. EM LTG	6	
	7	MAIN LEVEL AREA B NORTHWEST EM LTG	20 A	1	1.0	0.4					1	20 A	MAIN LEVEL AREA B SOUTHEAST EM LTG	8	
	9	MAIN LEVEL AREA B SOUTHWEST EM LTG	20 A	1			0.6	0.3			1	20 A	AREA B BLACKBOX EM LTG	10	
	11								0.2	0.2				12	
	13	M-EP-H2LSB-LTG-1	20 A	3	0.2	0.2					3	20 A	M-EP-H2LSB-LTG-2	14	
	15						0.2	0.2						16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					5.3 kVA		4.3 kVA		1.5 kVA						
					21 A		17 A		5 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	5619 VA	90.00%	5057 VA	TOTAL CONNECTED LOAD:	11051 VA
LTNG	4432 VA	100.00%	4432 VA	TOTAL ESTIMATED DEMAND:	10489 VA
KITCH	1000 VA	100.00%	1000 VA	TOTAL CONNECTED CURRENT:	13 A
				TOTAL ESTIMATED DEMAND CURRENT:	13 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	14 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H2LSA | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** Space 81
AMPERES: 100 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** EP-H1LSB

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1				1.5	1.1					1	20 A	MAIN LEVEL AREA A NORTH EM LTG	2	
1	3	T-EP-L2LSA	50 A	3			5.7	0.9			1	20 A	MAIN LEVEL AREA A SOUTH EM LTG	4	
	5								4.5	0.2	1	20 A	MAIN LEVEL AREA A EXT. EM WALL PACKS	6	
	7	MAIN CORRIDOR EM LTG	20 A	1	0.4	0.6					1	20 A	AUX GYM EM LTG	8	
	9	GYM WEST EM LTG	20 A	1			1.3	1.5			1	20 A	GYM EAST EM LTG	10	
	11								0.2	0.2				12	
	13	M-EP-H2LSA-LTG-1	20 A	3	0.2	0.2					3	20 A	M-EP-H2LSA-LTG-2	14	
	15						0.2	0.2						16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					3.9 kVA		9.8 kVA		5.1 kVA						
					14 A		36 A		19 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	12700 VA	90.00%	11430 VA	TOTAL CONNECTED LOAD:	18774 VA
LTNG	2714 VA	100.00%	2714 VA	TOTAL ESTIMATED DEMAND:	17504 VA
Lighting	3360 VA	100.00%	3360 VA	TOTAL CONNECTED CURRENT:	23 A
				TOTAL ESTIMATED DEMAND CURRENT:	21 A
				10 % ADDITIONAL CAPACITY:	2 A
				TOTAL PANEL CURRENT:	23 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. PROVIDE BREAKER WITH LSIG TRIP UNIT.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H2LSC | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** Space 45
AMPERES: 100 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** EP-H1LSB

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	MAIN LEVEL AREA C NORTHEAST EM LTG	20 A	1	1.1	1.8								2	
	3	MAIN LEVEL AREA C MEDIA CEN. EM LTG	20 A	1			1.0	2.1			3	60 A	EP-H3LSC	4	1
	5	MAIN LEVEL AREA C NORTHWEST EM LTG	20 A	1					1.3	0.0				6	
	7	MAIN LEVEL AREA C EAST EM LTG	20 A	1	1.4	1.0					1	20 A	MAIN LEVEL AREA C SOUTHWEST EM LTG	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					5.3 kVA		3.1 kVA		1.3 kVA						
					20 A		12 A		5 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	9711 VA	100.00%	9711 VA	TOTAL CONNECTED LOAD:	9711 VA
				TOTAL ESTIMATED DEMAND:	9711 VA
				TOTAL CONNECTED CURRENT:	12 A
				TOTAL ESTIMATED DEMAND CURRENT:	12 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	13 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. PROVIDE BREAKER WITH LSIG TRIP UNIT.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-H3LSC | **MAINS TYPE:** MCB | **PANEL INTERRUPTING RATING:** 42 KAIC
VOLTAGE: 480Y/277V,3P,4W | **SPD:** Yes | **LOCATION:** ELEC 389
AMPERES: 60 A | **MOUNTING:** SURFACE | **SUPPLY FROM:** EP-H2LSC

Notes	CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT	Notes
	1	UPPER LEVEL AREA C NW EM LTG	20 A	1	0.9	0.9					1	20 A	UPPER LEVEL AREA C SE LTG	2	
	3	UPPER LEVEL AREA C NE EM LTG	20 A	1			1.1	1.0			1	20 A	UPPER LEVEL AREA C SW LTG	4	
	5	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	6	
	7	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0					24	
					1.8 kVA		2.1 kVA		0.0 kVA						
					8 A		9 A		0 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
LTNG	3984 VA	100.00%	3984 VA	TOTAL CONNECTED LOAD:	3984 VA
				TOTAL ESTIMATED DEMAND:	3984 VA
				TOTAL CONNECTED CURRENT:	5 A
				TOTAL ESTIMATED DEMAND CURRENT:	5 A
				10 % ADDITIONAL CAPACITY:	0 A
				TOTAL PANEL CURRENT:	5 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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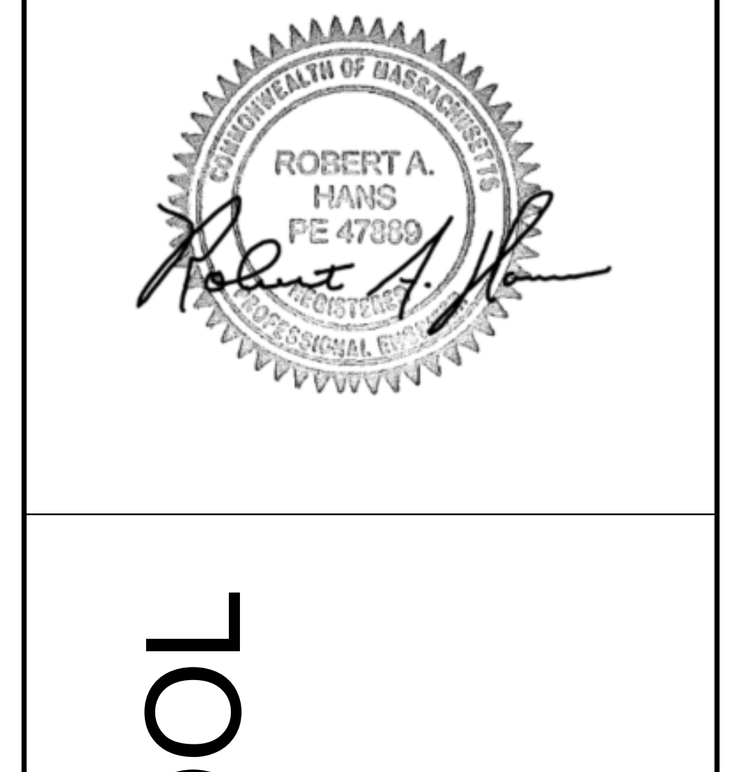
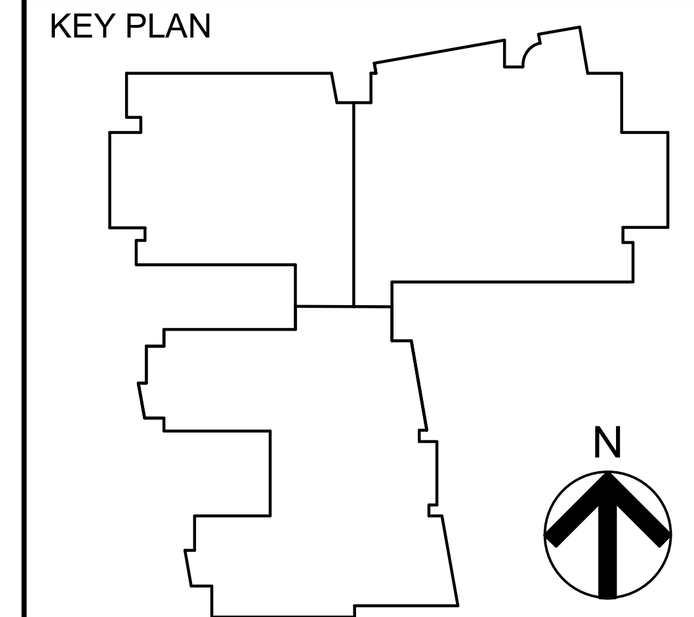


TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL EMERGENCY PANEL SCHEDULES 480V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.08

5/18/2026 11:13:07 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

E51 MAIN CIRCUIT BREAKER FOR PANELBOARD SHALL BE PROVIDED WITH LSIG TRIP UNIT.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L1OSB **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 kAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** EM 256
AMPERES: 400 A **MOUNTING:** SURFACE **SUPPLY FROM:** T-EP-L1OSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	MECH B005 - VHP	50 A	2	3.1	0.7					2	20 A	BO B023 - HHP	2	
	3						3.1	0.7						4	
	5								3.4	4.9				6	
	7	EP-L2OSA	60 A	3	3.8	4.0					3	100 A	EP-L2OSC	8	
	9						2.8	4.0						10	
	11	MDF B018 - RECEPTACLE	20 A	1					0.2	0.2	1	20 A	MDF B018 - RECEPTACLE	12	
	13	MDF B018 - RECEPTACLE	30 A	2	0.8	0.8					2	30 A	MDF B018 - RECEPTACLE	14	
	15						0.8	0.8						16	
	17	MDF B018 - SECURITY PANEL	20 A	1					0.5	0.5	1	20 A	MDF B018 - SECURITY PANEL	18	
	19	MDF B018 - RECEPTACLE	20 A	1	0.5	0.4					1	20 A	MDF B018 - RECEPTACLE	20	
	21	EM B005B - RECEPTACLE	20 A	1			0.5	0.5			1	20 A	ELEC B004A - RECEPTACLE	22	
	23	MECH B005 - BMS PANEL	20 A	1					0.5	0.5	1	20 A	MECH B005 - BMS PANEL	24	
	25	MECH B038B - BMS PANEL	20 A	1	0.5	0.2					1	20 A	ELEV 1 E001 - GFI RECEPTACLE	26	
	27	ELEV 1 E001 - SUMP PUMP	20 A	1			0.2	0.5			1	20 A	JAN B002 - ESP CONTROL PANEL	28	
	29	ELEV 2 E002 - SUMP PUMP	20 A	1					0.2	0.5	1	20 A	MECH B038B - ESP CONTROL PANEL	30	
	31				2.2	0.3					2	20 A	MECH B005 - CP-2	32	
	33	STAIR - EUH	30 A	3			2.2	0.3						34	
	35								2.2	0.0	2	20 A	SPARE	36	
	37	MECH B005 - CP-1	20 A	2	0.3	0.0								38	
	39						0.3	0.0			2	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0				42	
	43	SPARE	20 A	1	0.0	0.0					2	20 A	SPARE	44	
	45	SPARE	20 A	1			0.0	0.0						46	
	47	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	48	
	49	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	50	
	51	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	52	
	53	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	54	
	55	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
					17.3 kVA		16.5 kVA		13.5 kVA						
					148 A		141 A		113 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	7000 VA	90.00%	6300 VA	TOTAL CONNECTED LOAD:	47373 VA
HVAC	26573 VA	85.00%	22587 VA	TOTAL ESTIMATED DEMAND:	42587 VA
REC	10200 VA	99.02%	10100 VA	TOTAL CONNECTED CURRENT:	131 A
Receptacle	3600 VA	100.00%	3600 VA	TOTAL ESTIMATED DEMAND CURRENT:	118 A
				25 % ADDITIONAL CAPACITY:	30 A
				TOTAL PANEL CURRENT:	148 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L2OSB **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** Space 155
AMPERES: 150 A **MOUNTING:** SURFACE **SUPPLY FROM:** T-EP-L2OSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	MECH A150B - BMS PANEL	20 A	1	0.5	1.0					2	20 A	LOAD A147 - HHP	2	
	3	MEZZ M140 - BMS PANEL	20 A	1			0.5	1.0						4	
	5	CORRIDOR C105 - HHP	20 A	2					0.7	0.0	1	20 A	ELEC A147C - EF	6	
	7				0.7	0.4					1	20 A	IT A141A - RECEPTACLE	8	
	9	IT A141A - RECEPTACLE	20 A	1			0.4	0.2			1	20 A	FAM CONS SCI A143 - REFRIGERATOR	10	GFCI
GFCI	11	FAM CONS SCI A143 - REFRIGERATOR	20 A	1					0.2	0.2	1	20 A	FACULTY DINING A136 - REFRIGERATOR	12	GFCI
GFCI	13	FACULTY DINING A136 - REFRIGERATOR	20 A	1	0.2	0.2					1	20 A	IT A141A - RECEPTACLE	14	
	15	IT A141A - RECEPTACLE	30 A	2			0.8	0.5			1	20 A	IT A141 - SECURITY PANEL	16	
	17								0.8	1.3	1	20 A	ELEC A147 - RECEPTACLE	18	
	19	IT A141A - SECURITY PANEL	20 A	1	0.5	2.0					1	30 A	WALK-IN FREEZER LIGHTS, TEMP ALARM	20	
	21	WALK IN COOLER LIGHTS/TEMP/ALARM	20 A	1			1.0	0.2			1	20 A	DRAIN HEAT TRACE	22	
	23	COOLER EVAPORATOR COIL	20 A	1					0.2	0.5	2	20 A	FREEZER EVAPORATOR COIL	24	
	25				1.9	0.5								26	
	27	FREEZER CONDENSING UNIT	20 A	3			1.9	0.9						28	
	29								1.9	0.9	3	20 A	COOLER CONDENSING UNIT	30	
	31	STOR A150C - EF	20 A	1	0.2	0.9								32	
	33	DRAIN HEAT TRACE	20 A	1			0.2	1.2			1	20 A	SEC OFF A144 - RECEPTACLE	34	
	35	STOR A150C - AV RACK	20 A	1					0.2	0.4	1	20 A	SEC OFF. A144 - DISPLAY RECEPTACLE	36	
	37	CONTROL A139A - HHP	20 A	2	0.4	4.3								38	
	39						0.4	4.3			3	50 A	LOAD A147 - EUH	40	
	41	SPARE	20 A	1					0.0	4.3				42	
	43	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	44	
	45	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	46	
	47	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	48	
	49	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	50	
	51	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	52	
	53	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	54	
	55	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	56	
	57	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	58	
	59	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	60	
					13.6 kVA		13.4 kVA		11.4 kVA						
					116 A		114 A		95 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	2500 VA	90.00%	2250 VA	TOTAL CONNECTED LOAD:	38480 VA
HVAC	17370 VA	85.00%	14765 VA	TOTAL ESTIMATED DEMAND:	31211 VA
REC	4740 VA	100.00%	4740 VA	TOTAL CONNECTED CURRENT:	107 A
KITCH	12610 VA	65.00%	8197 VA	TOTAL ESTIMATED DEMAND CURRENT:	87 A
Receptacle	1260 VA	100.00%	1260 VA	10 % ADDITIONAL CAPACITY:	9 A
				TOTAL PANEL CURRENT:	95 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L1LSB **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** EM 256
AMPERES: 100 A **MOUNTING:** SURFACE **SUPPLY FROM:** T-EP-L1LSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1				1.0	0.5					1	20 A	ELEC B004A - GEN ANUNCIATOR PANEL	2	
1	3	EP-L3LSC	60 A	3			1.5	0.0			1	20 A	SPARE	4	
	5								1.0	0.0	1	20 A	SPARE	6	
	7	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					1.5 kVA		1.5 kVA		1.0 kVA						
					13 A		13 A		8 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	4000 VA	90.00%	3600 VA	TOTAL CONNECTED LOAD:	4000 VA
				TOTAL ESTIMATED DEMAND:	3600 VA
				TOTAL CONNECTED CURRENT:	11 A
				TOTAL ESTIMATED DEMAND CURRENT:	10 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	11 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. BREAKER SHALL BE PROVIDED WITH LSIG TRIP UNIT.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L3OSC **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** IT 345
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** EP-L2OSC

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	PREP B229A - HHP	20 A	2	0.7	0.2					1	20 A	IT B229B - RECEPTACLE	2	
	3						0.7	0.2			1	20 A	IT B229B - RECEPTACLE	4	
	5	IT B229B - RECEPTACLE	20 A	2					0.8	0.8	2	20 A	IT B229B - RECEPTACLE	6	
	7				0.8	0.8								8	
	9	IT B229B - RECEPTACLE	20 A	1			0.5	0.5			1	20 A	IT B229B - SECURITY PANEL	10	
	11	IT B229B - RECEPTACLE	20 A	1					0.5	0.5	1	20 A	ELEC B217 - RECEPTACLE	12	
	13	IT B229B - SECURITY PANEL	20 A	1	0.5	0.5					1	20 A	MECH B220A - BMS PANEL	14	
	15	MECH B215 - BMS PANEL	20 A	1			0.5	0.0			2	20 A	SPARE	16	
	17	PREP B210A - REFRIGERATOR	20 A	1					0.2	0.0				18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
	25	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	26	
	27	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					3.4 kVA		2.4 kVA		2.8 kVA						
					28 A		20 A		23 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	2000 VA	90.00%	1800 VA	TOTAL CONNECTED LOAD:	8512 VA
HVAC	1352 VA	85.00%	1149 VA	TOTAL ESTIMATED DEMAND:	8109 VA
REC	3720 VA	100.00%	3720 VA	TOTAL CONNECTED CURRENT:	24 A
Receptacle	1440 VA	100.00%	1440 VA	TOTAL ESTIMATED DEMAND CURRENT:	23 A
				10 % ADDITIONAL CAPACITY:	2 A
				TOTAL PANEL CURRENT:	25 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L2OSC **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** Space 79
AMPERES: 100 A **MOUNTING:** SURFACE **SUPPLY FROM:** EP-L1OSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1				3.4	0.2					1	20 A	TEACHER B040 - REFRIGERATOR	2	GFCI
	3	EP-L3OSC	60 A	3			2.4	0.2			1	20 A	TEACHER B137 - REFRIGERATOR	4	GFCI
	5								2.8	0.2	1	20 A	TEACHER B232 - REFRIGERATOR	6	
GFCI	7	PREP B229A - REFRIGERATOR	20 A	1	0.2	0.2					1	20 A	PREP B135A - REFRIGERATOR	8	GFCI
GFCI	9	PREP B101A - REFRIGERATOR	20 A	1			0.2	0.6			1	20 A	PREP B001A - REFRIGERATOR...	10	GFCI
	11	ELEC B107 - RECEPTACLE	20 A	1					0.2	0.2	1	20 A	SPEC ED B105 - REFRIGERATOR	12	GFCI
	13	STOR B126 - BMS PANEL	20 A	1	0.5	0.5					1	20 A	MECH B102 - BMS PANEL	14	
	15	SPARE	20 A	1			0.0	0.7			2	20 A	MECH B123 - HHP	16	
	17	SPARE	20 A	1					0.0	0.7				18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
	25	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	26	
	27	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	28	
	29	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	30	
	31	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	32	
	33	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	34	
	35	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	36	
	37	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	38	
	39	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	40	
	41	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	42	
					4.9 kVA		4.0 kVA		4.0 kVA						
					41 A		34 A		33 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	3000 VA	90.00%	2700 VA	TOTAL CONNECTED LOAD:	12904 VA
HVAC	2704 VA	85.00%	2298 VA	TOTAL ESTIMATED DEMAND:	12198 VA
REC	5580 VA	100.00%	5580 VA	TOTAL CONNECTED CURRENT:	36 A
Receptacle	1620 VA	100.00%	1620 VA	TOTAL ESTIMATED DEMAND CURRENT:	34 A
				10 % ADDITIONAL CAPACITY:	3 A
				TOTAL PANEL CURRENT:	37 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L3LSC **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** ELEC 389
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** EP-L1LSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	BDA SYSTEM POWER	20 A	1	0.5	0.5					1	20 A	ELE E201 - 2 WAY COMMUNICATION	2	
	3	ELE E202 - 2 WAY COMMUNICATION	20 A	1			0.5	1.0			1	20 A	ELE E201 - CAB LIGHT	4	
	5	ELE E202 - CAB LIGHT	20 A	1					1.0	0.0	1	20 A	SPARE	6	
	7	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	8	
	9	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					1.0 kVA		1.5 kVA		1.0 kVA						
					8 A		13 A		8 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	3500 VA	90.00%	3150 VA	TOTAL CONNECTED LOAD:	3500 VA
				TOTAL ESTIMATED DEMAND:	3150 VA
				TOTAL CONNECTED CURRENT:	10 A
				TOTAL ESTIMATED DEMAND CURRENT:	9 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	10 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L2LSB **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** Space 115
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** T-EP-L2LSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	VENTILATOR DEMAND CONTROL SYSTEM	20 A	1	0.5	1.5					1	15 A	KITCHEN HOOD POWER TO CONTROLS	2	
	3						0.4	0.5						4	
	5	KITCHEN HOOD POWER TO VFD	15 A	3					0.4	0.5	3	15 A	KITCHEN HOOD POWER TO VFD	6	
	7				0.4	0.5								8	
	9	VEST A140B - DAMPER ACTUATOR	20 A	1			0.5	0.5			1	20 A	CAFETERIA A137 - DAMPER ACTUATOR	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					2.9 kVA		1.9 kVA		0.9 kVA						
					25 A		17 A		7 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	4619 VA	90.00%	4157 VA	TOTAL CONNECTED LOAD:	5619 VA
KITCH	1000 VA	100.00%	1000 VA	TOTAL ESTIMATED DEMAND:	5157 VA
				TOTAL CONNECTED CURRENT:	16 A
				TOTAL ESTIMATED DEMAND CURRENT:	14 A
				10 % ADDITIONAL CAPACITY:	1 A
				TOTAL PANEL CURRENT:	16 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

E51

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L2LSA **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** Space 81
AMPERES: 100 A **MOUNTING:** SURFACE **SUPPLY FROM:** T-EP-L2LSA

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	ADMIN A100 - BDA ANUNCIATOR	20 A	1	0.5	0.5					1	20 A	ADMIN A100 - FACP	2	
	3	ROOF - SMOKE DAMPER	20 A	1			0.5	4.0			2	50 A	GENERATOR LOAD CENTER PANEL	4	1
	5	ROOF - SMOKE DAMPER	20 A	1					0.5	4.0				6	
	7	DOCKING STATION RECEPTACLE	20 A	1	0.5	0.0					1	20 A	SPARE	8	
	9	CORRIDOR C101B - WON DOOR	20 A	1			1.2	0.0			1	20 A	SPARE	10	
	11	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	12	
	13	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					1.5 kVA		5.7 kVA		4.5 kVA						
					13 A		51 A		41 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	11700 VA	90.00%	10530 VA	TOTAL CONNECTED LOAD:	11700 VA
				TOTAL ESTIMATED DEMAND:	10530 VA
				TOTAL CONNECTED CURRENT:	32 A
				TOTAL ESTIMATED DEMAND CURRENT:	29 A
				10 % ADDITIONAL CAPACITY:	3 A
				TOTAL PANEL CURRENT:	32 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.
1. BREAKER SHALL BE PROVIDED WITH LSIG TRIP UNIT.

PANELBOARD AND WIRING SCHEDULE

PANEL: EP-L2OSA **MAINS TYPE:** MCB **PANEL INTERRUPTING RATING:** 22 KAIC
VOLTAGE: 208Y/120V,3P,4W **SPD:** Yes **LOCATION:** Room 356
AMPERES: 60 A **MOUNTING:** SURFACE **SUPPLY FROM:** EP-L1OSB

Notes	CKT	Circuit Description	Trip	Poles	A	A	B	B	C	C	Poles	Trip	Circuit Description	CKT	Notes
	1	GYM MEZZANINE - HHP	20 A	2	0.7	0.0					1	20 A	ELEC A122B - EF	2	
	3						0.7	0.5			1	20 A	ELEC A122B - RECEPTACLE	4	
GFCI	5	WKRKM A117 - REFRIGERATOR	20 A	1					0.2	0.5	1	20 A	MECHANICAL MEZZANINE BMS PANEL	6	
	7	GYM STOR A121B - AV RACK	20 A	1	0.2	0.4					2	20 A	GYM STOR A121B - HHP	8	
	9						2.2	0.4						10	
	11	VESTIBULE V100 - EUH	30 A	3					2.2	0.0	1	20 A	SPARE	12	
	13				2.2	0.0					1	20 A	SPARE	14	
	15	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	16	
	17	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	18	
	19	SPARE	20 A	1	0.0	0.0					1	20 A	SPARE	20	
	21	SPARE	20 A	1			0.0	0.0			1	20 A	SPARE	22	
	23	SPARE	20 A	1					0.0	0.0	1	20 A	SPARE	24	
					3.4 kVA		3.8 kVA		2.8 kVA						
					29 A		32 A		24 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	500 VA	90.00%	450 VA	TOTAL CONNECTED LOAD:	10043 VA
HVAC	8643 VA	85.00%	7347 VA	TOTAL ESTIMATED DEMAND:	8697 VA
REC	540 VA	100.00%	540 VA	TOTAL CONNECTED CURRENT:	28 A
Receptacle	360 VA	100.00%	360 VA	TOTAL ESTIMATED DEMAND CURRENT:	24 A
				10 % ADDITIONAL CAPACITY:	2 A
				TOTAL PANEL CURRENT:	27 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

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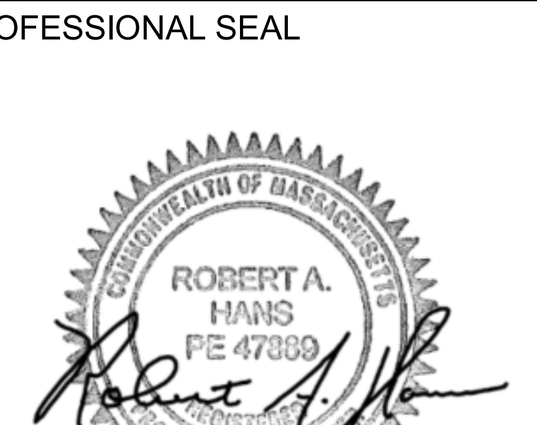
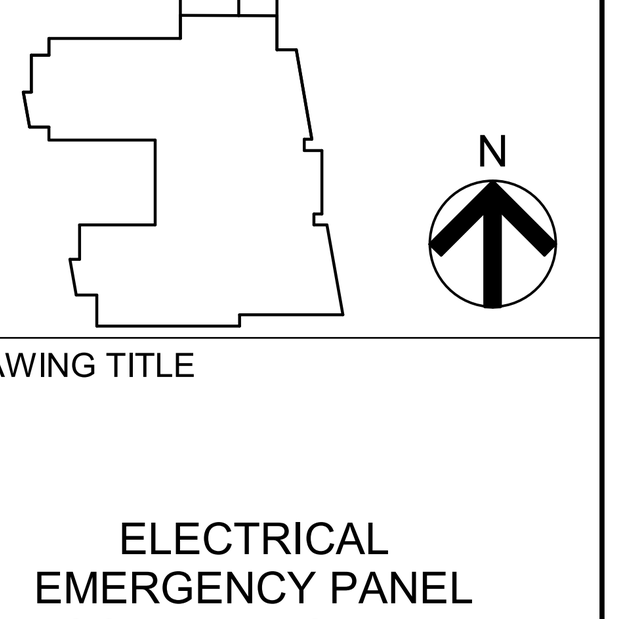


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL
EMERGENCY PANEL
SCHEDULES 208V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.09

5/18/2026 11:13:14 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

ELECTRICAL - EQUIPMENT CONNECTION SCHEDULE

EQUIPMENT TAG	EQUIPMENT DESCRIPTION	HP	VOLTAGE	POLES	MCA	VA	PANEL	CIRCUIT NUMBER	NEMA SIZE	DISCONNECT MEANS	FURNISHED BY	NEMA RATING	REMARKS
MECH													
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	43	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	40	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	45	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	42	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	47	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	28	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	30	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
CP-1	CONDENSATE PUMP		120	1	1	120 VA	M-L2A	50	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
DOAS-1	DEDICATED OUTDOOR AIR SYSTEM		480	3	218.9	178120 VA	EP-H1OSB	13,15,17	3#4/0 & 1#4G - 2"C	INTEGRAL DISCONNECT	MC	3R	FED FROM GENERATOR
EF-1	EXHAUST FAN		120	1	1.9	180 VA	M-L2C	31	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	
EF-2	EXHAUST FAN		120	1	1.9	180 VA	M-L3D	18	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	
EF-3	EXHAUST FAN		120	1	0.2	24 VA	EP-L2OSA	2	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	FED FROM GENERATOR
EF-3	EXHAUST FAN		120	1	0.2	24 VA	EP-L2OSB	6	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	FED FROM GENERATOR
EF-3	EXHAUST FAN		120	1	1.6	170 VA	EP-L2OSB	31	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	FED FROM GENERATOR
EF-4	EXHAUST FAN		120	1	1.6	170 VA	M-L2B	39	2#12 & 1#12G - 3/4"C	DISCONNECT	MC	1	
EUH-1	ELECTRIC UNIT HEATER		208	3	22.5	6477 VA	EP-L2OSA	9,11,13	3#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
EUH-1	ELECTRIC UNIT HEATER		208	3	22.5	6477 VA	M-L1B	21,23,25	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-1	ELECTRIC UNIT HEATER		208	3	22.5	6477 VA	M-L1C	17,19,21	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-1	ELECTRIC UNIT HEATER		208	3	22.5	6477 VA	M-L3C	20,22,24	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-1	ELECTRIC UNIT HEATER		208	3	22.5	6477 VA	EP-L1OSB	31,33,35	3#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L2A	44,46,48	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L2B	44,46,48	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L2A	49,51,53	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L1B	22,24,26	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L2B	38,40,42	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-2	ELECTRIC UNIT HEATER		208	3	30	8636 VA	M-L2B	33,35,37	3#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
EUH-3	ELECTRIC UNIT HEATER		208	3	45	12954 VA	EP-L2OSB	38,40,42	3#6 & 1#10G - 1"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	13,15	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	17,19	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	10,12	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	6,8	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	2,4	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2B	2,4	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L1C	13,15	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	25,27	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	37,39	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	M-L2A	32,34	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	EP-L2OSB	37,39	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-007	HORIZONTAL HEAT PUMP		208	2	4.6	790 VA	EP-L2OSA	8,10	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	5,7	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	9,11	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	14,16	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	18,20	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2A	21,23	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L1B	10,12	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	EP-L2OSB	5,7	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	EP-L2OSA	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	EP-L3OSC	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	EP-L1OSB	2,4	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	EP-L2OSC	16,18	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-012	HORIZONTAL HEAT PUMP		208	2	7.9	1352 VA	M-L2C	37,39	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-019	HORIZONTAL HEAT PUMP		208	2	11.8	2080 VA	EP-L2OSB	2,4	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
HHP-024	HORIZONTAL HEAT PUMP		208	2	15.7	2724 VA	M-L2C	17,19	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-036	HORIZONTAL HEAT PUMP		208	2	24.7	4284 VA	M-L2C	34,36	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
HHP-048	HORIZONTAL HEAT PUMP		208	2	30.9	5387 VA	M-L2C	14,16	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
KEF-1	EXHAUST FAN	1	208	3	5.75	1655 VA	M-L2B	24,26,28	3#12 & 1#12G - 3/4"C	DISCONNECT	MC	3R	
KEF-2	EXHAUST FAN	1	208	3	4.5	1295 VA	M-L2B	21,23,25	3#12 & 1#12G - 3/4"C	DISCONNECT	MC	3R	
P-1A	GEOTHERMAL PUMP	15	480	3	26.25	17438 VA	EP-H1OSB	7,9,11	3#10 & 1#10G - 3/4"C	VFD	MC	1	FED FROM GENERATOR
P-1B	GEOTHERMAL PUMP	15	480	3	26.25	0 VA	EP-H1OSB	2,4,6	3#10 & 1#10G - 3/4"C	VFD	MC	1	FED FROM GENERATOR
P-2	CIRCULATION PUMP	1/6	120	1	4.4	500 VA	M-L1B	34	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L2B	29	2#10 & 1#10G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L2B	36	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L2C	29	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L2A	55	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L2B	6	2#10 & 1#10G - 3/4"C	DISCONNECT	EC	1	

ELECTRICAL - EQUIPMENT CONNECTION SCHEDULE

EQUIPMENT TAG	EQUIPMENT DESCRIPTION	HP	VOLTAGE	POLES	MCA	VA	PANEL	CIRCUIT NUMBER	NEMA SIZE	DISCONNECT MEANS	FURNISHED BY	NEMA RATING	REMARKS
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L3D	17	2#10 & 1#10G - 3/4"C	DISCONNECT	EC	1	
P-2	CIRCULATION PUMP	1/6	120	1	4.4	528 VA	M-L1B	33	2#10 & 1#10G - 3/4"C	DISCONNECT	EC	1	
P-3	CIRCULATION PUMP	2/5	120	1	10	960 VA	M-L1B	31	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	
VHP-012	VERTICAL HEAT PUMP		208	2	7.9	1352 VA	M-L3C	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-012	VERTICAL HEAT PUMP		208	2	7.9	1352 VA	M-L3D	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L1B	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L1C	6,8	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L1B	14,16	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L2C	1,3	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L2A	29,31	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-019	VERTICAL HEAT PUMP		208	2	11.8	2080 VA	M-L2B	16,18	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2C	13,15	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L3C	10,12	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2A	22,24	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2B	20,22	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2B	8,10	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2B	12,14	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2C	21,23	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L3C	9,11	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2C	25,27	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2C	22,24	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L2A	33,35	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-024	VERTICAL HEAT PUMP		208	2	15.7	2724 VA	M-L3D	8,10	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L1C	2,4	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L2C	5,7	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L3D	13,15	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L2B	17,19	2#6 & 1#10G - 1"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L2B	13,15	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-030	VERTICAL HEAT PUMP		208	2	19.4	3348 VA	M-L2B	9,11	2#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-036	VERTICAL HEAT PUMP		208	2	24.7	4284 VA	M-L1B	9,11	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-036	VERTICAL HEAT PUMP		208	2	24.7	4284 VA	M-L2C	10,12	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-036	VERTICAL HEAT PUMP		208	2	24.7	4284 VA	M-L2C	18,20	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-036	VERTICAL HEAT PUMP		208	2	24.7	4284 VA	M-L3C	13,15	2#10 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	M-L1B	6,8	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	M-L1B	18,20	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	M-L2C	9,11	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	M-L3C	5,7	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	M-L1C	10,12	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-042	VERTICAL HEAT PUMP		208	2	35.3	6177 VA	EP-L1OSB	1,3	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	FED FROM GENERATOR
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1B	2,4	2#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1B	5,7	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1C	5,7	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1C	1,3	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1B	13,15	2#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L1B	17,19	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L2C	2,4	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L2C	6,8	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L3C	2,4	2#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L3C	6,8	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L3D	4,6	2#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L3D	7,9	2#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-048	VERTICAL HEAT PUMP		208	2	30.9	5387 VA	M-L2B	1,3	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-060	VERTICAL HEAT PUMP		208	2	37.6	6572 VA	M-L3C	14,16	2#8 & 1#10G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-072	VERTICAL HEAT PUMP		480	3	13.4	10059 VA	M-H2A	2,4,6	3#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-072	VERTICAL HEAT PUMP		480	3	13.4	10059 VA	M-H2B	1,3,5	3#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-096	VERTICAL HEAT PUMP		480	3	16.8	12637 VA	DP-H2C	13,15,17	3#12 & 1#12G - 3/4"C	INTEGRAL DISCONNECT	MC	1	
VHP-240	VERTICAL HEAT PUMP		480	3	44.2	33006 VA	M-H2B	7,9,11	3#6 & 1#10G - 1"C	INTEGRAL DISCONNECT	MC	1	
VHP-240	VERTICAL HEAT PUMP		480	3	44.2	33006 VA	M-H2B	2,4,6	3#6 & 1#10G - 1"C	INTEGRAL DISCONNECT	MC	1	
VHP-300	VERTICAL HEAT PUMP		480	3	60.8	45809 VA	M-H2A	1,3,5	3#4 & 1#8G - 1-1/4"C	INTEGRAL DISCONNECT	MC	1	
PLUMBING													
CP-1	CIRCULATION PUMP	1/2	208	2	2	520 VA	EP-L1OSB	37,39	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	FED FROM GENERATOR
CP-2	CIRCULATION PUMP	1/2	208	2	2	520 VA	EP-L1OSB	32,34	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	FED FROM GENERATOR
DWH-1	DOMESTIC WATER HEATER		480	3	45.4	30392 VA	EP-H1OSB	19,21,23	3#6 & 1#10G - 1"C	DISCONNECT	EC	1	FED FROM GENERATOR
DWH-2	DOMESTIC WATER HEATER		480	3	45.4	30392 VA	EP-H1OSB	20,22,24	3#6 & 1#10G - 1"C	DISCONNECT	EC	1	FED FROM GENERATOR
ESP-1	ELEVATOR SUMP PUMP		120	1	10.5	1260 VA	EP-L1OSB	27	2#12 & 1#12G - 3/4"C	DUPLEX RECEPTACLE	EC	1	FED FROM GENERATOR
ESP-2	ELEVATOR SUMP PUMP		120	1	10.5	1260 VA	EP-L1OSB	29	2#12 & 1#12G - 3/4"C	DUPLEX RECEPTACLE	EC	1	FED FROM GENERATOR
EWH-1	ELECTRIC WATER HEATER		480	3	27.5	18000 VA	M-H1B	1,3,5	3#10 & 1#10G - 3/4"C	DISCONNECT	EC	1	
TP-1	TRAP PRIMER		120	1	2	240 VA	M-L2B	5	2#12 & 1#12G - 3/4"C	DISCONNECT	EC	1	

NOTES:

1. REFER TO HEAT PUMP CONTROL CHART ON SHEET M8.03 FOR FINAL HEAT PUMP SIZES AND QUANTITIES. COORDINATE WITH MECHANICAL CONTRACTOR FOR ALL EXACT FINAL LOCATIONS OF CONNECTIONS TO MECHANICAL EQUIPMENT.

ELECTRICAL FLOORBOX SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL
FB-1	BASEMENT FLOORBOX WITH (2) DUPLEX OUTLETS	LEGRAND WIREMOLD	RFBA4C30OG
FB-2	POKE-THROUGH FLOORBOX WITH (2) DUPLEX OUTLETS	LEGRAND WIREMOLD	6ATC2PBK*

NOTES:

1. PROVIDE 3/4"C FOR POWER WIRING TO FLOORBOXES. REFER TO TELECOM DRAWINGS FOR QUANTITY OF DATA DEVICES AND CONDUITS REQUIRED.
2. COORDINATE FINISH COLORS WITH ARCHITECT.

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TSKP STUDIO

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ARCHITECTURE | PLANNING | INTERIORS

CMTA
A LEGENCE Company

PROFESSIONAL SEAL

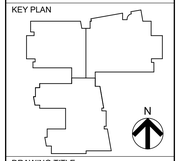


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL SCHEDULES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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ELEC - LUMINAIRE SCHEDULE (1 OF 2)

TYPE	LOCATION	DESCRIPTION	LAMPS / CCT	DRIVER	LUMENS	MOUNTING	WATTAGE	VOLTAGE	MANUFACTURER	REMARKS
A1-4	CLASSROOM	4' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	4500	SUSPENDED @8'-0" AFF U.O.N.	33	277 V	LEDALITE #77-0-5-L-B-C-VD-04-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A1-8	CLASSROOM	8' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	9000	SUSPENDED @8'-0" AFF U.O.N.	66	277 V	LEDALITE #77-0-5-L-B-C-VD-08-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A1-12	CLASSROOM	12' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	13500	SUSPENDED @8'-0" AFF U.O.N.	99	277 V	LEDALITE #77-0-5-L-B-C-VD-12-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A1-16	CLASSROOM	16' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	18000	SUSPENDED @8'-0" AFF U.O.N.	132	277 V	LEDALITE #77-0-5-L-B-C-VD-16-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A1-20	CLASSROOM	20' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	22500	SUSPENDED @8'-0" AFF U.O.N.	166	277 V	LEDALITE #77-0-5-L-B-C-VD-20-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-4	CLASSROOM	4' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	3100	SUSPENDED @8'-0" AFF U.O.N.	23	277 V	LEDALITE #77-0-5-L-B-E-VD-04-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-8	CLASSROOM	8' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	6200	SUSPENDED @8'-0" AFF U.O.N.	46	277 V	LEDALITE #77-0-5-L-B-E-VD-08-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-12	CLASSROOM	12' SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	9300	SUSPENDED @8'-0" AFF U.O.N.	68	277 V	LEDALITE #77-0-5-L-B-E-VD-12-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-16	CLASSROOM	16' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	12400	SUSPENDED @8'-0" AFF U.O.N.	91	277 V	LEDALITE #77-0-5-L-B-E-VD-16-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-20	CLASSROOM	20' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	15500	SUSPENDED @8'-0" AFF U.O.N.	114	277 V	LEDALITE #77-0-5-L-B-E-VD-20-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
A2-24	CLASSROOM	24' LED SUSPENDED DIRECT/INDIRECT LINEAR FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	18600	SUSPENDED @8'-0" AFF U.O.N.	137	277 V	LEDALITE #77-0-5-L-B-E-VD-24-7-D-E-W-N-NN-A6-X*-XX *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
B1	CONFERENCE / WORKROOM	2' X 4' GRID LAY-IN LED RECESSED TROFFER.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	4800	RECESSED	37	277 V	DAY-BRITE CFI #2CAZ-G-48L-835-4-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
B2	CONFERENCE / WORKROOM	2' X 4' GRID LAY-IN LED RECESSED TROFFER.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	3800	RECESSED	29	277 V	DAY-BRITE CFI #2CAZ-G-38L-835-4-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
B3	CONFERENCE / WORKROOM	2' X 4' GRID LAY-IN LED RECESSED TROFFER.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	6000	RECESSED	47	277 V	DAY-BRITE CFI #2CAZ-G-60L-835-4-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C	ADMIN / OFFICE	2' X 2' GRID LAY-IN LED RECESSED TROFFER FIXTURE.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	2000	RECESSED	18	277 V	DAY-BRITE CFI #2CAZ-G-20L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C1	ADMIN / OFFICE	2' X 2' GRID LAY-IN LED RECESSED TROFFER FIXTURE.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	3000	RECESSED	25	277 V	DAY-BRITE CFI #2CAZ-G-30L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C2	ADMIN / OFFICE	2' X 2' GRID LAY-IN LED RECESSED TROFFER FIXTURE.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	3800	RECESSED	33	277 V	DAY-BRITE CFI #2CAZ-G-38L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C3	ADMIN / OFFICE	2' X 2' GRID LAY-IN LED RECESSED TROFFER FIXTURE.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	4500	RECESSED	38	277 V	DAY-BRITE CFI #2CAZ-G-45L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C4	ADMIN / OFFICE	2' X 2' GRID LAY-IN LED RECESSED TROFFER FIXTURE.	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	5400	RECESSED	44	277 V	DAY-BRITE CFI #2CAZ-G-54L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
C5	GENERAL	4" RECESSED DOWNLIGHT FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	1500	RECESSED	12	277 V	LIGHTOLIER #4RN-P4R-DL-15-935-W-Z10-U; ORDER W/ VETRO DECORATIVE ELEMENT #D4PRXXXWHTLLFDIFF	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
D1	GENERAL	4" RECESSED DOWNLIGHT FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	1500	RECESSED	12	277 V	LIGHTOLIER #4RN-P4R-DL-15-935-W-CC-Z10-U	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
D2	GENERAL	4" RECESSED DOWNLIGHT FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	1000	RECESSED	9	277 V	LIGHTOLIER #4RN-P4R-DL-10-935-W-CC-Z10-U	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
D3	GENERAL	4" RECESSED DOWNLIGHT FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	2000	RECESSED	16	277 V	LIGHTOLIER #4RN-P4R-DL-20-935-W-CC-Z10-U	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
D4	GENERAL	4" RECESSED DOWNLIGHT FIXTURE	LED / 3500K / 90CRI	INTEGRAL 0-10V DIMMING TO 1%	3000	RECESSED	25	277 V	LIGHTOLIER #4RN-P4R-DL-30-935-W-CC-Z10-U	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
F2	CORRIDOR	3' DIAMETER ARCHITECTURAL RECESSED ROUND LIGHT WITH SATIN ACRYLIC FLAT LENS	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	4000	RECESSED	40	277 V	DAY-O-LITE #NASL-RND-D-SI-35-LO-3-F-W-DIM10	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
H1-4	GYM	4' LED SURFACE MOUNTED LINEAR FIXTURE, VANDAL RESISTANT	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	8200	SURFACE	71	277 V	WILLIAMS #AVX-4-L82-8-35-WPC-DIM-UNV FIXTURES TO BE MOUNTED TO CEILING CENTERED BETWEEN STRUCTURAL TRUSSES. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
H1-8	GYM	16' LED SURFACE MOUNTED LINEAR FIXTURE, VANDAL RESISTANT	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	16400	SURFACE	141	277 V	WILLIAMS #AVX-8-L164-8-35-WPC-DIM-UNV FIXTURES TO BE MOUNTED TO CEILING CENTERED BETWEEN STRUCTURAL TRUSSES. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
H2-12	MAIN CORRIDOR	12' LED SURFACE MOUNTED LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	6600	SURFACE	67	277 V	LEDALITE #29-1-1-L-935-22-LN-12-D-E-1-N-NN-W-SF	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
H3-12	LIBRARY MEDIA CENTER	12' LED SURFACE MOUNTED LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	9000	SURFACE	99	277 V	LEDALITE #29-1-1-L-935-30-LN-12-D-E-1-N-NN-W-SF	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
H3-16	CAFETERIA	16' LED SURFACE MOUNTED LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	12000	SURFACE	132	277 V	LEDALITE #29-1-1-L-935-30-LN-16-D-E-1-N-NN-W-SF	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
H4-16	AUX GYM	16' LED SURFACE MOUNTED LINEAR FIXTURE, VANDAL RESISTANT	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	12400	SURFACE	122	277 V	WILLIAMS (2) #AVX-8-L82-8-35-WPC-DIM-UNV FIXTURES TO BE MOUNTED TO CEILING CENTERED BETWEEN STRUCTURAL TRUSSES. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
J1	UTILITY	4' LINEAR UTILITY STRIP LIGHT	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	5500	SURFACE / SUSPENDED @9'-0" AFF U.O.N.	41	277 V	DAY-BRITE CFI #FSS-4-55L-835-UNV-DIM COORDINATE FINAL MOUNTING TYPE WITH ARCHITECT.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. PROVIDE SUSPENSION MOUNTING FOR ALL SPACES WITHOUT CEILINGS.
J8	UTILITY	8' LINEAR UTILITY STRIP LIGHT	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	6000	SURFACE / SUSPENDED @9'-0" AFF U.O.N.	44	277 V	DAY-BRITE CFI #FSS-8-60L-835-UNV-DIM COORDINATE FINAL MOUNTING TYPE WITH ARCHITECT.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. PROVIDE SUSPENSION MOUNTING FOR ALL SPACES WITHOUT CEILINGS.
K1-8	CLASSROOM	8' SURFACE MOUNTED DIRECT LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	8000	SURFACE	62	277 V	MOJO ILLUMINATION #GR2US-U-1100F-35K-010-M-SM-XX*-WH-08 *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
K1-12	CLASSROOM	12' LED SURFACE MOUNTED DIRECT LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	12000	SURFACE	93	277 V	MOJO ILLUMINATION #GR2US-U-1100F-35K-010-M-SM-XX*-WH-12 *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
K1-16	CLASSROOM	16' LED SURFACE MOUNTED DIRECT LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	16000	SURFACE	124	277 V	MOJO ILLUMINATION #GR2US-U-1100F-35K-010-M-SM-XX*-WH-12 *MOUNTING TYPE TO CORRESPOND WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
L1-10	CORRIDOR	10' LED SUSPENDED DIRECT LINEAR FIXTURE MOUNTED IN WOOD SLOT CEILING	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	3750	SUSPENDED	36	277 V	LEDALITE #29-0-1-L-935-15-LN-10-D-E-1-N-NN-W-A1-XX* *COORDINATE SUSPENSION CABLE LENGTH WITH ARCHITECT PRIOR TO ORDERING.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
L-4	CORRIDOR	4' LED SUSPENDED DIRECT LINEAR FIXTURE MOUNTED IN WOOD SLOT CEILING	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	2200	SUSPENDED	22	277 V	LEDALITE #29-0-1-L-935-22-LN-04-D-E-1-N-NN-W-A1-XX* *COORDINATE SUSPENSION CABLE LENGTH WITH ARCHITECT PRIOR TO ORDERING.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
L-10	CORRIDOR	10' LED SUSPENDED DIRECT LINEAR FIXTURE MOUNTED IN WOOD SLOT CEILING	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	5500	SUSPENDED	56	277 V	LEDALITE #29-0-1-L-935-22-LN-10-D-E-1-N-NN-W-A1-XX* *COORDINATE SUSPENSION CABLE LENGTH WITH ARCHITECT PRIOR TO ORDERING.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMIN

ELEC - LUMINAIRE SCHEDULE (2 OF 2)

TYPE	LOCATION	DESCRIPTION	LAMPS / CCT	DRIVER	LUMENS	MOUNTING	WATTAGE	VOLTAGE	MANUFACTURER	REMARKS
PL1	PLANETARIUM	LED RECESSED PERIMETER FIXTURE ORDERED IN 1' INCREMENTS	LED	0-10V DIMMING LEADS		COVE	500	277 V	SPITZ CHROMACOVE LIGHTING NANOCOVE RGB LED LIGHTING & SUPERBRIGHT LED LIGHTING* *FIXTURE RUN LENGTH SHALL BE COORDINATED WITH ARCHITECTURAL PLANS AND PLANETARIUM DRAWINGS. COORDINATE WITH PLANETARIUM COVE DETAILS FOR MOUNTING. BOTH NANOCOVE AND SUPERBRIGHT LED LIGHTS SHALL BE MOUNTED IN SHARED COVE PER DETAIL & MANUFACTURER'S DOCUMENTATION.	1. FIXTURE SHALL BE ORDERED WITH LED COVE FADER LOCATED PER PLANS.
PL2	PLANETARIUM	LED FLOOR RECESSED PERIMETER TAPE LIGHT FIXTURE	LED / 3500K	0-10V DIMMING LEADS	187 lm/ft	FLOOR RECESSED	0	277 V	CORE ARCHITECTURAL LIGHTING HOUSING CAT#: ALP23-LENGTH PER PLANS-FR-SI TAPE LIGHT CAT#: LSM20-35K-LENGTH PER PLANS-24V DRIVER CAT#: PSDE-96W-24V-010-JB	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
R1	CHANGING ROOM	12' LED RECESSED LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	9000	RECESSED	78	277 V	LEDALITE #39-0-0-L-935-30-L-S-4-12-D-E-1-N-NN-W	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. PROVIDE SUSPENSION MOUNTING FOR ALL SPACES WITHOUT CEILINGS.
S	KITCHEN	2' X 2' GRID LAY-IN LED RECESSED FLAT PANEL FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	5400	RECESSED	42	277 V	DAY-BRITE CFI #2FPZ-54L-835-2-DS-UNV-DIM	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
SC1	EXTERIOR	EXTERIOR WALL-MOUNTED SCONCE DOWNLIGHT FIXTURE	LED / 3000K	INTEGRAL 0-10V DIMMING TO 1%	2500	WALL	25	277 V	FC OUTDOOR LIGHTING #FCC600-10-WM-UNV-930-25L-BKE-50-LD	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING.
T	BLACK BOX	6" PENDANT MOUNTED CYLINDER DOWNLIGHT FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	4800	PENDANT MOUNTED, LEVEL WITH PIPE GRED, APPROX 20'-6" AFF	40	277 V	LIGHTOLIER #C6-P-DL-48-935-W-Z10-U-CC-B-CA-SK-*XX-BK *COORDINATE FINAL STEM LENGTH AND MOUNTING HEIGHT WITH ARCHITECT PRIOR TO ORDERING	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE.
V-4	STAIR	4' LED RECESSED DIRECT LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	4000	RECESSED	35	277 V	LEDALITE #39-0-0-L-935-40-L-S-X*-04-D-E-1-N-NN-W *COORDINATE MOUNTING TYPE WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
V-6	STAIR	6' LED RECESSED DIRECT LINEAR FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	6000	RECESSED	52	277 V	LEDALITE #39-0-0-L-935-40-L-S-X*-06-D-E-1-N-NN-W *COORDINATE MOUNTING TYPE WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS.	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. CONTRACTOR SHALL VERIFY AND COORDINATE LUMINAIRE INSTALLATION AND MOUNTING WITH ARCHITECTURAL DETAILS, HOUSING TYPE, FIELD CONDITIONS, AND CEILING SYSTEM DETAILS INCLUDING CEILING THICKNESS, GRID TYPE, FLANGE, AND INSULATION CLEARANCE. 4. COORDINATE FIXTURE LENGTH WITH PLANS PRIOR TO ORDERING.
W	ADMIN / OFFICE	WALL-MOUNTED SCONCE FIXTURE	LED / 3500K	INTEGRAL 0-10V DIMMING TO 1%	1950	WALL	30	277 V	ASL #BCRD-16-15-DVD-1950-FINISH-3500K	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. COORDINATE SCONCE FIXTURE MOUNTING HEIGHT WITH ARCHITECT.
X1	GENERAL	UNIVERSAL MOUNT EXIT SIGN	LED / N/A		N/A	SURFACE	2	277 V	LITHONIA #EDG-1-R-RMR-WM	1. REFER TO DRAWINGS FOR ARROWS AND SINGLE/DOUBLE FACE REQUIREMENTS. 2. REFER TO DRAWINGS FOR CEILING VS. WALL MOUNTING.
X2	GENERAL	MULLION MOUNT EXIT SIGN AT GLASS LOCATION	LED / N/A		N/A	SURFACE	2	277 V	SURE-LITES #ARCEL-6-1-R-C-MM	1. REFER TO DRAWINGS FOR ARROWS AND SINGLE/DOUBLE FACE REQUIREMENTS. 2. REFER TO DRAWINGS FOR CEILING VS. WALL MOUNTING.
Z	EXTERIOR	WALL PACK LED FIXTURE WITH TYPE IV DISTRIBUTION	LED / 3000K	INTEGRAL 0-10V DIMMING TO 1%	6000	WALL	39	277 V	GARDCO #GWM-A09-830-T4M-UNV-(DUCC)*-BK *ORDER WITH DUAL CIRCUIT CONTROL AS APPLICABLE FOR EMERGENCY FIXTURES	1. FIXTURE SHALL DIM. 2. ARCHITECT SHALL VERIFY FIXTURE FINISH PRIOR TO ORDERING. 3. COORDINATE MOUNTING HEIGHT WITH ARCHITECT AND DRAWINGS.

LIGHTING CONTROL PANEL RELAY SCHEDULE 'LCP-C1'

RELAY/CONTACT	PANEL-CKT	LOAD/ZONE	NOTES
1	L-H1B - 1	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
2	L-H1B - 3	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
3-4	-	SPARE	-

NOTES:

- PROVIDE 277V POWER TO LIGHTING CONTROL PANEL.
- COORDINATE WITH OWNER FOR TIME CLOCK SETPOINTS ON INTERIOR LIGHTING.
- PROVIDE 0-10V DIMMING CONTROLS AND CABLES AS INDICATED.
- PROVIDE LIGHTING CONTROL PANEL WITH A MINIMUM OF 4 RELAYS; THIS SHALL CONTROL THE LOADS INDICATED ABOVE.
- LIGHTING CONTROL PANEL SHALL BE FURNISHED WITH FIRE ALARM RELAY SUCH THAT LIGHTING OVERRIDES TO 100% OUTPUT UPON ACTIVATION OF FIRE ALARM SIGNAL.

LIGHTING CONTROL PANEL RELAY SCHEDULE 'LCP-A2'

RELAY/CONTACT	PANEL-CKT	LOAD/ZONE	NOTES
1	L-H2A - 1	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
2,3	L-H2A - 10,11	WALL PACKS	DUSK TIL 10PM, 100%; DIM TO 50% 10PM TIL DAWN
4	L-H2A - 4	MAIN CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
5	L-H2A - 5	AUX GYM	TIME SCHEDULE PER OWNER
6,7,8,9	L-H2A - 6,7,8,9	GYM	TIME SCHEDULE PER OWNER
10-12	-	SPARE	-

NOTES:

- PROVIDE 277V POWER TO LIGHTING CONTROL PANEL.
- PROVIDE PHOTOCELL CONNECTED TO PANEL. AIM NORTH.
- COORDINATE WITH OWNER FOR TIME CLOCK SETPOINTS ON INTERIOR LIGHTING.
- PROVIDE 0-10V DIMMING CONTROLS AND CABLES AS INDICATED.
- PROVIDE LIGHTING CONTROL PANEL WITH A MINIMUM OF 12 RELAYS; THIS SHALL CONTROL THE LOADS INDICATED ABOVE.
- LIGHTING CONTROL PANEL SHALL BE FURNISHED WITH FIRE ALARM RELAY SUCH THAT LIGHTING OVERRIDES TO 100% OUTPUT UPON ACTIVATION OF FIRE ALARM SIGNAL.

LIGHTING CONTROL PANEL RELAY SCHEDULE 'LCP-B2'

RELAY/CONTACT	PANEL-CKT	LOAD/ZONE	NOTES
1,2,3,4	L-H2B - 10,11,12,13	SITE LIGHTING	DUSK TIL DAWN; 100%, INTEGRAL DIMMING / OCCUPANCY SENSING PER IECC 2021
5	L-H2B - 15	WALL PACKS	DUSK TIL 10PM, 100%; DIM TO 50% 10PM TIL DAWN
6	L-H2B - 17	FLAG POLE LIGHTING	DUSK TIL 10PM, 100%; DIM TO 50% 10PM TIL DAWN
7	L-H2B - 5	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
8	L-H2B - 9	BLACK BOX	TIME SCHEDULE PER OWNER
9	L-H2B - 2	CAFETERIA	TIME SCHEDULE PER OWNER
10	L-H2B - 4	PLANETARIUM	TIME SCHEDULE PER OWNER
11-16	-	SPARE	-

NOTES:

- PROVIDE 277V POWER TO LIGHTING CONTROL PANEL.
- SITE POLE MOUNTED FIXTURES SHALL BE ORDERED WITH INTEGRAL OCCUPANCY SENSING AND DIMMING CAPABILITIES PER IECC 2021.
- PROVIDE PHOTOCELL CONNECTED TO PANEL. AIM NORTH.
- COORDINATE WITH OWNER FOR TIME CLOCK SETPOINTS ON INTERIOR LIGHTING.
- PROVIDE 0-10V DIMMING CONTROLS AND CABLES AS INDICATED.
- PROVIDE LIGHTING CONTROL PANEL WITH A MINIMUM OF 16 RELAYS; THIS SHALL CONTROL THE LOADS INDICATED ABOVE.
- LIGHTING CONTROL PANEL SHALL BE FURNISHED WITH FIRE ALARM RELAY SUCH THAT LIGHTING OVERRIDES TO 100% OUTPUT UPON ACTIVATION OF FIRE ALARM SIGNAL.

LIGHTING CONTROL PANEL RELAY SCHEDULE 'LCP-C2'

RELAY/CONTACT	PANEL-CKT	LOAD/ZONE	NOTES
1,2	L-H2C - 3,4	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
3	L-H2C - 6	MEDIA CENTER	TIME SCHEDULE PER OWNER
4	-	SPARE	-

NOTES:

- PROVIDE 277V POWER TO LIGHTING CONTROL PANEL.
- COORDINATE WITH OWNER FOR TIME CLOCK SETPOINTS ON INTERIOR LIGHTING.
- PROVIDE 0-10V DIMMING CONTROLS AND CABLES AS INDICATED.
- PROVIDE LIGHTING CONTROL PANEL WITH A MINIMUM OF 4 RELAYS; THIS SHALL CONTROL THE LOADS INDICATED ABOVE.
- LIGHTING CONTROL PANEL SHALL BE FURNISHED WITH FIRE ALARM RELAY SUCH THAT LIGHTING OVERRIDES TO 100% OUTPUT UPON ACTIVATION OF FIRE ALARM SIGNAL.

LIGHTING CONTROL PANEL RELAY SCHEDULE 'LCP-C2'

RELAY/CONTACT	PANEL-CKT	LOAD/ZONE	NOTES
1,2	L-H3C - 3,4	CORRIDOR	TIME SCHEDULE PER OWNER, WITH OCCUPANCY SENSOR OVERRIDE AFTER HOURS
3-4	-	SPARE	-

NOTES:

- PROVIDE 277V POWER TO LIGHTING CONTROL PANEL.
- COORDINATE WITH OWNER FOR TIME CLOCK SETPOINTS ON INTERIOR LIGHTING.
- PROVIDE 0-10V DIMMING CONTROLS AND CABLES AS INDICATED.
- PROVIDE LIGHTING CONTROL PANEL WITH A MINIMUM OF 4 RELAYS; THIS SHALL CONTROL THE LOADS INDICATED ABOVE.
- LIGHTING CONTROL PANEL SHALL BE FURNISHED WITH FIRE ALARM RELAY SUCH THAT LIGHTING OVERRIDES TO 100% OUTPUT UPON ACTIVATION OF FIRE ALARM SIGNAL.

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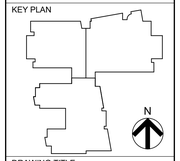
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ELECTRICAL LIGHTING CONTROL PANEL SCHEDULES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	ML
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

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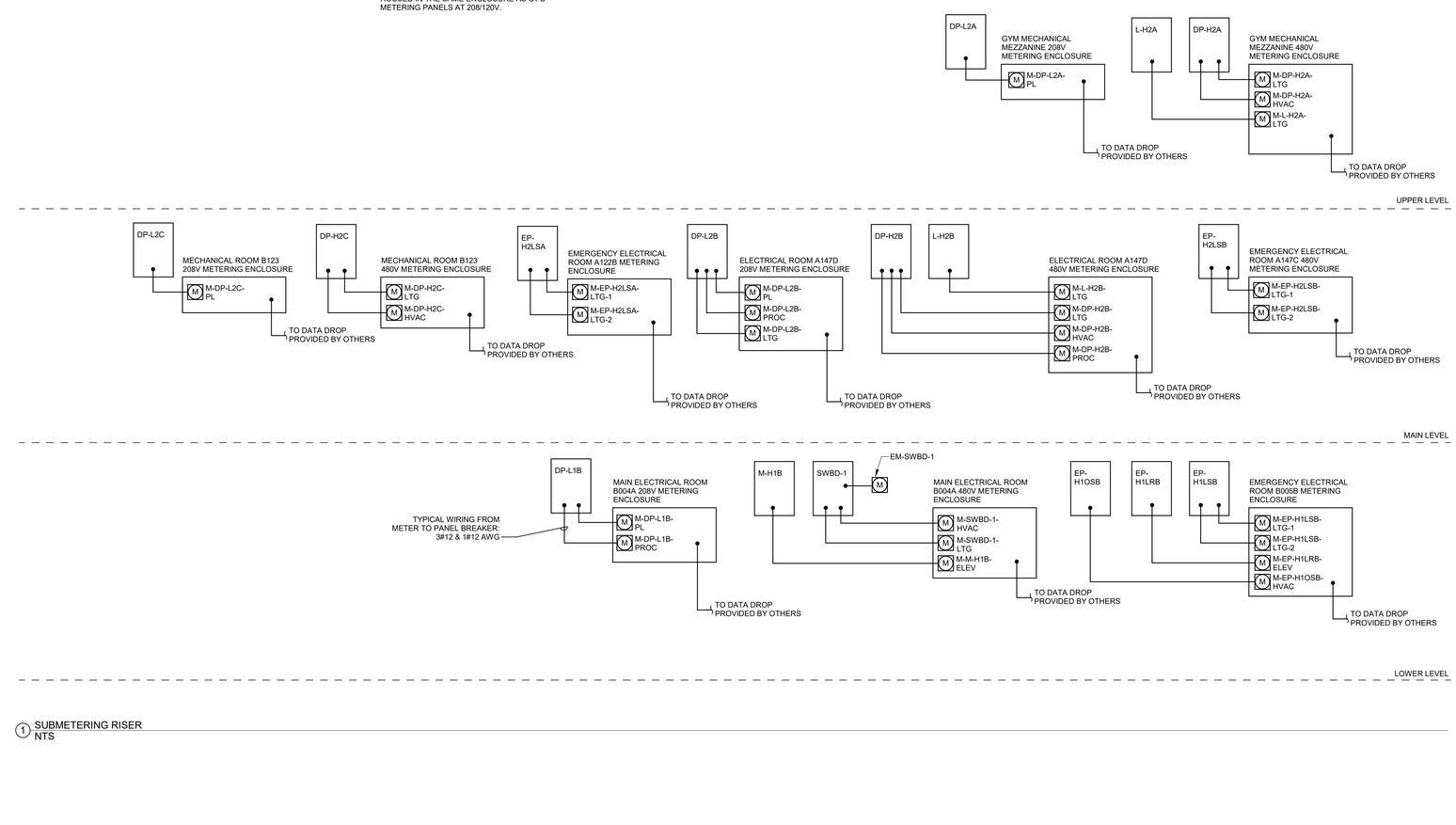
5/18/2026 11:13:16 AM Autodesk Docs://Trumbull Hillcrest Middle School/2505922-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

SUBMETERING RISER NOTES:

1. BASIS OF DESIGN: EGAUGE ENERGY METERING SYSTEM. PROVIDE BASIS OF DESIGN OR APPROVED EQUAL.
2. PROVIDE CT'S AT PANELS/SWITCHGEAR DEFINED BELOW AND LISTED IN SUBMETERING SCHEDULE. PROVIDE 3-PHASE CT'S AT EACH PANEL/SWITCHGEAR AND TOTAL LOADS PER CATEGORY FOR FINAL READOUTS. PROVIDE GRAPHS FOR EACH ACCORDINGLY. PROVIDE (1) METER PER (27) MEASURING POINTS BELOW WITH 3-PHASE LOADS BEING (3) POINTS.
3. A MAXIMUM OF (9) CT'S SHALL BE HOUSED IN EACH METERING ENCLOSURE. METERING ENCLOSURES SHALL BE LOCATED IN ELECTRICAL CLOSETS. REFER TO ELECTRICAL POWER FLOOR PLANS FOR LOCATIONS OF METERING ENCLOSURES. EXACT FINAL LOCATIONS TO BE DETERMINED IN THE FIELD.
4. ALL METERS SHALL BE CAPABLE OF RECORDING ELECTRICAL ENERGY USAGE WITH A MINIMUM RECORDING INTERVAL OF 15 MINUTES. THE RECORDED DATA SHALL BE REPORTED HOURLY, DAILY, MONTHLY, AND ANNUALLY TO THE ENERGY MANAGEMENT SYSTEM (EMS). THE METERING SYSTEM SHALL BE CAPABLE OF MAINTAINING ALL DATA COLLECTED FOR A MINIMUM OF 36 MONTHS. PROVIDE GRAPHS FOR LIGHTING, MECHANICAL, AND KITCHEN LOADS.
5. NETWORK CONNECTIONS TO THE METERING SYSTEM SHALL BE REQUIRED FOR REPORTING OF DATA.
6. COORDINATE WITH ATC CONTRACTOR FOR INTEGRATION OF METERING DATA WITH BUILDING EMS.
7. CT'S METERING PANELS AT 480/277V SHALL NOT BE HOUSED IN THE SAME ENCLOSURE AS CT'S METERING PANELS AT 208/120V.

SUBMETERING SCHEDULE

METER DESIGNATION	BASIS OF DESIGN	BREAKERS METERED	CONNECTED TO PANEL	LOAD CATEGORY	VOLTAGE	NUMBER OF POLES
M-EP-H1LRB-ELEV	EGAUGE ENERGY METERING SYSTEM	ELEVATOR 1 - MAIN POWER	EP-H1LRB	ELEVATOR	480 V	3
M-M-H1B-ELEV	EGAUGE ENERGY METERING SYSTEM	ELEVATOR 2 - MAIN POWER	M-H1B	ELEVATOR	480 V	3
M-L-H2B-LTG	EGAUGE ENERGY METERING SYSTEM	L-H2B-10,11,12,13,15,17	L-H2B	EXTERIOR LIGHTING	480 V	3
M-L-H2A-LTG	EGAUGE ENERGY METERING SYSTEM	L-H2A-10,11	L-H2A	EXTERIOR LIGHTING	480 V	3
M-EP-H2LSA-LTG-2	EGAUGE ENERGY METERING SYSTEM	EP-H2LSA-6	EP-H2LSA	EXTERIOR LIGHTING	480 V	3
M-EP-H2LSB-LTG-2	EGAUGE ENERGY METERING SYSTEM	EP-H2LSB-6	EP-H2LSB	EXTERIOR LIGHTING	480 V	3
M-EP-H1LSB-LTG-2	EGAUGE ENERGY METERING SYSTEM	EP-H1LSB-16	EP-H1LSB	EXTERIOR LIGHTING	480 V	3
M-SWBD-1-LTG	EGAUGE ENERGY METERING SYSTEM	L-H1B + L-H3C	SWBD-1	INTERIOR LIGHTING	480 V	3
M-DP-H2B-LTG	EGAUGE ENERGY METERING SYSTEM	L-H2B	DP-H2B	INTERIOR LIGHTING	480 V	3
M-DP-H2A-LTG	EGAUGE ENERGY METERING SYSTEM	L-H2A	DP-H2A	INTERIOR LIGHTING	480 V	3
M-DP-H2C-LTG	EGAUGE ENERGY METERING SYSTEM	LH1C + L-H2C	DP-H2C	INTERIOR LIGHTING	480 V	3
M-EP-H2LSA-LTG-1	EGAUGE ENERGY METERING SYSTEM	EP-H2LSA (MCB) - T-EP-L2LSA	EP-H2LSA	INTERIOR LIGHTING	480 V	3
M-EP-H2LSB-LTG-1	EGAUGE ENERGY METERING SYSTEM	EP-H2LSB (MCB) - T-EP-L2LSB	EP-H2LSB	INTERIOR LIGHTING	480 V	3
M-EP-H1LSB-LTG-1	EGAUGE ENERGY METERING SYSTEM	EP-H2LSC + EP-H1LSB-13,14,15,17	EP-H1LSB	INTERIOR LIGHTING	480 V	3
M-DP-L2B-LTG	EGAUGE ENERGY METERING SYSTEM	THEATER LIGHTING RELAY PANEL	DP-L2B	INTERIOR LIGHTING	208 V	3
M-SWBD-1	EGAUGE ENERGY METERING SYSTEM	SWBD-1 (MCB)		OVERALL MAIN POWER METER	480 V	3
M-DP-L1B-PL	EGAUGE ENERGY METERING SYSTEM	R-L1B + R-L3C	DP-L1B	PLUG LOAD	208 V	3
M-DP-L2B-PL	EGAUGE ENERGY METERING SYSTEM	R-L2B + R-L2D	DP-L2B	PLUG LOAD	208 V	3
M-DP-L2A-PL	EGAUGE ENERGY METERING SYSTEM	R-L2A + R-L2F	DP-L2A	PLUG LOAD	208 V	3
M-DP-L2C-PL	EGAUGE ENERGY METERING SYSTEM	R-L2C + R-L1C	DP-L2C	PLUG LOAD	208 V	3
M-DP-H2B-PROC	EGAUGE ENERGY METERING SYSTEM	K-H2B	DP-H2B	PROCESS LOAD	480 V	3
M-DP-L2B-PROC	EGAUGE ENERGY METERING SYSTEM	K-L2B1 + K-L2B2 + EV-LEB	DP-L2B	PROCESS LOAD	208 V	3
M-DP-L1B-PROC	EGAUGE ENERGY METERING SYSTEM	EV-LEA	DP-L1B	PROCESS LOAD	208 V	3
M-SWBD-1-HVAC	EGAUGE ENERGY METERING SYSTEM	M-H1B + M-H3C	SWBD-1	TOTAL HVAC SYSTEM	480 V	3
M-DP-H2B-HVAC	EGAUGE ENERGY METERING SYSTEM	M-H2B	DP-H2B	TOTAL HVAC SYSTEM	480 V	3
M-DP-H2C-HVAC	EGAUGE ENERGY METERING SYSTEM	M-H2C	DP-H2C	TOTAL HVAC SYSTEM	480 V	3
M-DP-H2A-HVAC	EGAUGE ENERGY METERING SYSTEM	M-H2A	DP-H2A	TOTAL HVAC SYSTEM	480 V	3
M-EP-H1OSB-HVAC	EGAUGE ENERGY METERING SYSTEM	P1A + P1B + DOAS-1	EP-H1OSB	TOTAL HVAC SYSTEM	480 V	3



1 SUBMETERING RISER
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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

ELECTRICAL SUBMETERING

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

E7.13

5/19/2026 11:13:17 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_ BIM360_ R26.rvt

PHOTOVOLTAIC SYSTEM SUMMARY - BASE BID	
PEAK SYSTEM SIZE	42 KW DC 31.5 KW AC
MODULE QUANTITY	70
INVERTER QUANTITY	1

PHOTOVOLTAIC SYSTEM SUMMARY - ADD ALTERNATE	
PEAK SYSTEM SIZE	993 KW DC 840 KW AC
MODULE QUANTITY	1670
INVERTER QUANTITY	12

PHOTOVOLTAIC GENERAL NOTES :

A. EACH CONTRACTOR, PROPOSER, SUPPLIER AND/OR MANUFACTURER SHALL REFER TO ALL DOCUMENTS PERTAINING TO THIS PROJECT AND COORDINATE ACCORDINGLY SO AS TO ENSURE ADEQUACY OF FIT, COMPLIANCE WITH SPECIFICATIONS, PROPER VOLTAGE AND CURRENT CHARACTERISTICS TO AVOID CONFLICT WITH ANY OTHER BUILDINGS SYSTEMS. VERIFY SAME WITH SHOP DRAWINGS.

B. ALL OFFSETS, TURNS, FITTINGS, TRIM, DETAILS ETC. MAY NOT BE INDICATED, BUT SHALL BE PROVIDED AS REQUIRED. ADDITIONAL ALLOWANCES SHALL BE INCLUDED FOR SAME AT EACH PROPOSER'S DISCRETION.

C. INSTALL NO CONDUIT, ETC. IN A LOCATION OR IN A MANNER WHICH WILL ALLOW FREEZING AND THE COLLECTION OF CONDENSATION THEREON. IF IN DOUBT, CONTACT THE ENGINEERS.

D. ADVISE THE ENGINEERS OF ANY CONFLICTS, ERRORS, OR OMISSIONS, ETC. AT LEAST 10 DAYS PRIOR TO BID DATE TO ALLOW CLARIFICATION BY WRITTEN ADDENDUM.

E. DEVIATION FROM SPECIFICATIONS OR PLANS REQUIRES PRIOR WRITTEN APPROVAL FROM THE ENGINEERS AND MUST BE SUBMITTED IN WRITING NO LATER THAN TEN DAYS PRIOR TO THE BID DATE.

F. OBSERVE ALL APPLICABLE CODES, RULES AND REGULATIONS THAT MAY APPLY TO THE WORK UNDER THIS CONTRACT (CITY, COUNTY, LOCAL, STATE, FEDERAL, MUNICIPALITY, UTILITY COMPANY, OSHA, ETC.)

G. INSTALL EQUIPMENT, MATERIALS, ETC. IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND DIRECTIONS. IF IN CONFLICT WITH THE DESIGN INDICATED IN CONTRACT DOCUMENTS, ADVISE THE ENGINEER PRIOR TO INSTALLATION FOR CLARIFICATION.

H. DO NOT RECESS PANELBOARD TUBS OR OTHER FLUSH-MOUNTED EQUIPMENT IN WALLS THAT HAVE A FIRE RATING, AS REQUIRED BY CODES. NO INSTALLATION SHALL DIMINISH OR VOID FIRE RESISTIVE RATINGS IN ANY WAY.

I. THE PURPOSE AND INTENT OF ALL THE DOCUMENTS PERTAINING TO THIS PROJECT IS TO PROVIDE A COMPLETE, FUNCTIONAL, SAFE, LIKE-NEW FACILITY. ANYTHING LESS SHALL BE UNACCEPTABLE.

J. ALL SYSTEMS, EQUIPMENT, AND MATERIALS ARE TO BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. WORK NOT MEETING THIS CRITERION SHALL BE REMOVED AND REINSTALLED SATISFACTORILY. FINAL DETERMINATION OF THE ACCEPTABILITY OF THE QUALITY OF WORK RESIDES WITH THE ENGINEER.

K. ALL WORK, MATERIALS, EQUIPMENT, ETC. SHALL BE FULLY GUARANTEED FOR ONE FULL CALENDAR YEAR FROM THE DATE OF SUBSTANTIAL COMPLETION AS DOCUMENTED BY THE ENGINEER, UNLESS LONGER WARRANTY PERIODS FOR EQUIPMENT ARE SPECIFIED.

L. UNLESS OTHERWISE SPECIFIED OR INDICATED, ALL EQUIPMENT AND/OR MATERIALS WITHIN OCCUPIED SPACES OR EXPOSED TO VIEW ON THE BUILDING EXTERIOR SHALL BE PRIMED AND FINISHED SO AS TO COMPLEMENT THE ADJACENT SURFACE, UNLESS OTHERWISE NOTED. COORDINATE WORK AND COLORS WITH OWNER REPRESENTATIVE.

M. WHERE PENETRATING EXISTING ROOFING MEMBRANE OR OTHER MATERIALS USED FOR WEATHER-PROOFING THE BUILDING, MAKE SUCH PENETRATIONS IN A WAY THAT WILL NOT DIMINISH THE ROOFING WARRANTY OR INTEGRITY IN ANY WAY. COORDINATE ALL SUCH PENETRATIONS WITH THE ROOFING MANUFACTURER OR OWNER REPRESENTATIVE.

N. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY COMPANY FEES, CASH CONTRIBUTIONS OR OTHER COSTS THAT THE UTILITY COMPANY MAY REQUIRE TO COMPLETE THEIR WORK (ELECTRIC, ETC.)

O. PROVIDE DETAILED SHOP DRAWINGS TO ENGINEERS PRIOR TO PURCHASING OR INSTALLING ANY EQUIPMENT.

P. DEVIATIONS IN SIZES, CAPACITIES, FIT, FINISH, ETC. FOR EQUIPMENT THAT PRIME SPECIFIED SHALL BE THE RESPONSIBILITY OF THE PURCHASER OF THAT EQUIPMENT. ANY PROVISIONS REQUIRED TO ACCOMMODATE A DEVIATION, WHETHER APPROVED BY THE ENGINEER OR NOT, SHALL BE THE RESPONSIBILITY OF THE PURCHASER.

Q. THE CONSTRUCTION MANAGER, GENERAL CONTRACTOR OR WHOMEVER HOLDS THE PRIME CONTRACT(S) FOR THIS CONSTRUCTION IS RESPONSIBLE FOR THE COORDINATION, APPEARANCE, SCHEDULING, AND TIMELINES OF THE WORK OF ALL TRADES, CONTRACTORS, SUPPLIERS, INSTALLERS, ETC. POOR OR UNTIMELY WORK ON THE PART OF ANY SUBCONTRACTORS SHALL BE RESOLVED BY THE PARTY WHO ENGAGED THEM ON THIS PROJECT.

R. WHERE MOUNTING HEIGHTS ARE NOT INDICATED OR ARE IN CONFLICT WITH OTHER BUILDING SYSTEM, CONTACT THE ENGINEER BEFORE AFFECTING INSTALLATION. REFER ALSO TO ARCHITECTURAL INTERIOR, AND EXTERIOR ELEVATIONS, CEILING HEIGHTS, AND OTHER DETAILS OF THESE DOCUMENTS, AS APPLICABLE.

S. ALL ELECTRICAL COMPONENTS OR EQUIPMENT SHALL BE LISTED AND LABELED BY UNDERWRITERS LABORATORIES OR OTHER APPROVED LISTING AGENCY, APPROVAL AND LABELING OF INDIVIDUAL COMPONENTS ON AN ASSEMBLY IS NOT ACCEPTABLE AS MEETING THIS REQUIREMENT, UNLESS WAIVED BY THE ENGINEER IN WRITING.

T. ALL WIRING SYSTEMS SHALL BE INSTALLED WITH A MINIMUM OF SPLICES, CONDUCTORS, WHETHER SINGLE OR MULTI-PAIR, SHALL BE INSTALLED, CONTINUOUS AS FAR AS POSSIBLE FROM TERMINAL POINT TO TERMINAL POINT.

U. ALL CONTRACTORS SHALL EXERCISE EXTREME CARE IN THE COURSE OF THEIR WORK SO AS TO ENSURE THAT THEY DO NOT INTERRUPT ANY EXISTING SERVICE OR SUB-SERVICE FOR SAFETY PURPOSES. PAY PARTICULAR ATTENTION TO THIS PRECAUTION RELATIVE TO REQUIREMENTS. UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE MUNICIPALITY OR UTILITY COMPANY STANDARDS. IN ALL CASES, THE MOST STRINGENT REQUIREMENTS SHALL APPLY.

V. ALL SUPPORTS FOR EQUIPMENT, DEVICES OR FIXTURES SHALL BE UNIQUE, DIRECTLY FROM THE BUILDING STRUCTURE. DO NOT SUPPORT WORK FROM OTHER TRADES' EQUIPMENT OR SUPPORTS WITHOUT WRITTEN PERMISSION FROM THE ENGINEER AND CONSENT FROM THE OTHER TRADE IN WRITING.

W. WHERE INTERRUPTING AN EXISTING UTILITY OR SERVICE DELIBERATELY OR ACCIDENTALLY, THE RESPONSIBLE CONTRACTOR SHALL WORK CONTINUOUSLY AS NEEDED TO RESTORE THE SAME, PROVIDING PREMIUM TIME AS NEEDED.

X. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED FOR HIS WORK. ALL CUTTING AND PATCHING SHALL BE IN ACCORDANCE WITH THE ARCHITECT'S STANDARDS FOR SUCH WORK.

Y. ALL WORK SHALL BE CONCEALED UNLESS SPECIFICALLY INDICATED TO BE EXPOSED, OR REQUIRED TO BE EXPOSED. IF IN DOUBT, CONTACT THE ENGINEER FOR CLARIFICATION PRIOR TO INSTALLING ANY SUCH WORK.

Z. INTERRUPTION OF ANY EXISTING SERVICES SHALL BE COORDINATED WITH THE OWNER, GENERAL CONTRACTOR, UTILITY COMPANY AS NECESSARY, AND THE OWNER REPRESENTATIVE, AT LEAST TWO WEEKS IN ADVANCE OF ANY ANTICIPATED INTERRUPTION. A SCHEDULE FOR THESE OUTAGES SHALL BE DEVELOPED AND AGREED UPON BETWEEN THE PARTIES MENTIONED, TO AVOID UNNECESSARY INCONVENIENCE TO THE OWNER OR ANY AFFECTED PARTY. NOTIFY THE UTILITY COMPANY OF ANY ANTICIPATED SERVICES REQUIRED TWO WEEKS IN ADVANCE, IN WRITING. IF UTILITY COMPANY REQUIRES A LONGER NOTIFICATION PERIOD, SO PROVIDE.

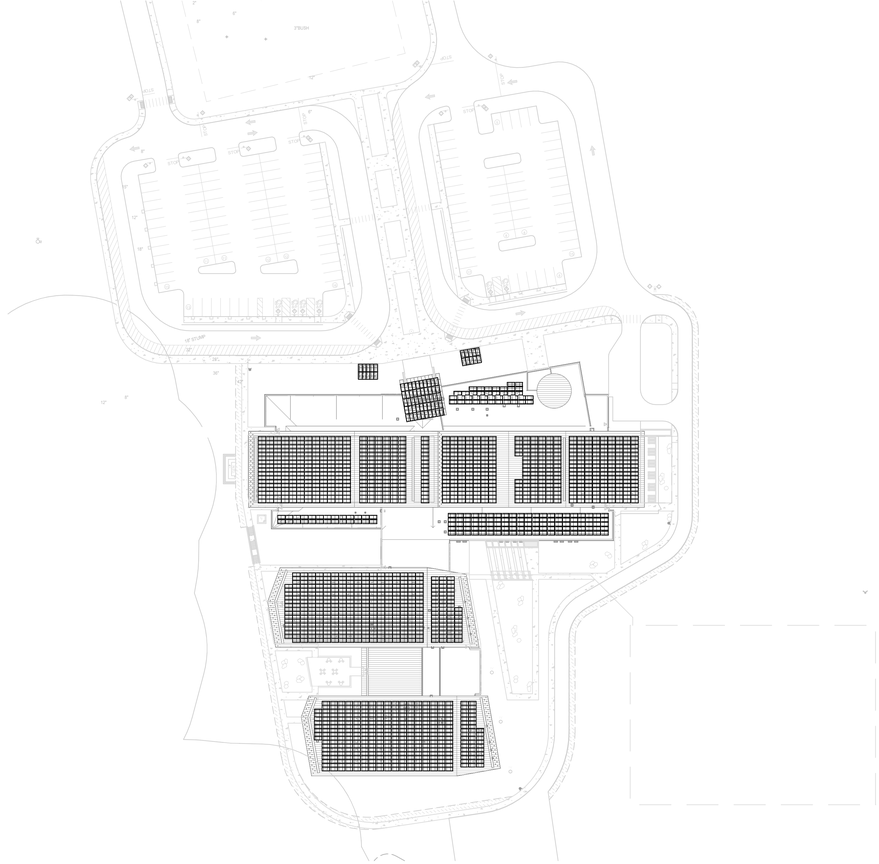
AA. ALL MATERIALS FURNISHED AND ALL WORK INSTALLED SHALL COMPLY WITH THE CURRENT EDITION OF THE NATIONAL ELECTRIC CODES, NATIONAL FIRE CODES OF THE NATIONAL FIRE PROTECTION ASSOCIATION, THE REQUIREMENTS OF LOCAL UTILITY COMPANIES AND WITH THE REQUIREMENT OF ALL GOVERNMENTAL AGENCIES OR DEPARTMENTS HAVING JURISDICTION. IF ANY CONFLICT OR DISCREPANCIES OCCUR THE MOST STRINGENT WILL APPLY.

BB. DO NOT SCALE FROM DRAWINGS, AS PRINTING DISTORTS SCALE. WORK SHALL BE LAID OUT FROM DIMENSIONED DRAWINGS, OR DIMENSIONS SUPPLIED TO THE CONTRACTOR.

CC. NOISY WORK, WORK OUTSIDE CONSTRUCTION BARRIERS, WORKS IN OCCUPIED AREAS, ETC. SHALL BE PERFORMED AFTER HOURS OR ON WEEKENDS OR DURING SUMMER BREAK. COORDINATE EXACT SCHEDULING WITH FACILITY PRIOR TO CONSTRUCTION.

DD. PROVIDE NEMA RATINGS THAT ARE APPROPRIATE FOR THE ENVIRONMENT. WHERE NO NEMA RATING IS LISTED, THE ENGINEER SHALL MAKE THE FINAL DETERMINATION.

EE. THIS PROJECT IS DESIGNED IN ACCORDANCE WITH THE 2020 NEC AND SHALL BE CONSTRUCTED AS SUCH.



2 SITE OVERVIEW
1" = 60'-0"



3 PROJECT LOCATION
1" = 200'-0"

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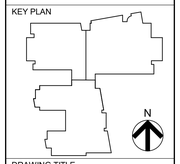
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

PHOTOVOLTAIC LEGEND

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

PV0.01

5/18/2026 11:13:21 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (PHOTOVOLTAICS):

A. REFER TO THE ARCHITECT'S REFLECTED CEILING PLANS, ELEVATIONS, AND CASEWORK DETAILS FOR EXACT LOCATIONS OF ALL WALL AND CEILING MOUNTED ELECTRICAL DEVICES.

B. SOLAR MODULE STRINGS SHALL NOT EXCEED 1000V DC.

C. SETBACKS FROM EDGE OF ROOF SHALL BE COMPLIANT WITH NEC AND INTERNATIONAL FIRE CODE (IFC) SECTION 1205.3.

D. CONDUIT SUPPORTS SHALL BE SPACED 10' ON CENTER. CONDUIT MUST BE APPROPRIATELY LABELED AND STRAPPED.

E. WHERE CONDUIT BODIES ARE NOT USED ON AC RUNS TO THE UTILITY ACCESSIBLE DISCONNECT SWITCH, ALL JUNCTION BOXES SHALL BE NEMA-4X RATED. TROUGHS MUST INCLUDE APPROPRIATE SEALANT.

F. FOR ALL CONDUIT RUNS LONGER THAN 100', CONTRACTOR SHALL USE EXPANSION JOINTS.

G. AT LOW POINTS IN CONDUIT WHERE WATER IS LIKELY TO SETTLE, CONTRACTOR IS REQUIRED TO INSTALL 0.25" WEEP HOLES. DO NOT ADD WEEP HOLES TO ANY EQUIPMENT WITHOUT PERMISSION FROM ENGINEER, AS THIS MAY INVALIDATE WARRANTIES.

H. 2-PART EPOXY IS REQUIRED ON ALL OUTDOOR PLACARDS, INCLUDING THOSE INSTALLED ON INVERTERS.

I. EQUIPMENT GROUNDING CONDUCTOR MUST BE BARE OR PV-WIRE WHEN EXPOSED TO FREE AIR.

J. OUTDOOR CONDUCTORS NOT BURIED SHALL RUN THROUGH EMT CONDUIT.

K. CONTRACTOR SHALL USE PV EXPANSION COUPLINGS WHERE PVC ENTERS OR EXITS THE GROUND.

L. ALL CONDUIT CONNECTIONS SHALL USE WEATHER-TIGHT RATED CONDUIT HUBS.

M. COORDINATE INTEGRATION OF PHOTOVOLTAIC SYSTEM WITH LIGHTNING PROTECTION CONTRACTOR.

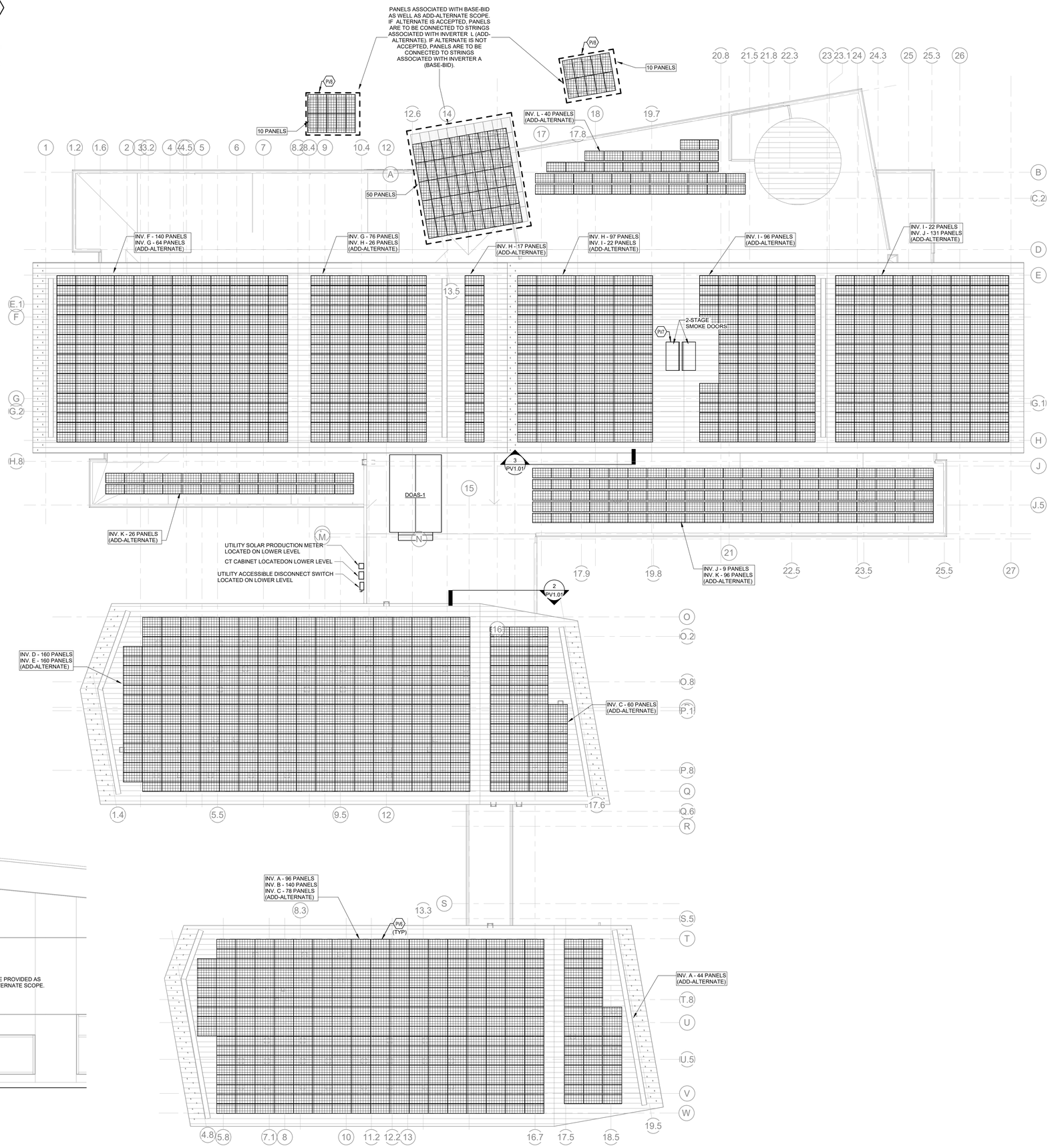
N. RACKING SYSTEM TO BY PROVIDED BY OTHERS. ALL RACKING SHALL BE NON-PENETRATING, SLIP SHEETS SHALL BE PROVIDED FOR BALLASTED SYSTEM ON FLAT ROOFS WHERE APPLICABLE. BALLASTED PANELS ON FLAT ROOFS SHALL HAVE A 5 DEGREE TILT.

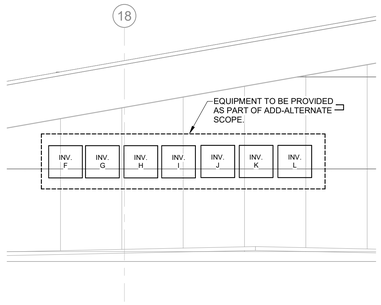
TAGGED NOTES

PV6 PROVIDE BOD: JA SOLAR JAM72D40-600/MB SOLAR MODULE, OR APPROVED EQUAL. MODULE SHALL CONFORM TO NEC 690 STANDARDS.

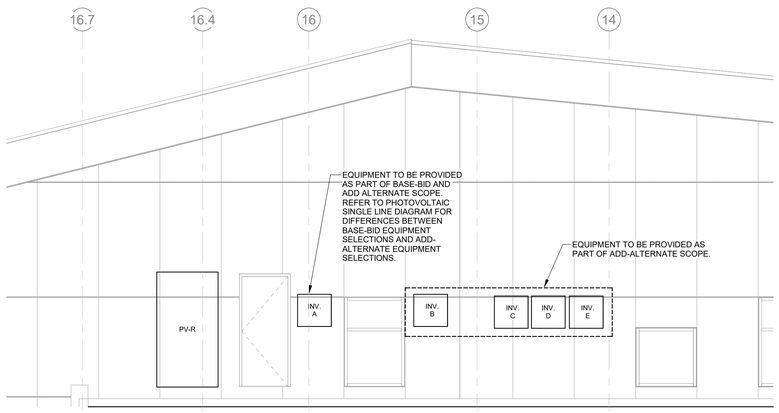
PV7 A MINIMUM OF 4' CLEARANCE SHALL BE OBSERVED AROUND MECHANICAL UNIT PER INTERNATIONAL FIRE CODE (IFC) SECTION 1205.3.

PV8 WIRING AND CONDUIT FOR CANOPY PV EXTERNAL TO THE BUILDING SHALL RUN BELOW GRADE AND UNDER-SLAB. CONDUIT SHALL STUB UP THROUGH PENETRATION IN SLAB AND RUN THROUGH BUILDING TO LOCATION OF INVERTER. COORDINATE ROUTING OF CONDUIT WITH BUILDING CONDITIONS. CONDUIT BELOW GRADE SHALL BE 1" GALVANIZED RIGID STEEL CONDUIT (GRSC).





3 PHOTOVOLTAIC INVERTERS E-I SECTION PLAN - ADD ALTERNATE
1/4" = 1'-0"



2 PHOTOVOLTAIC INVERTERS A-D SECTION PLAN - ADD ALTERNATE
1/4" = 1'-0"

1 ROOF PHOTOVOLTAIC PLAN
1/16" = 1'-0"

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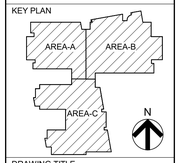
STATE OF CONNECTICUT
PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ROOF PHOTOVOLTAIC PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

PV1.01

5/18/2026 11:13:24 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

⬡	EQUIPMENT SCHEDULE				
TAG	DESCRIPTION	QTY	BASIS OF DESIGN	REMARKS	BASE-BID / ALTERNATE SCOPE
1	600W SOLAR PV MODULE	140	JA SOLAR JAM72D40-600/MB		ADD-ALT. ONLY
2	600W SOLAR PV MODULE	138	JA SOLAR JAM72D40-600/MB		ADD-ALT. ONLY
3	600W SOLAR PV MODULE	160	JA SOLAR JAM72D40-600/MB		ADD-ALT. ONLY
4	600W SOLAR PV MODULE	122	JA SOLAR JAM72D40-600/MB		ADD-ALT. ONLY
5	600W SOLAR PV MODULE	110	JA SOLAR JAM72D40-600/MB		ADD-ALT. ONLY
6	600W SOLAR PV MODULE	70	JA SOLAR JAM72D40-600/MB		BASE-BID ONLY
7	RAPID SHUTDOWN DEVICE		APSMART RSD-D		BASE-BID AND ADD-ALT.
8	70 KW SOLAR INVERTER	12	SUNNY TRIPOWER X 70-US		ADD-ALT. ONLY
9	30 KW SOLAR INVERTER	1	SUNNY TRIPOWER X 30-US		BASE-BID ONLY
10	AC RECOMBINER BOX	1	GAMECHANGE AC COMBINER	PANEL SHALL BE MINIMUM NEMA-3R RATED.	BASE-BID AND ADD-ALT.

○	WIRING SCHEDULE				
TAG	CONDUCTOR TYPE	CONDUCTOR SIZE (AWG/KCMIL)	CONDUIT & RACEWAY TYPE	CONDUIT & RACEWAY SIZE	REMARKS
1	PV WIRE	2#10	FREE AIR	N/A	PROVIDE COPPER PV-RATED WIRE WITH BLACK INSULATION.
2	THWN-2	4#1 & 1#6G	GRSC	1-1/2"	
3	THWN-2	4#8 & 1#10G	GRSC	3/4"	
5	THWN-2	(3) 4#600 & 1#3/0G	GRSC	(3) 4"	

GENERAL NOTES (PHOTOVOLTAIC RISER):

A. SOLAR MODULE STRINGS SHALL NOT EXCEED 1000V DC.

B. ALL CONDUCTORS SHALL BE COPPER (SEE SPECIFICATIONS FOR TYPES)

C. PROVIDE A COORDINATION/FAULT CURRENT STUDY FOR BREAKERS ON THIS PROJECT. STUDY SHALL INCLUDE ALL MAINS AND FEEDERS SHOWN ON THESE DRAWINGS AND SHALL EXTEND TO THE MAIN LUGS OR BREAKER OF THE FURTHEST DEVICE DOWNSTREAM. SUBMIT AS SHOP DRAWING TO ENGINEER PRIOR TO ORDERING ANY POWER DISTRIBUTION EQUIPMENT.

D. PROVIDE A COMPREHENSIVE ARC FLASH HAZARD ANALYSIS FOR POWER DISTRIBUTION DEVICES ON THIS PROJECT. PROVIDE ALL LABELS, WARNING SIGNAGE, ETC. PER NFPA-70E AND OSHA REQUIREMENTS.

E. NEC AND LOCAL JURISDICTION GUIDELINES TO BE FOLLOWED.

F. ALL WIRE, VOLTAGES, AMPERAGES, AND EQUIPMENT SHALL BE SIZED ACCORDING TO TEMPERATURE DERATING AND LOCATIONS.

G. ALL EQUIPMENT SHALL BE GROUNDED, INCLUDING BONDING JUMPERS WHERE NECESSARY ACROSS RAIL SPLICE PLATES TO BOND INDIVIDUAL PIECES OF RAIL.

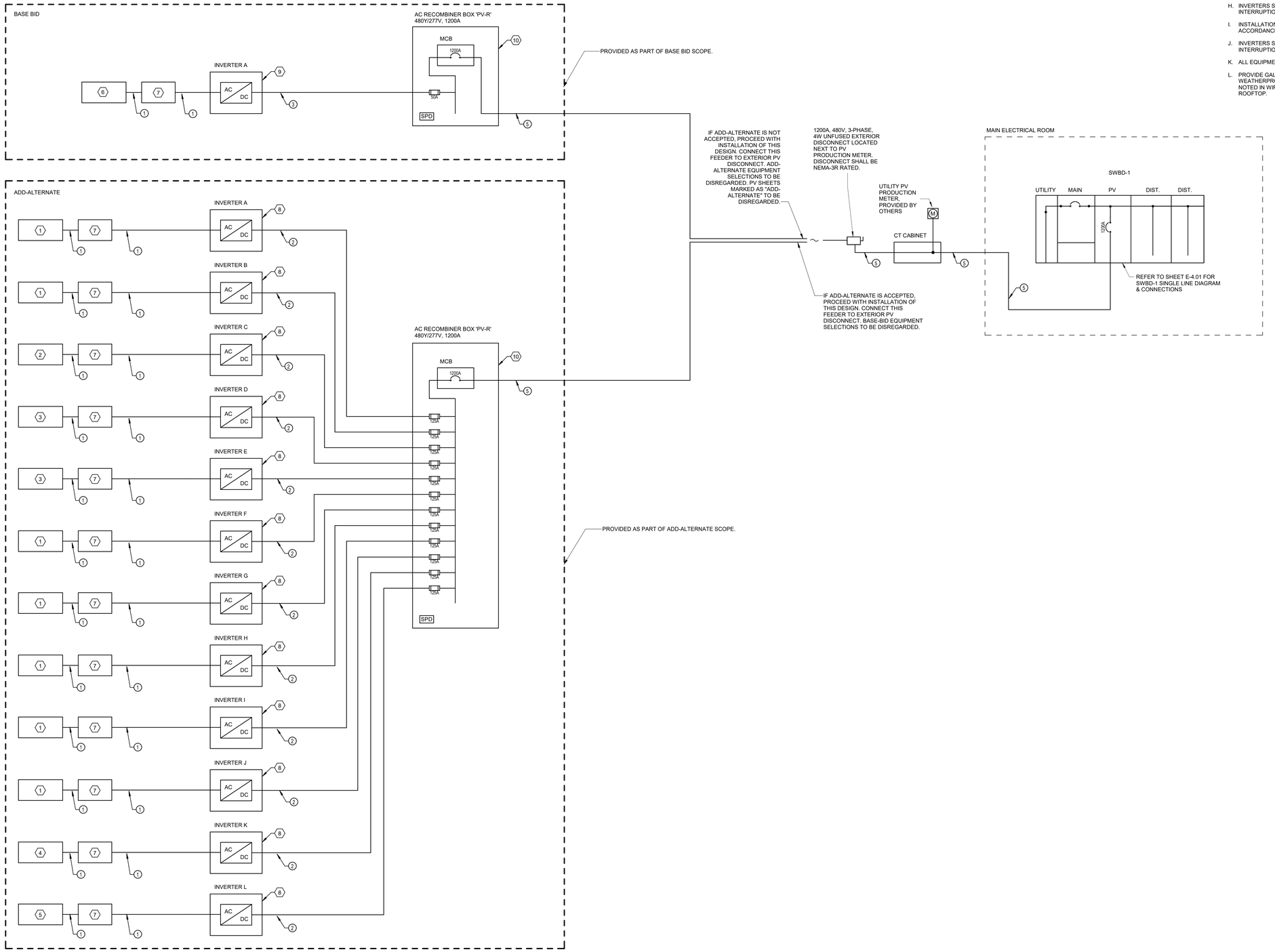
H. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

I. INSTALLATION, LABELING, MARKINGS, AND PLACARDS SHALL BE IN ACCORDANCE WITH NEC 690.

J. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

K. ALL EQUIPMENT SHALL BE LISTED FOR USE.

L. PROVIDE GALVANIZED RIGID STEEL CONDUIT (GRSC) WITH WEATHERPROOF FITTINGS FOR OUTDOOR INSTALLATIONS WHERE NOTED IN WIRING SCHEDULE AND FOR ALL OTHER THWN FEEDERS ON ROOFTOP.



1 PHOTOVOLTAIC DISTRIBUTION RISER
1/8" = 1'-0"

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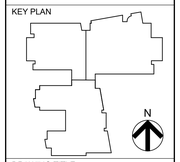
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

PHOTOVOLTAIC SINGLE LINE DIAGRAM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
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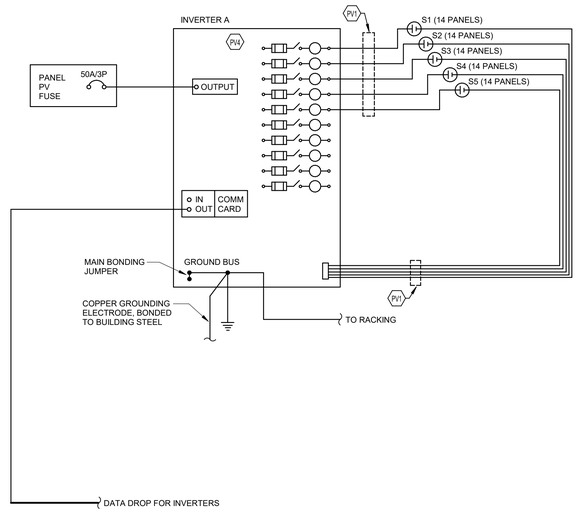
PV2.01

5/18/2026 11:13:25 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt



1 PHOTOVOLTAIC RISER - BASE BID
1/8" = 1'-0"

GENERAL NOTES (PHOTOVOLTAIC RISER):

A. SOLAR MODULE STRINGS SHALL NOT EXCEED 1000V DC.

B. ALL CONDUCTORS SHALL BE COPPER (SEE SPECIFICATIONS FOR TYPES)

C. PROVIDE A COORDINATION/FAULT CURRENT STUDY FOR BREAKERS ON THIS PROJECT. STUDY SHALL INCLUDE ALL MAINS AND FEEDERS SHOWN ON THESE DRAWINGS AND SHALL EXTEND TO THE MAIN LUGS OR BREAKER OF THE FURTHEST DEVICE DOWNSTREAM. SUBMIT AS SHOP DRAWING TO ENGINEER PRIOR TO ORDERING ANY POWER DISTRIBUTION EQUIPMENT.

D. PROVIDE A COMPREHENSIVE ARC FLASH HAZARD ANALYSIS FOR POWER DISTRIBUTION DEVICES ON THIS PROJECT. PROVIDE ALL LABELS, WARNING SIGNAGE, ETC. PER NFPA-70E AND OSHA REQUIREMENTS.

E. NEC AND LOCAL JURISDICTION GUIDELINES TO BE FOLLOWED.

F. ALL WIRE, VOLTAGES, AMPERAGES, AND EQUIPMENT SHALL BE SIZED ACCORDING TO TEMPERATURE DERATING AND LOCATIONS.

G. ALL EQUIPMENT SHALL BE GROUNDED, INCLUDING BONDING JUMPERS WHERE NECESSARY ACROSS RAIL SPLICE PLATES TO BOND INDIVIDUAL PIECES OF RAIL.

H. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

I. INSTALLATION, LABELING, MARKINGS, AND PLACARDS SHALL BE IN ACCORDANCE WITH NEC 690.

J. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

K. ALL EQUIPMENT SHALL BE LISTED FOR USE.

L. PROVIDE GALVANIZED RIGID STEEL CONDUIT (GRSC) WITH WEATHERPROOF FITTINGS FOR OUTDOOR INSTALLATIONS WHERE NOTED IN WIRING SCHEDULE AND FOR ALL OTHER THWN FEEDERS ON ROOFTOP.

TAGGED NOTES

(##)

PV1 PROVIDE # OF #10 INDICATED, 1000VDC, COPPER PV-RATED WITH BLACK INSULATION WIRING FOR PV STRINGS.

PV4 PROVIDE 1000VDC, 480/277VAC, 3-PHASE, 125 KW AC PHOTOVOLTAIC INVERTER WITH MINIMUM CALIFORNIA ENERGY COMMISSION (CEC) EFFICIENCY RATING OF 96.5%. PROVIDE SMA SUNNY TRIPOWER X 70-US OR APPROVED EQUAL. INVERTER SHALL BE OUTDOOR RATED AND CONFORM TO NEC 690.12.

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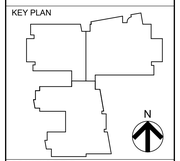

DRAWING TITLE

PHOTOVOLTAIC RISER

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

PV2.02

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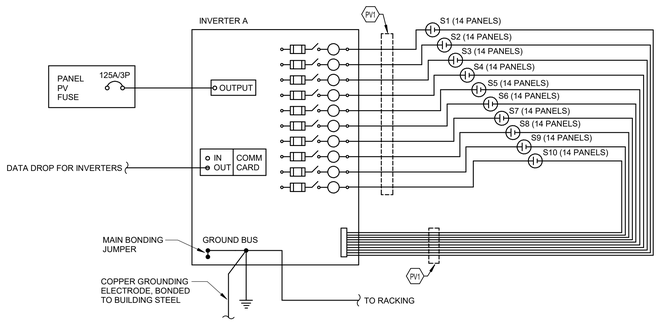

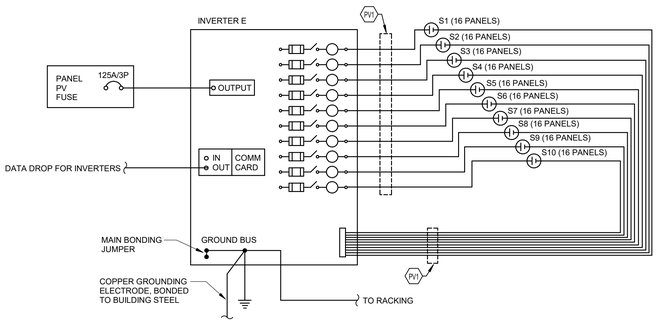

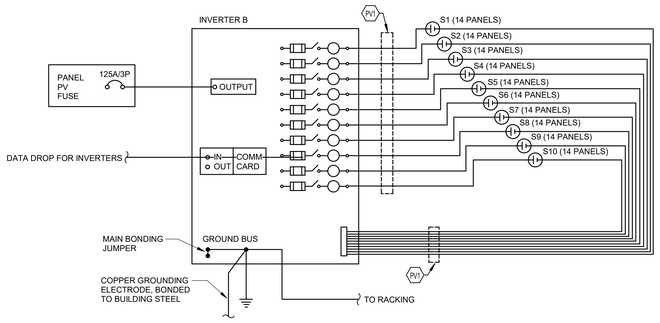

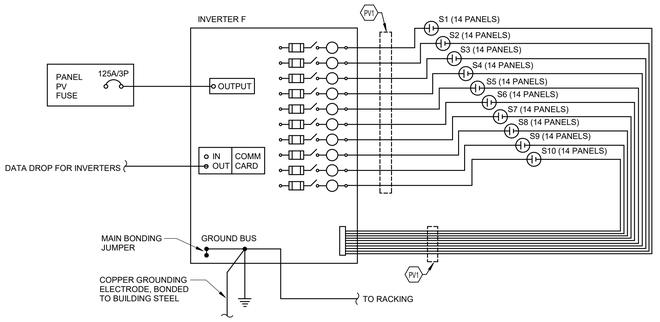

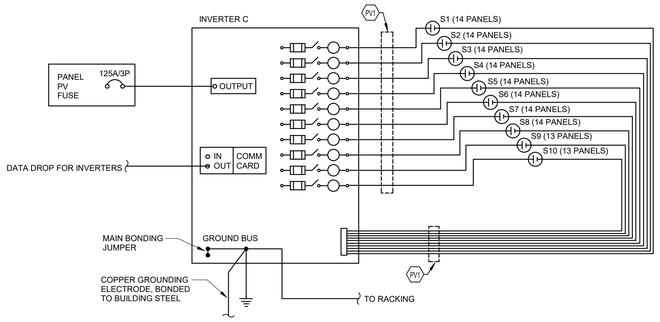

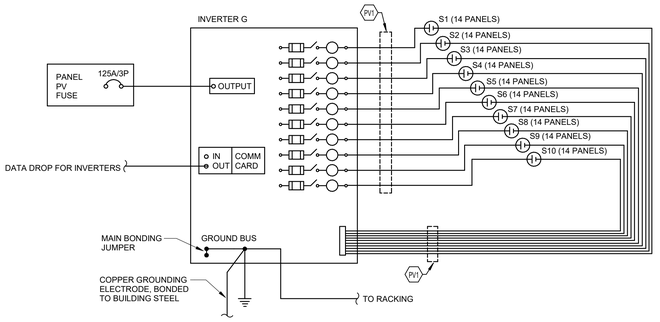

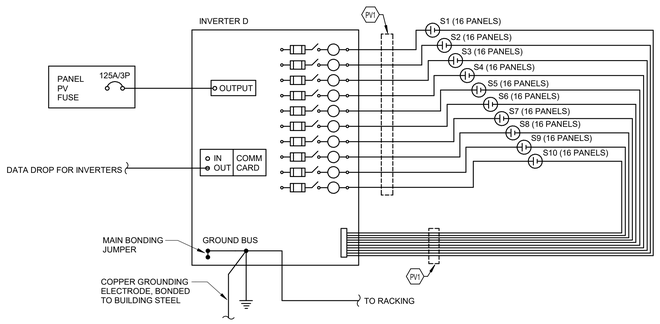

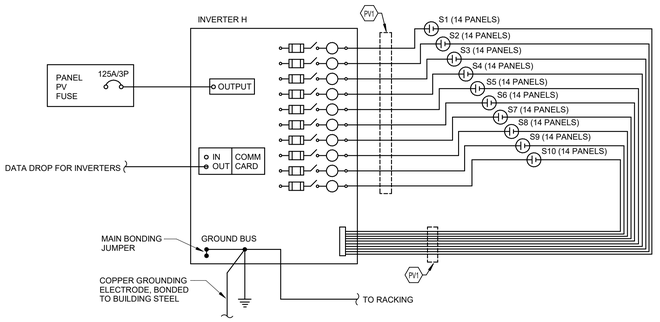

1 PHOTOVOLTAIC RISER
1/8" = 1'-0"

GENERAL NOTES (PHOTOVOLTAIC RISER):

A. SOLAR MODULE STRINGS SHALL NOT EXCEED 1000V DC.

B. ALL CONDUCTORS SHALL BE COPPER (SEE SPECIFICATIONS FOR TYPES)

C. PROVIDE A COORDINATION/FAULT CURRENT STUDY FOR BREAKERS ON THIS PROJECT. STUDY SHALL INCLUDE ALL MAINS AND FEEDERS SHOWN ON THESE DRAWINGS AND SHALL EXTEND TO THE MAIN LUGS OR BREAKER OF THE FURTHEST DEVICE DOWNSTREAM. SUBMIT AS SHOP DRAWING TO ENGINEER PRIOR TO ORDERING ANY POWER DISTRIBUTION EQUIPMENT.

D. PROVIDE A COMPREHENSIVE ARC FLASH HAZARD ANALYSIS FOR POWER DISTRIBUTION DEVICES ON THIS PROJECT. PROVIDE ALL LABELS, WARNING SIGNAGE, ETC. PER NFPA-70E AND OSHA REQUIREMENTS.

E. NEC AND LOCAL JURISDICTION GUIDELINES TO BE FOLLOWED.

F. ALL WIRE, VOLTAGES, AMPERAGES, AND EQUIPMENT SHALL BE SIZED ACCORDING TO TEMPERATURE DERATING AND LOCATIONS.

G. ALL EQUIPMENT SHALL BE GROUNDED, INCLUDING BONDING JUMPERS WHERE NECESSARY ACROSS RAIL SPLICE PLATES TO BOND INDIVIDUAL PIECES OF RAIL.

H. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

I. INSTALLATION, LABELING, MARKINGS, AND PLACARDS SHALL BE IN ACCORDANCE WITH NEC 690.

J. INVERTERS SHALL CONTAIN A GROUND FAULT DETECTION AND INTERRUPTION DEVICE.

K. ALL EQUIPMENT SHALL BE LISTED FOR USE.

L. PROVIDE GALVANIZED RIGID STEEL CONDUIT (GRSC) WITH WEATHERPROOF FITTINGS FOR OUTDOOR INSTALLATIONS WHERE NOTED IN WIRING SCHEDULE AND FOR ALL OTHER THWN FEEDERS ON ROOFTOP.

TAGGED NOTES

(##)

PV1 PROVIDE # OF #10 INDICATED, 1000VDC, COPPER PV-RATED WITH BLACK INSULATION WIRING FOR PV STRINGS.

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

PHOTOVOLTAIC RISER - ADD ALTERNATE

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

ISSUE DATES

NO.	DATE	PURPOSE
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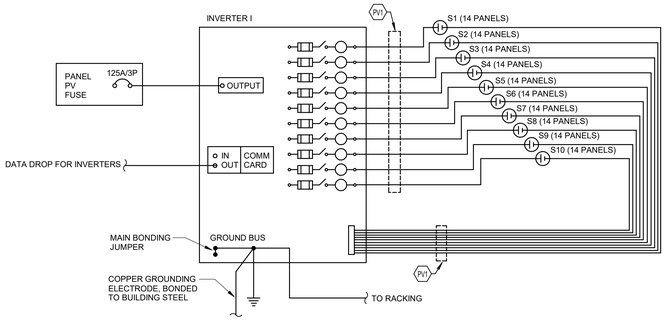

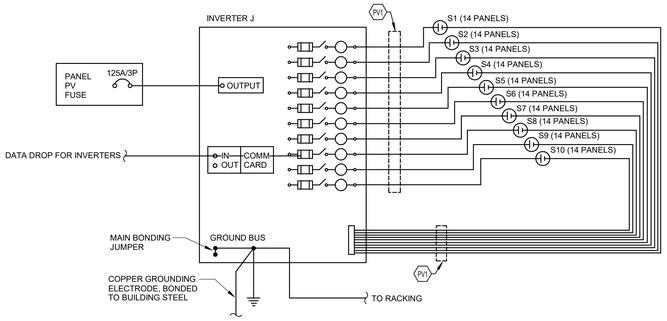

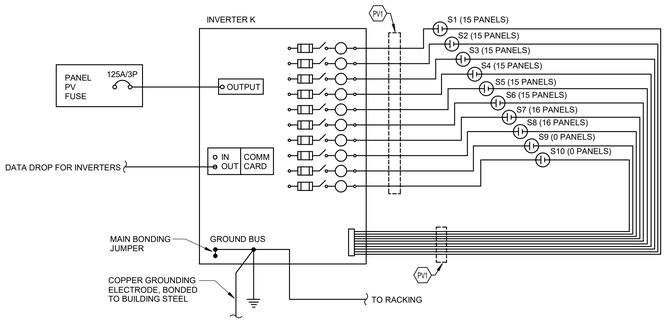

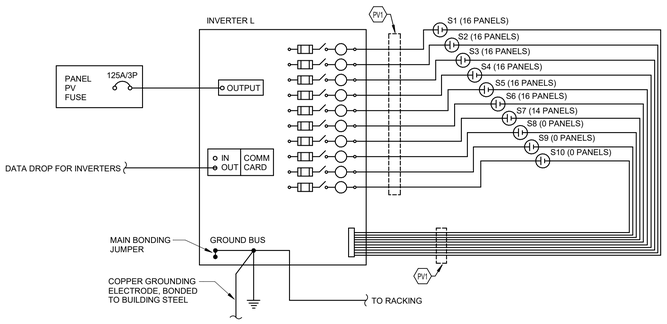

1 PHOTOVOLTAIC RISER
1/8" = 1'-0"

GENERAL NOTES (PHOTOVOLTAIC RISER):

A. SOLAR MODULE STRINGS SHALL NOT EXCEED 1000V DC.

B. ALL CONDUCTORS SHALL BE COPPER (SEE SPECIFICATIONS FOR TYPES)

C. PROVIDE A COORDINATION/FAULT CURRENT STUDY FOR BREAKERS ON THIS PROJECT. STUDY SHALL INCLUDE ALL MAINS AND FEEDERS SHOWN ON THESE DRAWINGS AND SHALL EXTEND TO THE MAIN LUGS OR BREAKER OF THE FURTHEST DEVICE DOWNSTREAM. SUBMIT AS SHOP DRAWING TO ENGINEER PRIOR TO ORDERING ANY POWER DISTRIBUTION EQUIPMENT.

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TAGGED NOTES

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530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

PHOTOVOLTAIC RISER - ADD ALTERNATE

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	WS
APPROVED BY	MA

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PV2.04

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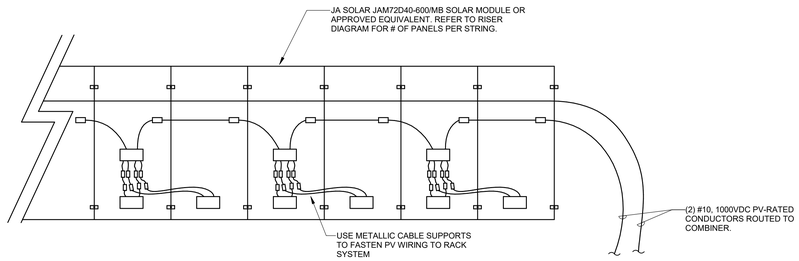
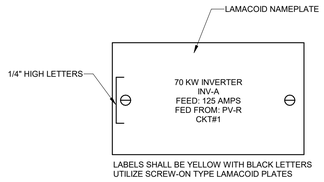


2 TYPICAL ROOF MOUNTED MODULE STRING DETAIL
1/8" = 1'-0"



1 TYPICAL INVERTER NAMEPLATE DETAIL
1/8" = 1'-0"

PANELBOARD AND WIRING SCHEDULE

PANEL: PV-R
VOLTAGE: 480Y/277V,3P,4W
AMPERES: 1200 A
MAINS TYPE: MCB
SPD: Yes
MOUNTING: SURFACE
PANEL INTERRUPTING RATING: 42 KAIC
LOCATION:
SUPPLY FROM:

Notes	CKT	Circuit Description	Fuse	Poles	A	B	C	Poles	Fuse	Circuit Description	CKT	Notes
	1				0.0	0.0					2	
	3	INV. A	125 A	3		0.0	0.0	3	125 A	INV. B	4	
	5						0.0	0.0			6	
	7				0.0	0.0					8	
	9	INV. C	125 A	3		0.0	0.0	3	125 A	INV. D	10	
	11						0.0	0.0			12	
	13				0.0	0.0					14	
	15	INV. E	125 A	3		0.0	0.0	3	125 A	INV. F	16	
	17						0.0	0.0			18	
	19				0.0	0.0					20	
	21	INV. G	125 A	3		0.0	0.0	3	125 A	INV. H	22	
	23						0.0	0.0			24	
	25				0.0	0.0					26	
	27	INV. I	125 A	3		0.0	0.0	3	125 A	INV. J	28	
	29						0.0	0.0			30	
	31				0.0	0.0					32	
	33	INV. K	125 A	3		0.0	0.0	3	125 A	INV. L	34	
	35						0.0	0.0			36	
	37				--	--					38	
	39	SPACE	--	3	--	--		3	--	SPACE	40	
	41						--	--			42	
					0.0 kVA	0.0 kVA	0.0 kVA					
					0 A	0 A	0 A					

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
EQUIP	0 VA	0.00%	0 VA	TOTAL CONNECTED LOAD:	0 VA
				TOTAL ESTIMATED DEMAND:	0 VA
				TOTAL CONNECTED CURRENT:	0 A
				TOTAL ESTIMATED DEMAND CURRENT:	0 A
				10 % ADDITIONAL CAPACITY:	0 A
				TOTAL PANEL CURRENT:	0 A

NOTES: WHERE NOT LISTED, WIRE AND CONDUIT SHALL BE BE MINIMUM PER SPECIFICATIONS. SPARE BREAKERS TO BE 20A/1P.

NOTES:

1. MAIN BREAKER FOR PANEL 'PV-R' SHALL BE 100% RATED AND PROVIDED WITH LSIG AND ARMS.
2. FUSES FOR INVERTERS B, C, D, E, F, G, H, AND I ARE TO BE PROVIDED AS ADD-ALTERNATES ONLY. IF THE ADD-ALTERNATE IS NOT ACCEPTED, FUSES FOR THESE INVERTERS SHALL NOT BE PROVIDED.
3. THE BASE-BID FUSE SIZE FOR INVERTER A IS 50A, AND THE ADD-ALTERNATE FUSE SIZE FOR INVERTER A IS 125A. IF ADD-ALTERNATE IS NOT ACCEPTED, PROVIDE A 50A FUSE FOR INVERTER A.

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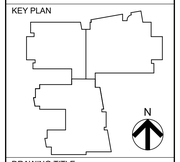
PROJECT STATUS

KEY PLAN



DRAWING TITLE

PHOTOVOLTAIC DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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PV3.01

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FIRE ALARM SYSTEM INPUT/OUTPUT MATRIX

SYSTEM OUTPUTS

FACP ANNUNCIATION | NOTIFICATION | REQUIRED FIRE SAFETY CONTROL

SYSTEM INPUTS

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	-
1	FIRE ALARM SYSTEM AC POWER FAILURE			●	●							●															1
2	FIRE ALARM SYSTEM LOW BATTERY					●	●						●														2
3	OPEN CIRCUIT					●	●						●														3
4	GROUND FAULT					●	●						●														4
5	NOTIFICATION APPLIANCE CIRCUIT SHORT					●	●						●														5
6	BUILDING MANUAL PULL STATIONS	●	●					●	●	●	●			●						●							6
7	CORRIDOR SMOKE DETECTORS	●	●					●	●	●	●			●	●					●	●		●	●	●		7
8	AREA SMOKE DETECTORS	●	●					●	●	●	●			●	●					●	●		●	●	●		8
9	HVAC AIR DUCT SMOKE DETECTORS			●	●			●				●										●					9
10	ROOM FIRE SUPPRESSION SYSTEM ALARM	●	●					●	●	●	●			●	●					●	●						10
11	SPRINKLER TAMPER SWITCH			●	●			●				●															11
12	SPRINKLER WATER FLOW IN BUILDING	●	●					●	●	●	●			●	●					●	●						12
13	SPRINKLER WATER FLOW IN ELEV EQUIP RM OR SHAFT	●	●					●	●	●	●			●	●		●	●		●	●						13
14	ELEV EQUIP RM AREA SMOKE DETECTOR	●	●					●	●	●	●			●	●		●			●	●						14
15	ELEV SHAFT AND ELEV EQUIP RM HEAT DETECTORS	●	●					●	●	●	●			●	●		●	●		●	●						15
16	ELEV LOBBY SMOKE DETECTORS - UPPER FLOORS	●	●					●	●	●	●			●	●					●	●		●	●	●		16
17	ELEV LOBBY SMOKE DETECTOR - RECALL FLOOR	●	●					●	●	●	●			●		●	●			●	●		●	●	●		17
18	ELEV CONTROLLER POWER SHUNT TRIP STATUS			●	●			●				●															18
19	LEGALLY REQUIRED GENERATOR SYSTEM LOW FUEL			●	●			●				●															22
20	LEGALLY REQUIRED GENERATOR NOT IN AUTOMATIC			●	●			●				●															23
21	AREA OF REFUGE TWO-WAY COMMUNICATIONS STATUS			●	●			●				●															24
22	-																										25
23	-																										26
24																											27
	FA0.02 - REV 09/11/25	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	-

DESCRIPTION

FIRE ALARM - CONTROL UNITS (PANELS)		SYMBOL
MAIN CONTROL PANEL CENTRAL PROCESSING UNIT (CPU)		FACP
REMOTE L.C.D. FIRE ALARM ANNUNCIATOR		FAA
REMOTE FIRE ALARM ANNUNCIATOR W/ MICROPHONE		FAAM
SMOKE CONTROL PANEL		SCP
NOTIFICATION CIRCUIT POWER BOOSTER, EXTENDER PANEL		NAC
TRANSPONDER CABINET		TPR
REMOTE TEST STATION		RTS
GRAPHIC ANNUNCIATOR PANEL		GAP
BATTERY CABINET		BAT
FIRE ALARM DOCUMENT CABINET		FADC
FIRE ALARM TERMINAL CABINET		FATC
LCD ANNUNCIATOR DISPLAY		LCD
MASTER FIRE ALARM CONTROL UNIT		MFACU
POST INDICATOR VALVE		PIV
PULL STATION		F
KEYED, LOCKED PULL STATION : DOUBLE ACTION. STATION SHALL ONLY BE OPERABLE VIA KEY IN POSSESSION OF STAFF.		F K
AUDIO/VISUAL NOTIFICATION APPLIANCE		F (S) (C)
AUDIO-ONLY NOTIFICATION APPLIANCE		F (S) (C)
VISUAL-ONLY NOTIFICATION APPLIANCE		F (S) (C)
BELL / LIGHT		BL
BELL ONLY		B
SMOKE DETECTOR		S
PHOTO-ELECTRIC SMOKE DETECTOR		S P
HEAT DETECTOR		HD
CONTROL MODULE		CM
MONITOR MODULE		MM
CARBON MONOXIDE DUCT DETECTOR		CO
CARBON MONOXIDE ALARM: SINGLE STATION W/SOUNDER BASE	CLG	CO
CARBON MONOXIDE AUDIO/VISUAL NOTIFICATION APPLIANCE	WALL	F CO
CARBON DIOXIDE DUCT SENSOR		CO2
CARBON DIOXIDE SENSOR	CLG	CO
DOOR HOLDER : WALL TYPE	WALL	DH
DOOR HOLDER : CLOSURE TYPE	ABV DOOR	DH C
DUCT SMOKE DETECTOR	ABV CLG	DS S,R
CONNECTION TO SPRINKLER FLOW SWITCH WITH ADDRESSABLE MODULE		FS
CONNECTION TO SPRINKLER TAMPER SWITCH WITH ADDRESSABLE MODULE		TS
PRESSURE SWITCH		PS
ISOLATION MODULE	WALL	I
ZONE ADDRESSABLE MODULE		ZM
H.V.A.C. SMOKE DAMPER CONNECTION		SM
FIRE SMOKE DAMPER		FSD
SMOKE DAMPER		SD
FLUSH MOUNTED REMOTE ALARM INDICATING STATION/TEST SWITCH		AI
FIREMAN'S PHONE JACK		FP
FIREMAN'S KNOX BOX CONNECTION		KB
ADDRESSABLE RELAY MODULE		R
BEAM SMOKE DETECTOR EMITTER		BE
BEAM SMOKE DETECTOR RECEIVER		BR
INDICATES VANDAL-PROOF POLYCARBONATE COVER, VANDAL PROOF COVERS SHALL BE UL LISTED FOR USE WITH THE SPECIFIC DEVICE THEY ARE PROTECTING		VR
INDICATES CHIME AUDIBLE NOTIFICATION		CH
DEVICE USED FOR ELEVATOR CONTROL		EL

GENERAL NOTES (FIRE ALARM RISER):

A. THIS RISER IS PARTIAL. ALL THE DEVICES CONNECTED TO THE "FACP" UNITS ARE NOT SHOWN. THE CONTRACTOR SHALL REFER TO THE ELECTRICAL FLOOR PLANS FOR THE COMPLETE FIRE ALARM SYSTEM.

B. THE EXTENT OF ALL FIRE ALARM SYSTEM WORK IS INDICATED OR IMPLIED ON THE CONTRACT DRAWINGS.

C. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS OF ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

D. PROVIDE CONNECTIONS TO ALL FIRE PROTECTION TAMPER AND FLOW SWITCHES VIA ZONE ADDRESSABLE MODULES AS REQUIRED. CONTRACTOR SHALL VERIFY ALL LOCATIONS WITH FIRE PROTECTION SYSTEM SHOP DRAWINGS. CONTRACTOR SHALL PROVIDE A UNIT PRICE FOR COMPLETE INSTALLATION OF A CONNECTION TO EXISTING FIRE PROTECTION SWITCHES.

E. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDING STANDARDS AS REQUIRED.

F. TAP SPEAKERS TO PROVIDE SUFFICIENT AUDIBILITY FOR AREA SERVED.

G. SMOKE DETECTORS SHALL NOT BE LOCATED CLOSER THAN 36" TO SUPPLY, RETURN OR EXHAUST AIR OPENINGS NOR CLOSER THAN 12" TO WALL/ CEILING INTERSECTIONS.

H. ADDITIONAL DUCT DETECTORS MAY BE SHOWN ON MECHANICAL DRAWINGS. PROVIDE AND CONFIGURE DUCT DETECTOR(S) FOR EITHER SHUTDOWN OF EQUIPMENT OR CLOSURE OF SMOKE DAMPER(S) AS REQUIRED BY CODE.

I. AIR HANDLING UNITS SHALL ONLY SHUT DOWN WHEN SMOKE IS DETECTED AT THAT PARTICULAR AIR HANDLING UNIT (UON). SMOKE DAMPERS SHALL CLOSE ONLY WHEN SMOKE IS DETECTED AT THAT PARTICULAR SMOKE DAMPER BY ACTIVATION OF THE CONTROLLING SMOKE DETECTOR. REFER TO THE SPECIFICATIONS FOR FURTHER REQUIREMENTS.

J. PROVIDE DUCT SMOKE DETECTORS WITH REMOTE TEST SWITCH/INDICATOR LIGHT AT 7'-6" AFF ON WALL IN AREA BELOW DETECTOR.

K. RISER DIAGRAM IS FOR BID PURPOSES ONLY. SYSTEM SHALL BE INSTALLED AND CONNECTED IN ACCORDANCE WITH WIRING DIAGRAMS OBTAINED FROM MANUFACTURER, THAT HAVE BEEN APPROVED BY THE STATE FIRE MARSHAL'S OFFICE OR AUTHORITY HAVING JURISDICTION.

L. PROVIDE FIRE ALARM MANUFACTURER WITH LOCATION DESCRIPTIONS FOR ALL FIRE ALARM DEVICES AS SOON AS POSSIBLE AFTER AWARD OF CONTRACT FOR PRE-PROGRAMMING OF FIRE ALARM SYSTEM. COORDINATE DESCRIPTIONS WITH BUILDING OWNER. UTILIZE FINAL ROOM NAMES AND NUMBERS, NOT NAMES AND NUMBERS FROM FLOOR PLANS.

M. EACH FIRE ALARM DEVICE SHALL BE LABELED WITH SELF ADHESIVE POLYESTER COATED PRINTED LABELS INDICATING DEVICE ADDRESS AND CIRCUIT PER FIRE ALARM SHOP DRAWINGS.

N. MODIFY AND/OR EXPAND EXISTING CONTROL PANEL(S) AND ANNUNCIATOR(S) TO ACCOMMODATE AS REQUIRED TO SUPPORT ADDITIONAL DEVICES SHOWN. FURNISH AND INSTALL ANY MODULES OR EQUIPMENT NECESSARY TO EXPAND SYSTEM. EXISTING ANNUNCIATOR(S) AND CONTROL PANEL(S) SHALL BE UPDATED TO DISPLAY TROUBLES AND ALARM LOCATIONS FOR ALL NEW ZONES.

O. PROVIDE CONNECTIONS TO NEW ACCESS CONTROL DOORS TO ALLOW POSITIVE LATCHING AND FREE EGRESS UNDER ALARM CONDITIONS. COORDINATE EXACT REQUIREMENTS WITH SUCCESSFUL DOOR HARDWARE MANUFACTURER PRIOR TO CONSTRUCTION.

P. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

Q. PROVIDE APPROVED TESTING AND REQUIRED CERTIFICATION OF SYSTEM COMPONENTS AND PROVE OPERATION OF SYSTEM FOR THE AREA OF WORK WHEN COMPLETE.

R. WIRING TO ALL FIRE ALARM DEVICES SHALL BE PER NEC AND MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL WIRING REQUIREMENTS WITH THE OWNER AND FIRE ALARM VENDOR.

S. ALL NEW DEVICES INDICATED, SUCH AS SMOKE DETECTORS, NOTIFICATION APPLIANCES, ETC., SHALL MATCH AND BE COMPATIBLE WITH EXISTING BUILDING SYSTEM.

T. ALL 120V POWER FOR NEW FIRE ALARM SYSTEM COMPONENTS SHALL BE CONNECTED TO EMERGENCY LIFE-SAFETY BRANCH PANELS AS APPLICABLE. PROVIDE ALL NEW POWER CONNECTIONS AS REQUIRED FOR SYSTEM OPERATION.

U. PROVIDE A DEDICATED POWER CIRCUIT TO EACH FIRE ALARM EQUIPMENT PANEL OR POWER SUPPLY.

V. FIRE ALARM OCP DEVICES SHALL HAVE NON-REMOVABLE LOCKABLE HANDLE PAINTED RED.

W. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL BUILDING PERMITS, ELECTRICAL APPROVALS, AND APPROVALS FROM THE STATE OFFICE OF FIRE SAFETY OR AUTHORITY HAVING JURISDICTION (AHJ). THIS INCLUDES PREPARING DRAWINGS, CUTSHEETS, AND OTHER DOCUMENTATION REQUIRED BY THE AHJ OR FIRE ALARM EQUIPMENT MANUFACTURER. A COPY OF THESE REQUIREMENTS SHALL BE OBTAINED FROM AHJ. THE DRAWINGS SHALL BE PREPARED AS A FINAL SUBMITTAL AS OUTLINED IN THE SUBMITTAL REQUIREMENTS. ELECTRONIC COPIES OF THESE PLANS REQUIRED FOR THIS PURPOSE MAY BE OBTAINED FROM THE ENGINEER. DRAWINGS THAT ARE REQUIRED FOR APPROVAL SHALL BE FINISHED WITHIN 7 WORKING DAYS OF AWARD OF CONTRACT.

X. WRITTEN CERTIFICATION OF ENTIRE FIRE ALARM SYSTEM SHALL BE SUBMITTED TO OWNER & ENGINEER AT CLOSE OF PROJECT.

Y. A TECHNICAL REPRESENTATIVE OF FIRE ALARM MANUFACTURER SHALL BE PRESENT AT ALL TIMES DURING FIRE ALARM CERTIFICATION.

Z. CONTRACTOR SHALL MONITOR TROUBLES ON EXISTING PANEL EQUIPMENT ON A DAILY BASIS. WHERE A TROUBLE IS INDICATED, IT SHALL BE REPORTED TO THE OWNER AND CONSTRUCTION SHALL STOP UNTIL TROUBLE IS RESOLVED UNLESS OTHERWISE INDICATED BY OWNER.

AA. INITIATING DEVICE CIRCUITS AND NOTIFICATION APPLIANCE CIRCUITS SHALL BE IN SEPARATE RACEWAYS. FIRE ALARM SYSTEM JUNCTION BOXES, BACK BOXES, AND PULL BOXES SHALL BE PAINTED RED.

BB. PROVIDE QUANTITY OF POWER SUPPLIES AND NAC PANELS BASED UPON FINAL SYSTEM DESIGN AND REQUIRED SPARE CAPACITY. LOCATE ADDITIONAL PANELS ADJACENT TO THOSE SHOWN ON PLANS. DO NOT INSTALL ADDITIONAL EQUIPMENT IN OTHER AREAS OF THE PROJECT WITHOUT WRITTEN CONSENT BY THE ENGINEER.

Sheet List - Fire Alarm

SHEET #	SHEET NAME
FA0.01	FIRE ALARM LEGEND
FA1.01	FIRE ALARM RISER DIAGRAM
FA2.01	LOWER LEVEL FIRE ALARM PLAN
FA2.02A	MAIN LEVEL FIRE ALARM PLAN - AREA A
FA2.02B	MAIN LEVEL FIRE ALARM PLAN - AREA B
FA2.02C	MAIN LEVEL FIRE ALARM PLAN - AREA C
FA2.03A	UPPER LEVEL FIRE ALARM PLAN - AREA A
FA2.03B	UPPER LEVEL FIRE ALARM PLAN - AREA B
FA2.03C	UPPER LEVEL FIRE ALARM PLAN - AREA C
FA3.01	FIRE ALARM DETAILS

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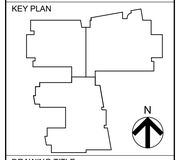
ROBERT A. HAAS P.E. #27038 STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

FIRE ALARM LEGEND

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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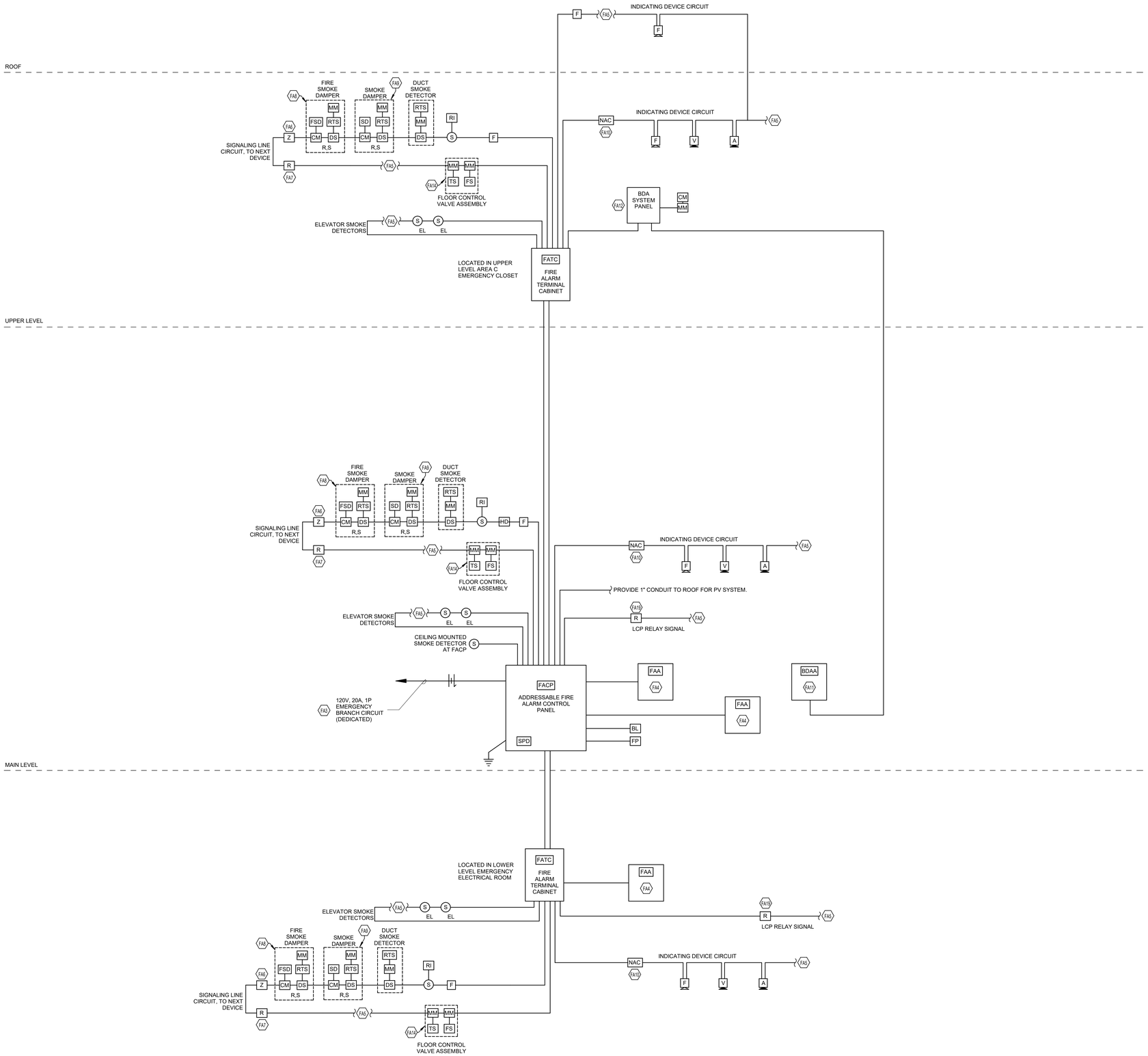
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FA0.01

5/18/2026 11:17:36 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt



1 FIRE ALARM RISER DIAGRAM
1/2" = 1'-0"

TAGGED NOTES

##

- FA3 REFER TO ELECTRICAL PLANS FOR CIRCUITING INFORMATION.
- FA4 FURNISH AND INSTALL FIRE ALARM LCD GRAPHIC ANNUNCIATOR. COORDINATE EXACT FINAL LOCATION PRIOR TO INSTALLTION. PROVIDE BUILDING MAP AS REQUIRED BY LOCAL AHJ.
- FA5 TO ALL OTHER DEVICES ON LOOP/CIRCUIT AS REQUIRED. REFER TO FLOOR PLAN FOR PROPOSED DEVICE LOCATIONS.
- FA6 PROVIDE ZONE ADDRESSABLE MODULE FOR SUPERVISION OF ANCILLARY FIRE PROTECTION/MONITORING SYSTEMS. DEVICE SHALL BE SURFACE MOUNTED IN NEMA-1 ENCLOSURE, ABOVE SUSPENDED CEILING. PROVIDE QUANTITY AND TYPE AS REQUIRED FOR FIRE PROTECTION TAMPR, FLOW, AND PRESSURE SWITCHES, FIRE PROTECTION POST-INDICATOR VALVE, DRY/CHEMICAL FIRE SUPRESSION SYSTEMS, AND KITCHEN HOOD FIRE SUPPRESSION SYSTEM.
- FA7 PROVIDE ADDRESSABLE FIRE ALARM RELAY FOR SIGNAL OUTPUT TO ANCILLARY BUILDING SYSTEMS. DEVICE SHALL BE SURFACE MOUNTED IN NEMA-1 ENCLOSURE, ABOVE SUSPENDED CEILING. PROVIDE QUANTITY AND TYPE AS REQUIRED. OPERABLE FIRE SHUTTERS TO CLOSE ON FIRE ALARM. ACCESS CONTROL DOORS TO UNLOCK AND POSITIVELY LATCH ON FIRE ALARM. ELEVATOR FOR ALL SPECIFIED AND REQUIRED FUNCTIONS.
- FA8 FOR EVERY FIRE SMOKE DAMPER CONNECTION, PROVIDE REMOTE TEST STATION IN MOST ADJACENT ACCESSIBLE LOCATION.
- FA9 FOR EVERY SMOKE DAMPER CONNECTION, PROVIDE REMOTE TEST STATION IN MOST ADJACENT ACCESSIBLE LOCATION.
- FA10 PROVIDE NUMBER OF NOTIFICATION APPLIANCE POWER SUPPLIES AS REQUIRED. LOCATE IN ELECTRICAL ROOMS. SUBMIT PROPOSED LOCATIONS IN SHOP DRAWINGS FOR REVIEW.
- FA11 BDA DEDICATED ANNUNCIATOR PANEL PROVIDED BY OTHERS WITH BDA SYSTEM. FINAL LOCATION TO BE DETERMINED BY THE AHJ.
- FA12 PROVIDE A FULLY FUNCTIONAL BDA SYSTEM, ALL SYSTEM COMPONENTS TO BE COORDINATED WITH FIRE ALARM BDA CONTRACTOR.
- FA14 PROVIDE FLOW AND TAMPER SWITCH MONITOR MODULES DEDICATED TO FLOOR CONTROL VALVE ASSEMBLY. COORDINATE INTERCONNECTION AND EXACT LOCATIONS WITH FIRE PROTECTION DRAWINGS.
- FA19 PROVIDE ADDRESSABLE FIRE ALARM RELAY FOR SIGNAL OUTPUT TO LIGHTING CONTROL PANEL FOR LIGHTING LEVEL OVERRIDE UPON FIRE ALARM NOTIFICATION SIGNAL. PROVIDE QUANTITY AND TYPE AS REQUIRED. REFER TO FIRE ALARM FLOOR PLANS FOR LOCATIONS.

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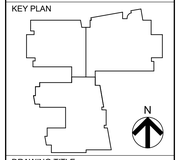
PROJECT STATUS

KEY PLAN



DRAWING TITLE

FIRE ALARM RISER DIAGRAM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/2" = 1'-0"
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FA1.01

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GENERAL NOTES (FIRE ALARM):

A. REFER TO ARCHITECT'S REFLECTED CEILING PLANS AND ELEVATIONS FOR LOCATIONS OF FIRE ALARM DEVICES. FINAL LOCATIONS ARE SUBJECT TO CHANGE PER ASSESSMENT BY FIRE DEPARTMENT AND LOCAL AHJS.

B. PROVIDE PROTECTIVE COVERS ON ALL FIRE ALARM PULL STATIONS THROUGHOUT BUILDING.

C. REFER TO DRAWINGS FA0.01 AND FA1.01 FOR FIRE ALARM SEQUENCE OF OPERATIONS MATRIX AND RISER DIAGRAM WITH ADDITIONAL INFORMATION PER EACH FLOOR.

D. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

E. PROVIDE CONNECTIONS TO ALL FIRE PROTECTION TAMPER AND FLOW SWITCHES VIA ZONE ADDRESSABLE MODULES AS REQUIRED. CONTRACTOR SHALL VERIFY ALL LOCATIONS WITH FIRE PROTECTION SYSTEM SHOP DRAWINGS. CONTRACTOR SHALL PROVIDE A UNIT PRICE FOR COMPLETE INSTALLATION OF A CONNECTION TO EXISTING FIRE PROTECTION SWITCHES.

F. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDINGS STANDARDS AS REQUIRED.

G. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

H. WIRING TO ALL FIRE ALARM DEVICES SHALL BE PER NEC AND MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL WIRING REQUIREMENTS WITH THE OWNER AND FIRE ALARM VENDOR.

I. PROVIDE QUANTITY OF POWER SUPPLIES AND NAC PANELS BASED UPON FINAL SYSTEM DESIGN AND REQUIRED SPARE CAPACITY. LOCATE ADDITIONAL PANELS ADJACENT TO THOSE SHOWN ON PLANS.

J. MARK ALL CEILING MOUNTED EQUIPMENT AT THE CEILING TILE.

K. PULL STATIONS WITH STUDENT ACCESS SHALL BE PROVIDED WITH A STOPPER COVER AND LOCAL ALARM

TAGGED NOTES

(##)

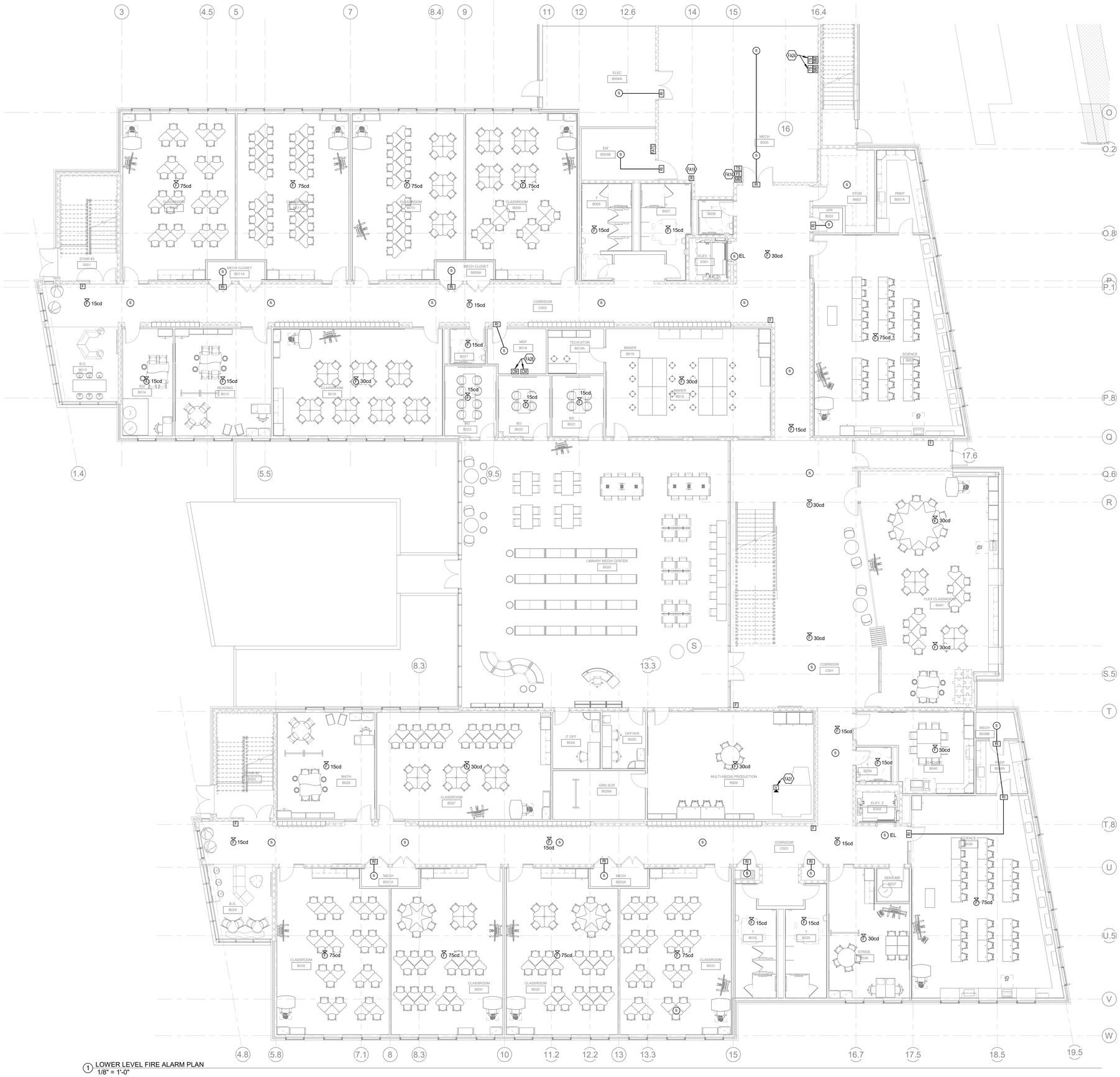
FA14 PROVIDE FLOW AND TAMPER SWITCH MONITOR MODULES DEDICATED TO FLOOR CONTROL VALVE ASSEMBLY. COORDINATE INTERCONNECTION AND EXACT LOCATIONS WITH FIRE PROTECTION DRAWINGS.

FA18 LIGHTING CONTROL PANEL FIRE ALARM CONTACT LOCATION. SIGNAL SHALL OVERRIDE CONTROL PRESETS AND BRING CORRIDOR AND COMMON SPACE LIGHTING TO 100%. OVERRIDE SHALL TIME OUT AFTER

FA24 PROVIDE MONITORING MODULES AND TAMPER SWITCHES FOR DOUBLE CHECK VALVE ASSEMBLY. COORDINATE EXACT FINAL LOCATION PRIOR TO STARTING WORK.

FA28 PROVIDE CONTROL MODULES FOR FIRE ALARM INTERFACE WITH SECURITY PANELS. FIRE ALARM SYSTEM SHALL INTERFACE WITH SECURITY PANEL TO RELEASE DOORS LOCKED IN THE DIRECTION OF EGRESS IN THE EVENT OF SYSTEM ACTIVATION. COORDINATE INTERCONNECTIONS AND EXACT FINAL LOCATIONS WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.

FA31 PROVIDE VISUAL NOTIFICATION DEVICE INSIDE SOUND BOOTH. COORDINATE EXACT FINAL LOCATION OF CONNECTION WITH EQUIPMENT MANUFACTURER.



1 LOWER LEVEL FIRE ALARM PLAN
1/8" = 1'-0"

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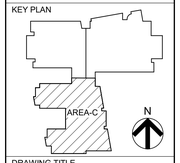
STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL FIRE ALARM PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
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FA2.01

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GENERAL NOTES (FIRE ALARM):

A. REFER TO ARCHITECT'S REFLECTED CEILING PLANS AND ELEVATIONS FOR LOCATIONS OF FIRE ALARM DEVICES. FINAL LOCATIONS ARE SUBJECT TO CHANGE PER ASSESSMENT BY FIRE DEPARTMENT AND LOCAL AHJS.

B. PROVIDE PROTECTIVE COVERS ON ALL FIRE ALARM PULL STATIONS THROUGHOUT BUILDING.

C. REFER TO DRAWINGS FA0.01 AND FA1.01 FOR FIRE ALARM SEQUENCE OF OPERATIONS MATRIX AND RISER DIAGRAM WITH ADDITIONAL INFORMATION PER EACH FLOOR.

D. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

E. PROVIDE CONNECTIONS TO ALL FIRE PROTECTION TAMPER AND FLOW SWITCHES VIA ZONE ADDRESSABLE MODULES AS REQUIRED. CONTRACTOR SHALL VERIFY ALL LOCATIONS WITH FIRE PROTECTION SYSTEM SHOP DRAWINGS. CONTRACTOR SHALL PROVIDE A UNIT PRICE FOR COMPLETE INSTALLATION OF A CONNECTION TO EXISTING FIRE PROTECTION SWITCHES.

F. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDINGS STANDARDS AS REQUIRED.

G. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

H. WIRING TO ALL FIRE ALARM DEVICES SHALL BE PER NEC AND MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL WIRING REQUIREMENTS WITH THE OWNER AND FIRE ALARM VENDOR.

I. PROVIDE QUANTITY OF POWER SUPPLIES AND NAC PANELS BASED UPON FINAL SYSTEM DESIGN AND REQUIRED SPARE CAPACITY. LOCATE ADDITIONAL PANELS ADJACENT TO THOSE SHOWN ON PLANS.

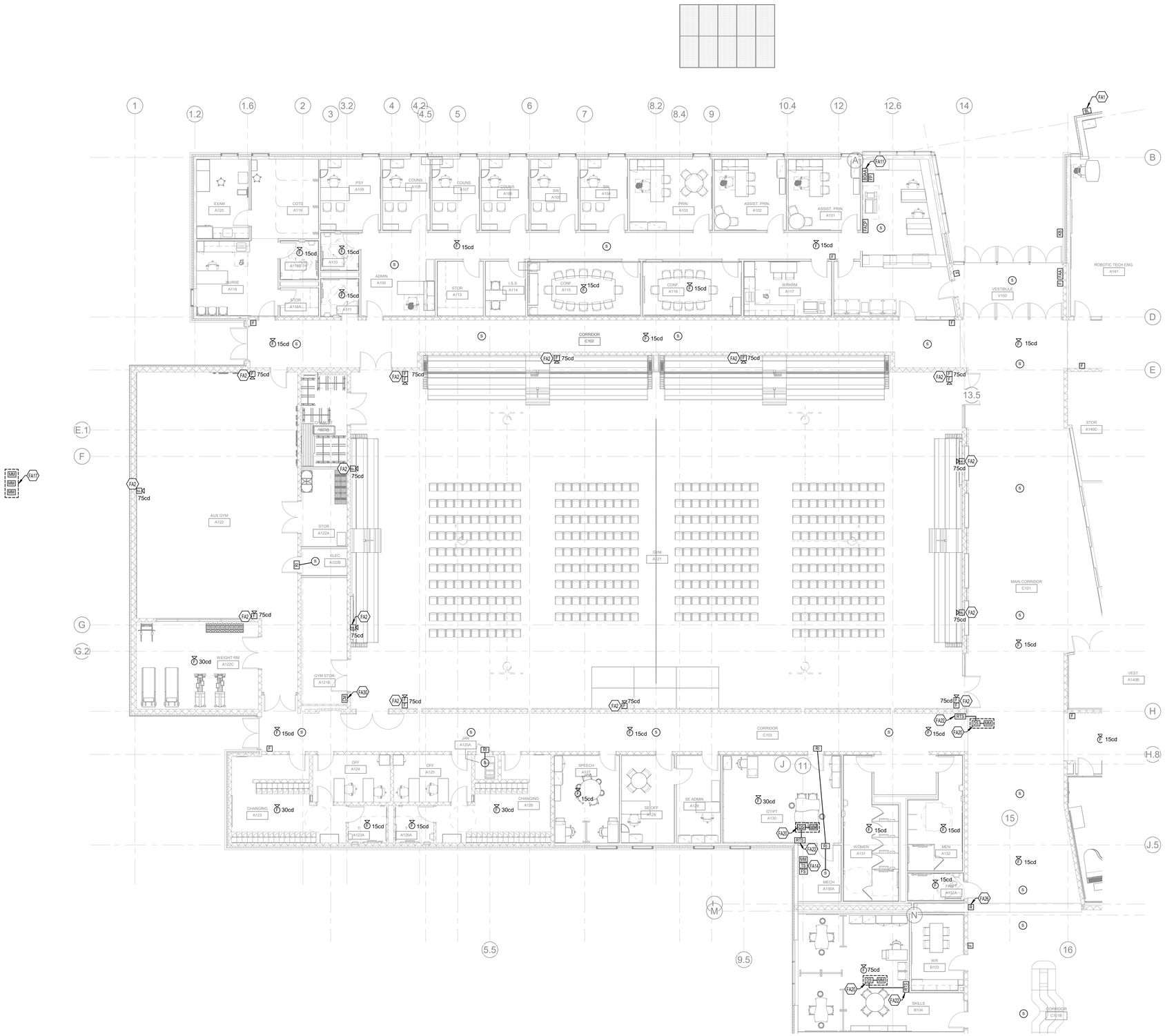
J. MARK ALL CEILING MOUNTED EQUIPMENT AT THE CEILING TILE.

K. PULL STATIONS WITH STUDENT ACCESS SHALL BE PROVIDED WITH A STOPPER COVER AND LOCAL ALARM

TAGGED NOTES

(##)

FA1	FINAL BEACON LOCATION TO BE CONFIRMED WITH FIRE DEPARTMENT AND ARCHITECT PRIOR TO INSTALLATION.
FA2	ALL FIRE ALARM DEVICES WITHIN GYM TO BE PROVIDED WITH WIREGUARD ENCLOSURE. COORDINATE ALL DEVICE MOUNTING HEIGHTS WITH ARCHITECT.
FA11	BDA DEDICATED ANNUNCIATOR PANEL PROVIDED BY OTHERS WITH BDA SYSTEM. FINAL LOCATION TO BE DETERMINED BY THE AHJ.
FA14	PROVIDE FLOW AND TAMPER SWITCH MONITOR MODULES DEDICATED TO FLOOR CONTROL VALVE ASSEMBLY. COORDINATE INTERCONNECTION AND EXACT LOCATIONS WITH FIRE PROTECTION DRAWINGS.
FA17	PROVIDE MONITORING MODULES FOR GENERATOR. CONNECT MODULES AT FIRE ALARM PANEL FOR (1) GENERATOR RUNNING, (2) GENERATOR FAULT, AND (3) GENERATOR SWITCH IN NON-AUTOMATIC POSITION.
FA20	PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.
FA22	PROVIDE REMOTE TEST STATION WITH KEY LOCATED IN VISIBLE ACCESSIBLE LOCATION TO DUCT SMOKE DETECTOR. PROVIDE LABEL WITH UNIT SERVED. COORDINATE EXACT FINAL LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK.
FA26	PROVIDE WIRING TO CONNECT TO INTERNAL ALARM RELAY THAT IS PROVIDED WITH WON DOOR CONTROLLER.
FA30	PROVIDE FIRE ALARM RELAY FOR AV RACK. COORDINATE CONNECTIONS WITH LOW VOLTAGE CONTRACTOR.



1 MAIN LEVEL FIRE ALARM PLAN - AREA A
1/8" = 1'-0"

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PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL FIRE ALARM PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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FA2.02A

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GENERAL NOTES (FIRE ALARM):

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B. PROVIDE PROTECTIVE COVERS ON ALL FIRE ALARM PULL STATIONS THROUGHOUT BUILDING.

C. REFER TO DRAWINGS FA0.01 AND FA1.01 FOR FIRE ALARM SEQUENCE OF OPERATIONS MATRIX AND RISER DIAGRAM WITH ADDITIONAL INFORMATION PER EACH FLOOR.

D. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

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F. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDINGS STANDARDS AS REQUIRED.

G. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

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J. MARK ALL CEILING MOUNTED EQUIPMENT AT THE CEILING TILE.

K. PULL STATIONS WITH STUDENT ACCESS SHALL BE PROVIDED WITH A STOPPER COVER AND LOCAL ALARM

TAGGED NOTES

(##)

FA1 FINAL BEACON LOCATION TO BE CONFIRMED WITH FIRE DEPARTMENT AND ARCHITECT PRIOR TO INSTALLATION.

FA2 ALL FIRE ALARM DEVICES WITHIN GYM TO BE PROVIDED WITH WIREGUARD ENCLOSURE. COORDINATE ALL DEVICE MOUNTING HEIGHTS WITH ARCHITECT.

FA16 PROVIDE CONTROL AND MONITORING MODULE FOR SIGNAL OUTPUT TO KITCHEN HOOD CONTROL PANEL. REFER TO KITCHEN PLANS FOR FURTHER INFORMATION. COORDINATE WITH KITCHEN CONTRACTOR PRIOR TO STARTING WORK.

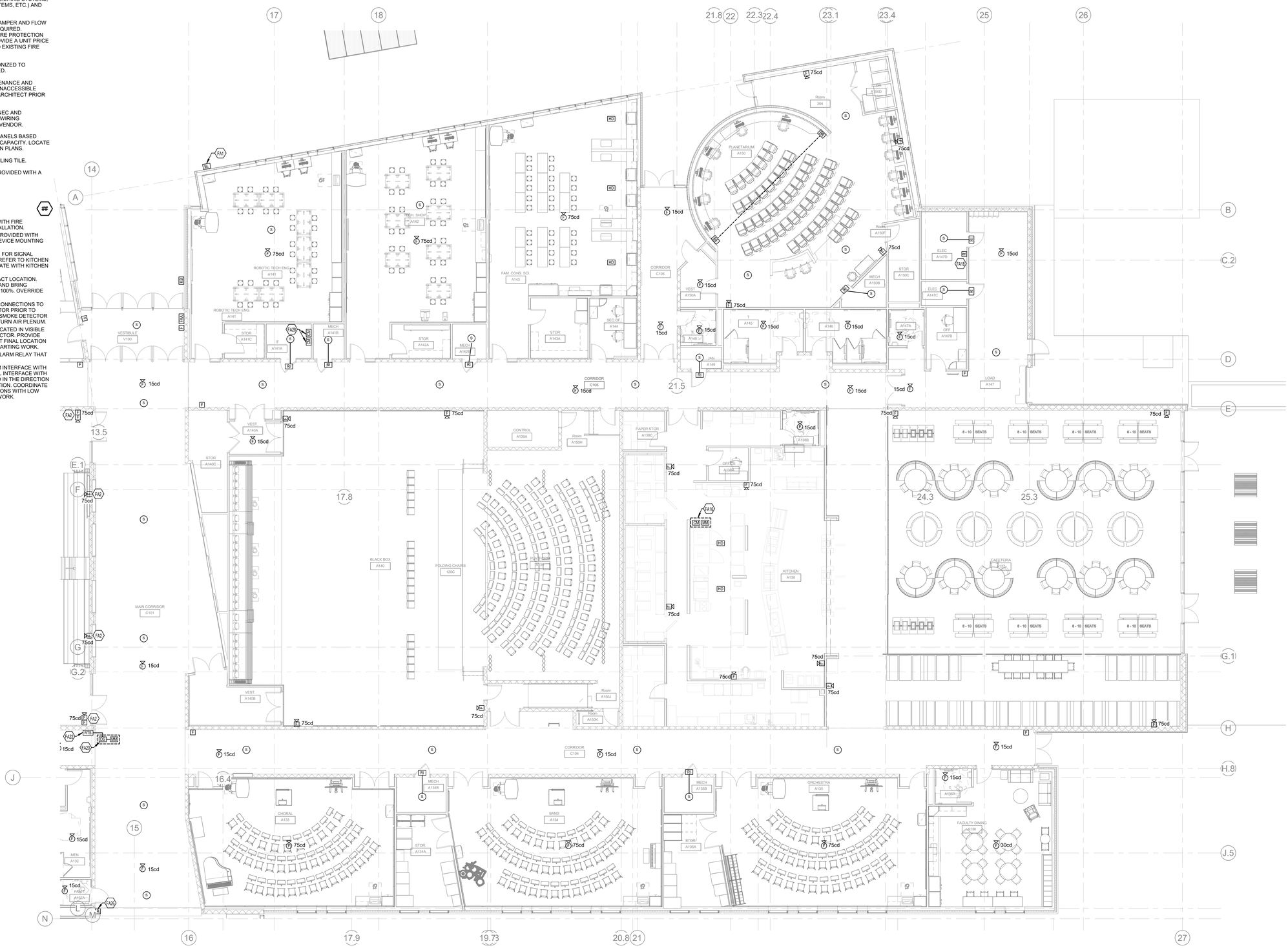
FA18 LIGHTING CONTROL PANEL FIRE ALARM CONTACT LOCATION. SIGNAL SHALL OVERRIDE CONTROL PRESETS AND BRING CORRIDOR AND COMMON SPACE LIGHTING TO 100%. OVERRIDE SHALL TIME OUT AFTER

FA20 PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.

FA22 PROVIDE REMOTE TEST STATION WITH KEY LOCATED IN VISIBLE ACCESSIBLE LOCATION TO DUCT SMOKE DETECTOR. PROVIDE LABEL WITH UNIT SERVED. COORDINATE EXACT FINAL LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK.

FA26 PROVIDE WIRING TO CONNECT TO INTERNAL ALARM RELAY THAT IS PROVIDED WITH WON DOOR CONTROLLER.

FA28 PROVIDE CONTROL MODULES FOR FIRE ALARM INTERFACE WITH SECURITY PANELS. FIRE ALARM SYSTEM SHALL INTERFACE WITH SECURITY PANEL TO RELEASE DOORS LOCKED IN THE DIRECTION OF EGRESS IN THE EVENT OF SYSTEM ACTIVATION. COORDINATE INTERCONNECTIONS AND EXACT FINAL LOCATIONS WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.



1 MAIN LEVEL FIRE ALARM PLAN - AREA B
1/8" = 1'-0"

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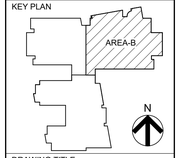
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL FIRE ALARM PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FA2.02B

5/18/2026 11:17:51 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (FIRE ALARM):

A. REFER TO ARCHITECT'S REFLECTED CEILING PLANS AND ELEVATIONS FOR LOCATIONS OF FIRE ALARM DEVICES. FINAL LOCATIONS ARE SUBJECT TO CHANGE PER ASSESSMENT BY FIRE DEPARTMENT AND LOCAL AHJS.

B. PROVIDE PROTECTIVE COVERS ON ALL FIRE ALARM PULL STATIONS THROUGHOUT BUILDING.

C. REFER TO DRAWINGS FA0.01 AND FA1.01 FOR FIRE ALARM SEQUENCE OF OPERATIONS MATRIX AND RISER DIAGRAM WITH ADDITIONAL INFORMATION PER EACH FLOOR.

D. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

E. PROVIDE CONNECTIONS TO ALL FIRE PROTECTION TAMPER AND FLOW SWITCHES VIA ZONE ADDRESSABLE MODULES AS REQUIRED. CONTRACTOR SHALL VERIFY ALL LOCATIONS WITH FIRE PROTECTION SYSTEM SHOP DRAWINGS. CONTRACTOR SHALL PROVIDE A UNIT PRICE FOR COMPLETE INSTALLATION OF A CONNECTION TO EXISTING FIRE PROTECTION SWITCHES.

F. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDINGS STANDARDS AS REQUIRED.

G. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

H. WIRING TO ALL FIRE ALARM DEVICES SHALL BE PER NEC AND MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL WIRING REQUIREMENTS WITH THE OWNER AND FIRE ALARM VENDOR.

I. PROVIDE QUANTITY OF POWER SUPPLIES AND NAC PANELS BASED UPON FINAL SYSTEM DESIGN AND REQUIRED SPARE CAPACITY. LOCATE ADDITIONAL PANELS ADJACENT TO THOSE SHOWN ON PLANS.

J. MARK ALL CEILING MOUNTED EQUIPMENT AT THE CEILING TILE.

K. PULL STATIONS WITH STUDENT ACCESS SHALL BE PROVIDED WITH A STOPPER COVER AND LOCAL ALARM

TAGGED NOTES

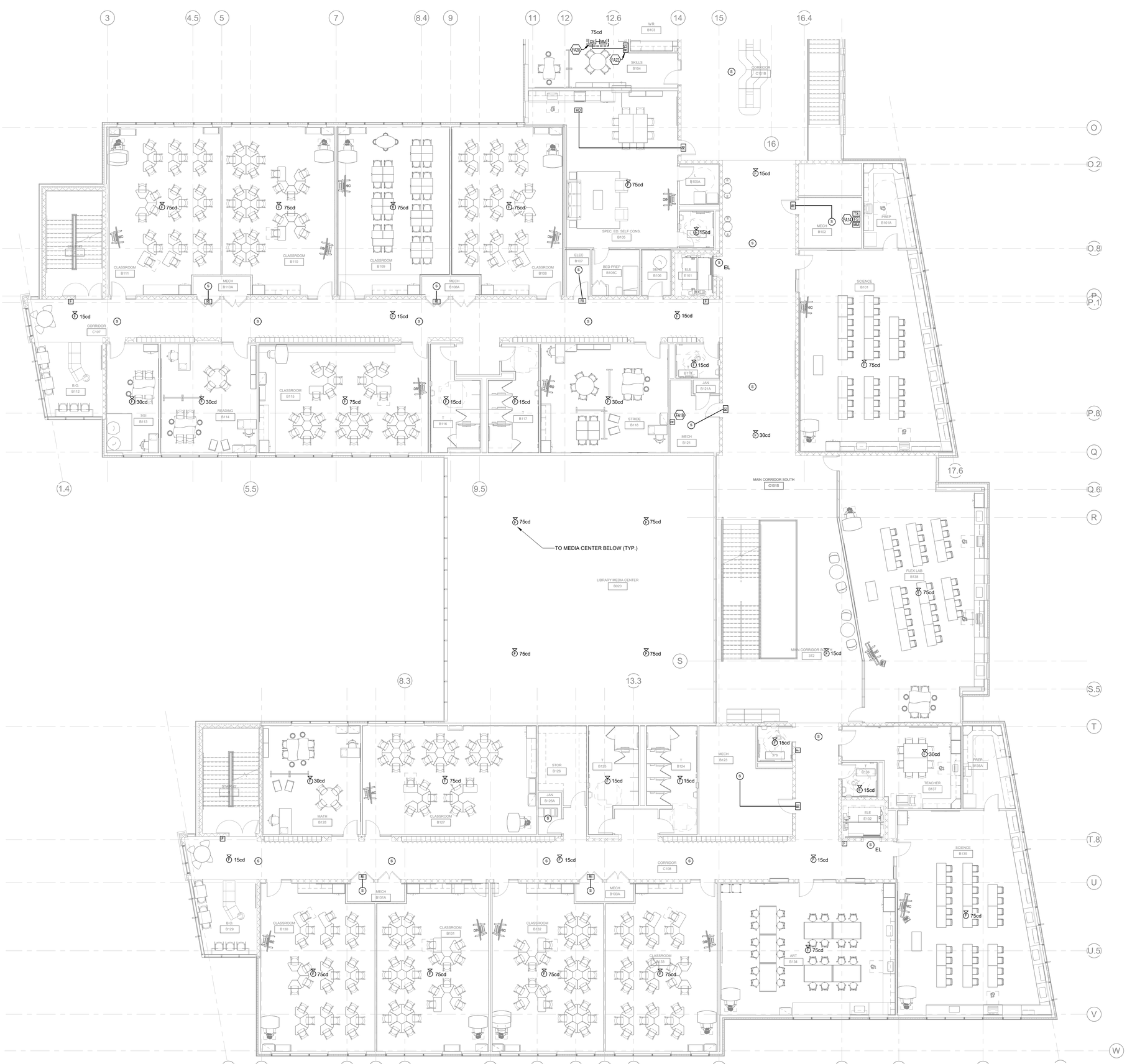
(##)

FA14 PROVIDE FLOW AND TAMPER SWITCH MONITOR MODULES DEDICATED TO FLOOR CONTROL VALVE ASSEMBLY. COORDINATE INTERCONNECTION AND EXACT LOCATIONS WITH FIRE PROTECTION DRAWINGS.

FA18 LIGHTING CONTROL PANEL FIRE ALARM CONTACT LOCATION. SIGNAL SHALL OVERRIDE CONTROL PRESETS AND BRING CORRIDOR AND COMMON SPACE LIGHTING TO 100%. OVERRIDE SHALL TIME OUT AFTER

FA20 PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.

FA22 PROVIDE REMOTE TEST STATION WITH KEY LOCATED IN VISIBLE ACCESSIBLE LOCATION TO DUCT SMOKE DETECTOR. PROVIDE LABEL WITH UNIT SERVED. COORDINATE EXACT FINAL LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK.



1 MAIN LEVEL FIRE ALARM PLAN - AREA C
1/8" = 1'-0"

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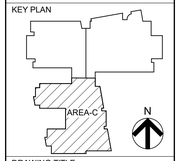
ROBERT A. HAINS PE-47028 LICENSED PROFESSIONAL ENGINEER STATE OF CONNECTICUT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL FIRE ALARM PLAN - AREA C

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OFFICE PROJ. NO.	250501
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DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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GENERAL NOTES (FIRE ALARM):

A. REFER TO ARCHITECT'S REFLECTED CEILING PLANS AND ELEVATIONS FOR LOCATIONS OF FIRE ALARM DEVICES. FINAL LOCATIONS ARE SUBJECT TO CHANGE PER ASSESSMENT BY FIRE DEPARTMENT AND LOCAL AHJS.

B. PROVIDE PROTECTIVE COVERS ON ALL FIRE ALARM PULL STATIONS THROUGHOUT BUILDING.

C. REFER TO DRAWINGS FA0.01 AND FA1.01 FOR FIRE ALARM SEQUENCE OF OPERATIONS MATRIX AND RISER DIAGRAM WITH ADDITIONAL INFORMATION PER EACH FLOOR.

D. FIELD VERIFY THE EXACT NUMBER AND LOCATIONS ALL MECHANICALLY RELATED ITEMS (SPRINKLER CONNECTIONS, EXTINGUISHING SYSTEMS, SMOKE DAMPERS, RANGE HOOD SUPPRESSION SYSTEMS, ETC.) AND MAKE CONNECTIONS AS REQUIRED/INDICATED.

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F. ALL FIRE ALARM STROBE LIGHTS SHALL BE SYNCHRONIZED TO ACCOMMODATE BUILDINGS STANDARDS AS REQUIRED.

G. PROVIDE ACCESS PANELS AS REQUIRED FOR MAINTENANCE AND TESTING FOR SMOKE DETECTORS LOCATED ABOVE INACCESSIBLE CEILINGS. COORDINATE SIZE AND LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

H. WIRING TO ALL FIRE ALARM DEVICES SHALL BE PER NEC AND MANUFACTURER'S RECOMMENDATIONS. VERIFY ALL WIRING REQUIREMENTS WITH THE OWNER AND FIRE ALARM VENDOR.

I. PROVIDE QUANTITY OF POWER SUPPLIES AND NAC PANELS BASED UPON FINAL SYSTEM DESIGN AND REQUIRED SPARE CAPACITY. LOCATE ADDITIONAL PANELS ADJACENT TO THOSE SHOWN ON PLANS.

J. MARK ALL CEILING MOUNTED EQUIPMENT AT THE CEILING TILE.

K. PULL STATIONS WITH STUDENT ACCESS SHALL BE PROVIDED WITH A STOPPER COVER AND LOCAL ALARM

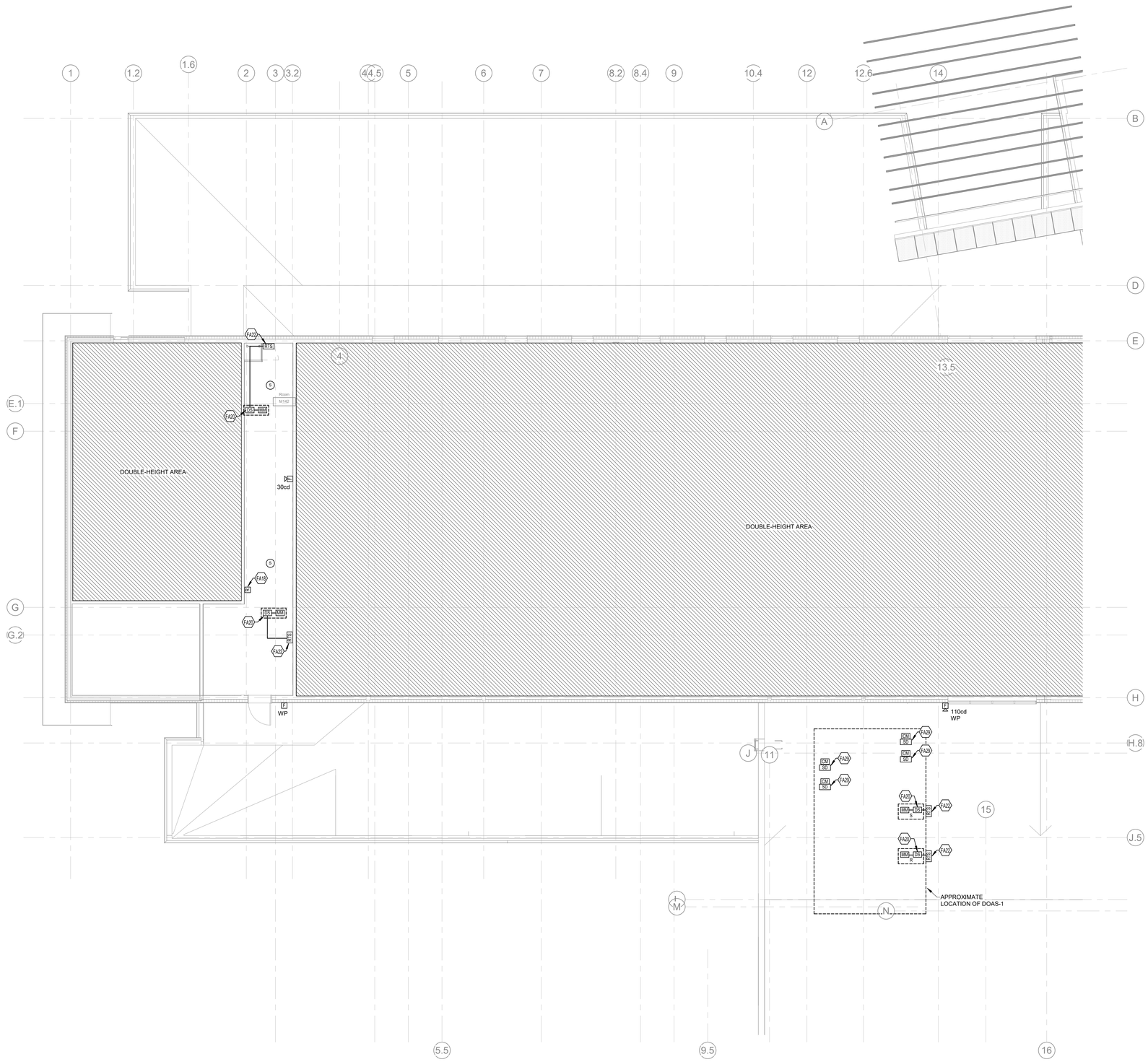
TAGGED NOTES

FA18 LIGHTING CONTROL PANEL FIRE ALARM CONTACT LOCATION. SIGNAL SHALL OVERRIDE CONTROL PRESETS AND BRING CORRIDOR AND COMMON SPACE LIGHTING TO 100%. OVERRIDE SHALL TIME OUT AFTER

FA20 PROVIDE DUCT SMOKE DETECTOR. CONFIRM CONNECTIONS TO SAMPLING TUBE WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK. CLEARLY LABEL DUCT WITH SMOKE DETECTOR INDICATING UNIT SERVED AND SUPPLY OR RETURN AIR PLENUM.

FA22 PROVIDE REMOTE TEST STATION WITH KEY LOCATED IN VISIBLE ACCESSIBLE LOCATION TO DUCT SMOKE DETECTOR. PROVIDE LABEL WITH UNIT SERVED. COORDINATE EXACT FINAL LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO STARTING WORK.

FA29 SMOKE DAMPERS TO BE INSTALLED. COORDINATE EXACT FINAL LOCATIONS OF DEVICES AND CONNECTIONS TO DAMPER WITH MECHANICAL CONTRACTOR. PROVIDE CONTROL MODULE FOR REMOTE ACTUATION OF SMOKE DAMPERS, TO BE CONNECTED TO FIRE ALARM CONTROL PANEL.



1 UPPER LEVEL FIRE ALARM PLAN - AREA A
1/8" = 1'-0"

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ROBERT A. HAAS
PE-0 47038
REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

DRAWING TITLE

UPPER LEVEL FIRE ALARM PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
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4	3/26/2026	PHASE 1
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FA2.03A

5/18/2026 11:17:55 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

GENERAL NOTES (FIRE ALARM):

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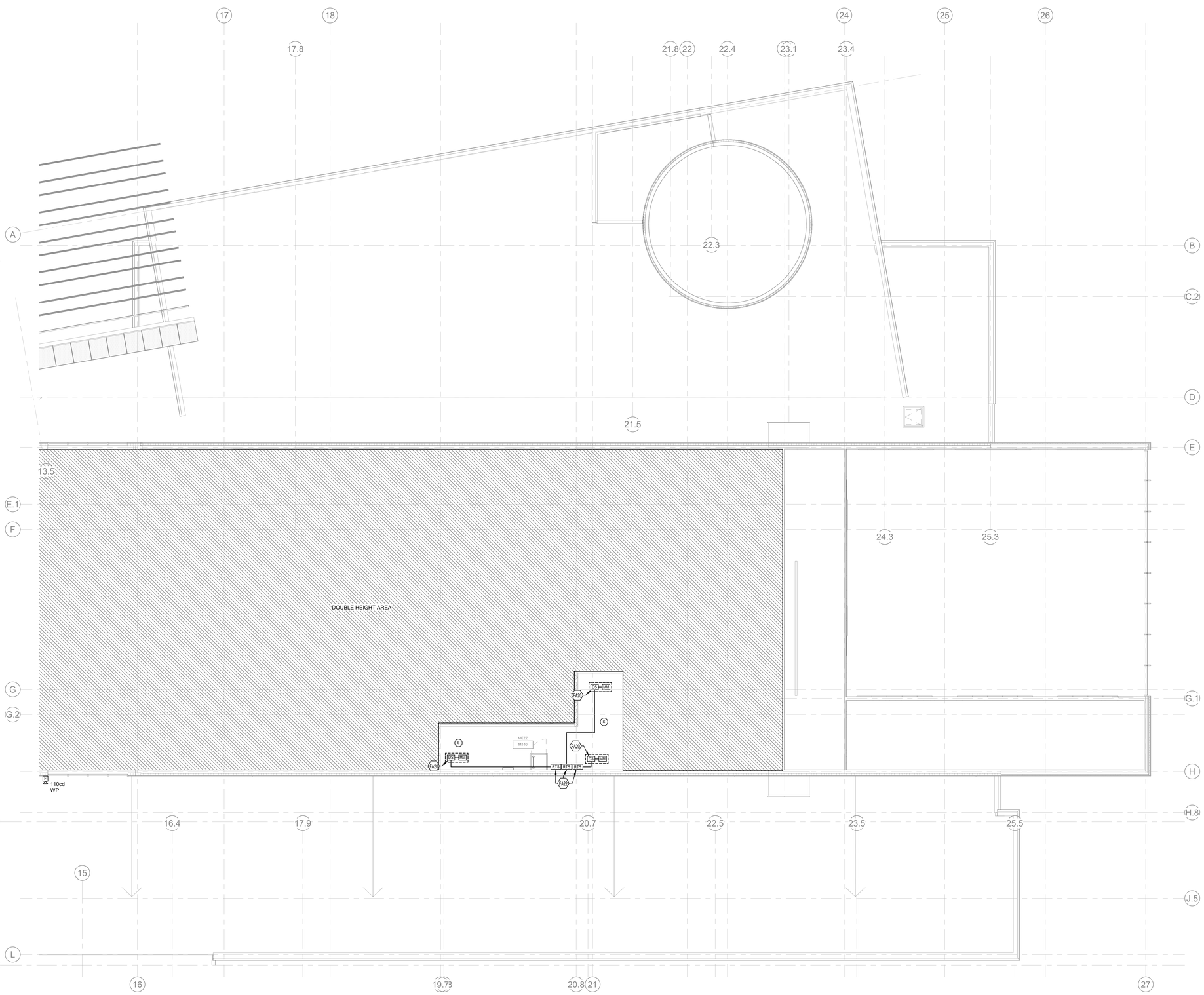

1 UPPER LEVEL FIRE ALARM PLAN - AREA B
1/8" = 1'-0"

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ROBERT A. HANS
PE-47038

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

AREA-C

N

DRAWING TITLE

UPPER LEVEL FIRE ALARM PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

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TAGGED NOTES

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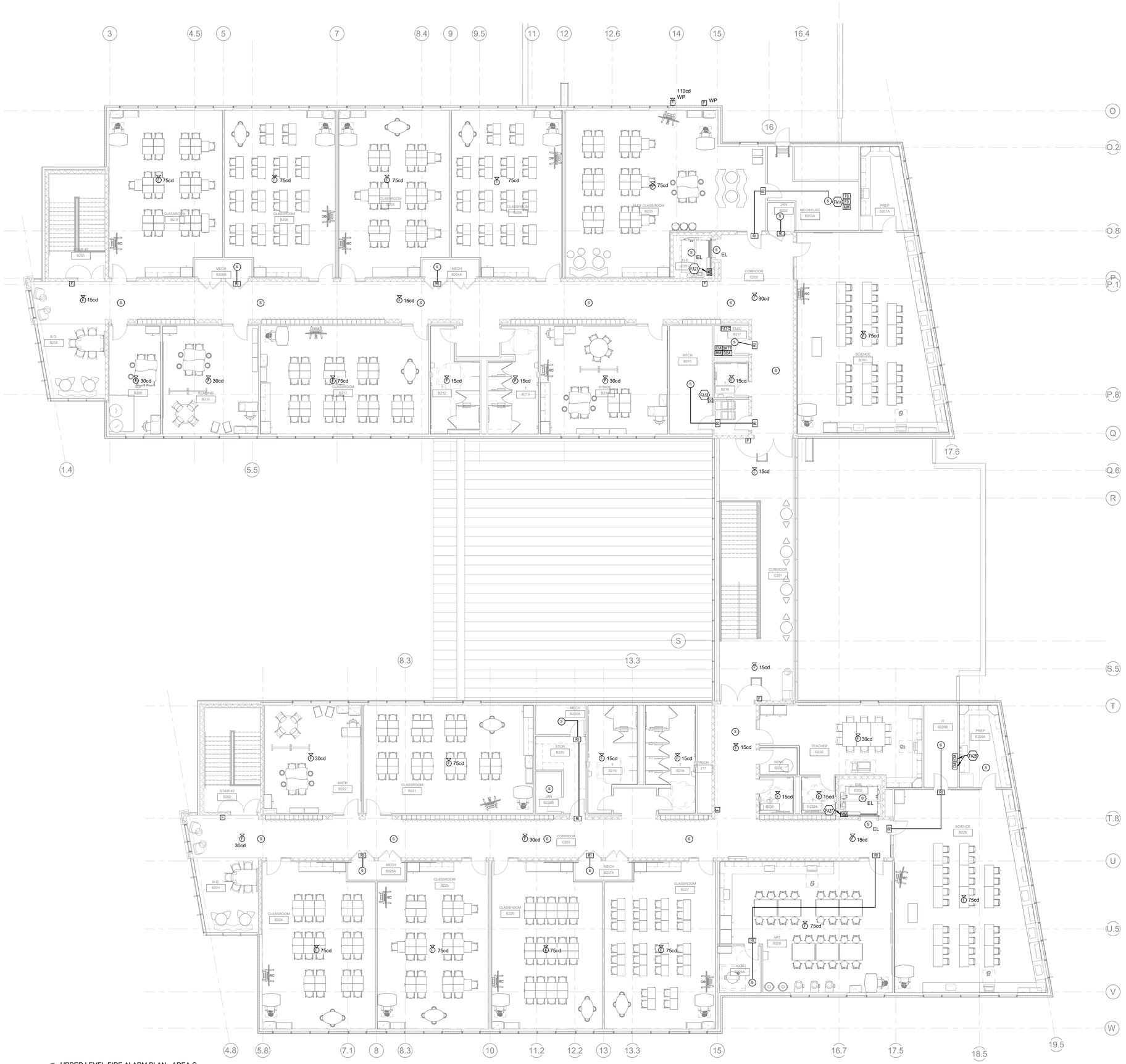
FA18 LIGHTING CONTROL PANEL FIRE ALARM CONTACT LOCATION. SIGNAL SHALL OVERRIDE CONTROL PRESETS AND BRING CORRIDOR AND COMMON SPACE LIGHTING TO 100%. OVERRIDE SHALL TIME OUT AFTER

FA27 PROVIDE MONITORING MODULE FOR ELEVATOR TWO-WAY COMMUNICATION PHONE WIRING. COORDINATE EXACT LOCATION WITH ELEVATOR MANUFACTURER AND LOW VOLTAGE CONTRACTOR.

FA28 PROVIDE CONTROL MODULES FOR FIRE ALARM INTERFACE WITH SECURITY PANELS. FIRE ALARM SYSTEM SHALL INTERFACE WITH SECURITY PANEL TO RELEASE DOORS LOCKED IN THE DIRECTION OF EGRESS IN THE EVENT OF SYSTEM ACTIVATION. COORDINATE INTERCONNECTIONS AND EXACT FINAL LOCATIONS WITH LOW VOLTAGE CONTRACTOR PRIOR TO STARTING WORK.



1 UPPER LEVEL FIRE ALARM PLAN - AREA C
1/8" = 1'-0"

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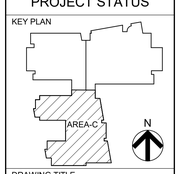
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL FIRE ALARM PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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APPROVED BY	Approver

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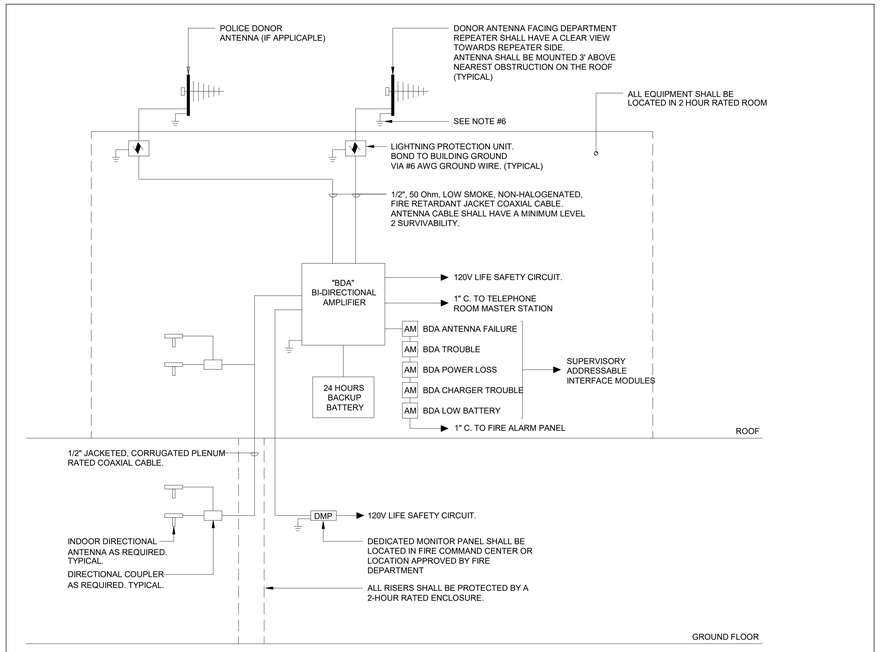
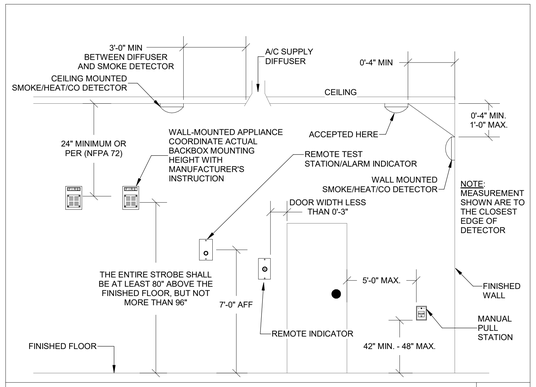


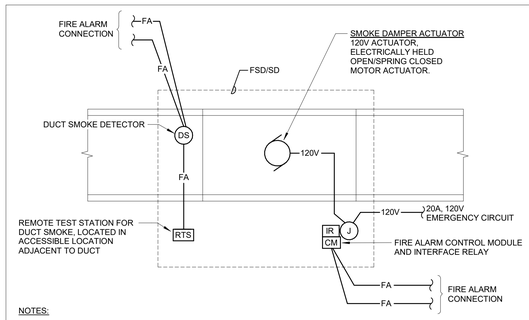
SYSTEM NOTES:

1. SYSTEMS SHALL INCLUDE, BUT NOT BE LIMITED TO BI-DIRECTIONAL ANTENNA, SYSTEM ENCLOSURES, BATTERIES, CABLING, START-UP, PROGRAMMING AND TESTING FOR COMPLETE EMERGENCY COMMUNICATION SYSTEM BUILDING COVERAGE. SEE ADDITIONAL REQUIREMENTS AS FOLLOWS:
   - A. ALL CABLE SHALL BE PLENUM RATED.
   - B. SYSTEM MANUFACTURER SHALL PROVIDE ALL SIGNAL STRENGTH TESTS PRIOR TO INSTALLATION.
   - C. SYSTEM EQUIPMENT POWER AN ALL FA EQUIPMENT AND WIRING FOR INTERFACE.
   - D. HORIZONTAL CABLE RUNS SHALL BE ON 2HR ENCLOSURE, COORDINATE WITH LOCAL FIRE DEPARTMENT FOR ANY ADDITIONAL REQUIREMENTS.
2. PROVIDE FIRE ALARM INTERFACE FOR TROUBLE SIGNAL. PROVIDE MONITOR MODULE AND TIE INTO FIRE ALARM SYSTEM.
3. EMERGENCY RESPONDER RADIO COVERAGE SYSTEMS SHALL BE PROVIDED WITH STANDBY POWER "BATTERIES" . THE STANDBY POWER SUPPLY "BATTERIES" SHALL BE CAPABLE OF OPERATING THE EMERGENCY RESPONDER RADIO COVERAGE SYSTEM FOR A DURATION OF NOT LESS THAN 24 HOURS.
4. DEVICES INDICATED ON THIS RISER DIAGRAM ARE TYPICAL, EXACT QUANTITIES AND LOCATION SHALL BE INDICATED BY SYSTEM PROVIDER.
5. PROVIDE TESTING AND REPORT INDICATING SYSTEM STRENGTH THROUGHOUT THE BUILDING. THE BUILDING SHALL BE CONSIDERED TO HAVE ACCEPTABLE EMERGENCY RESPONDER RADIO COVERAGE WHEN SIGNAL STRENGTH MEASUREMENTS IN 95%OF ALL AREAS ON EACH FLOOR OF THE BUILDING .
5. THE EMERGENCY RESPONDER RADIO COVERAGE SYSTEM SHALL BE CAPABLE OF MODIFICATION OR EXPANSION IN THE EVENT FREQUENCY CHANGES ARE REQUIRED BY THE FCC OR ADDITIONAL FREQUENCIES ARE MADE AVAILABLE BY THE FCC.
6. BDA ENCLOSURE, LIGHTNING PROTECTION UNIT, ANTENNA'S, DEDICATED MONITOR PANEL, ETC., SHALL BE GROUNDED TO BUILDING STEEL, GROUND WIRE SHALL BE SIZED AS PER MANUFACTURER RECOMMENDATIONS AND SHALL NOT BE SMALLER THAN # 6AWG.
7. CARRY IN BID ALL COSTS INCLUDING THOSE COSTS OF THE SYSTEMS PROVIDER FOR COMPLETE INSTALLATION.
8. PATHWAY SURVIVABILITY, LEVEL 2 SHALL CONSIST OF ONE OR MORE OF THE FOLLOWING:
   - A. 2-HOUR FIRE-RATED CIRCUIT INTEGRITY (CI) CABLE.
   - B. 2-HOUR FIRE-RATED CABLE SYSTEM [ELECTRICAL CIRCUIT PROTECTIVE SYSTEM(S)].
   - C. 2-HOUR FIRE-RATED ENCLOSURE OR PROTECTED AREA.
   - D. 2-HOUR PERFORMANCE ALTERNATIVES APPROVED BY THE AUTHORITY HAVING JURISDICTION.
9. CAFR-20A CABLE IS TESTED AND CERTIFIED TO UL 2196 AND THE MOUNTING INSTRUCTIONS ARE PROVIDED BY THE TESTING LABORATORY (ETL INTERTEK) AS FOLLOWS:
   - A. CABLES: NOM. 1/2 IN. CABLE WITH CORRUGATED COPPER OUTER CONDUCTOR AND JACKETED CMP, MODEL APH012J50-2H OR MODEL CAFR-20A. INSTALL CABLES USING STRUT CHANNELS AND CABLE CLAMPS. AT BENDS IN THE CABLE, A MIN. 8 IN. RADIUS SHALL BE MAINTAINED. STRUT CHANNELS SHALL BE INSTALLED AT . MAX. 24 IN. ON CENTER (OC) SPACING.
   - B. CABLE SUPPORT SYSTEM SHALL CONSIST OF THE FOLLOWING COMPONENTS: STRUT CHANNELS: MIN. 12 GA X 1-5/8 IN. WIDE X 1-5/8 IN. HIGH GALVANIZED STEEL STRUT.

EMERGENCY BDA RESPONDER | NTS



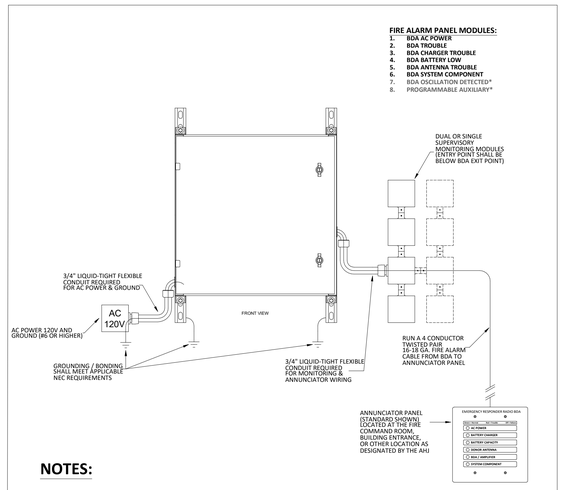
FIRE ALARM TYPICAL DEVICE MOUNTING HEIGHTS | NTS



NOTES:

1. REMOTE TEST/RESET STATION SHALL BE WALL-MOUNTED 6" BELOW CEILING OR ON THE CEILING DIRECT BELOW DEVICE SERVED.
2. REMOTE TEST/RESET STATION SHALL BE LABELED.
3. IN THE EVENT THE DETECTOR IS ACTIVATED A SIGNAL VIA CONTROL MODULE RELAY SHALL SHUT DOWN THE ASSOCIATED UNIT FANS AND ACTUATE THE SMOKE DAMPER.

COMBINATION FIRE/SMOKE DAMPER DETAIL | NTS



NOTES:

1. NO ADDITIONAL PENETRATIONS OF THE BDA ENCLOSURE SHALL BE MADE WITHOUT APPROVAL FROM RADIO SOLUTIONS, INC.
2. UP TO 5 ANNUNCIATOR PANELS CAN BE CONNECTED USING A 4-WIRE (2 TWISTED PAIRS) FIRE ALARM CABLE. THE PANELS ARE ADDRESSABLE, FULLY SUPERVISED AND POWERED BY THE BDA.
3. MONITORING MODULES CONNECT TO PROVIDED NORMALLY OPEN RELAY OUTPUT "DRY CONTACTS" WITH BUILT-IN EOL RESISTORS.
4. AUXILIARY PORT CAN BE PROGRAMMED FOR DIFFERENT FUNCTIONS, INCLUDING AN ENCLOSURE DOOR / TAMPER ALARM.
5. *BDA OSCILLATION DETECTED AND PROGRAMABLE AUXILIARY MODULES TO BE INSTALLED PER AHJ DISCRETION.
6. SINGLE 15A / 20A DEDICATED CIRCUIT SHALL BE TERMINATED INSIDE THE ENCLOSURE TO A PROVIDED STANDARD DUPLEX OUTLET.
7. FOR ADDITIONAL DETAILED TECHNICAL INFORMATION, SEE PRODUCT DATA SHEET.

STANDARD BDA ENCLOSURE | 1/8"=1"

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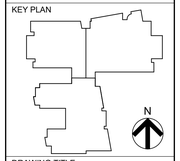
ROBERT A. HAAS P.E. #27039 STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

FIRE ALARM DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	Author
APPROVED BY	Approver

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FA3.01

5/19/2026 11:18:03 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

FIRE PROTECTION HAZARDOUS MATERIALS NOTES

A THE CONTRACTOR IT IS HEREBY ADVISED THAT IS POSSIBLE THAT ASBESTOS AND/OR OTHER HAZARDOUS MATERIALS ARE OR WERE PRESENT IN THIS BUILDING(S). ANY WORKER, OCCUPANT, VISITOR, ETC., WHO ENCOUNTERS ANY MATERIAL OF WHOSE CONTENT THEY ARE NOT CERTAIN SHALL PROMPTLY REPORT THE EXISTENCE AND LOCATION OF THAT MATERIAL TO THE OWNER. FURTHERMORE, THE CONTRACTOR SHALL ENSURE THAT NO ONE COMES NEAR TO OR IN CONTACT WITH ANY SUCH MATERIAL OR FUMES THEREFROM UNTIL ITS CONTENT CAN BE ASCERTAINED TO BE NON-HAZARDOUS.

B CMTA, INC. HAS NO EXPERTISE IN THE DETERMINATION OF THE PRESENCE OF ANY HAZARDOUS MATERIAL. THEREFORE, NO ATTEMPT HAS BEEN MADE BY CMTA TO IDENTIFY THE EXISTENCE OR LOCATION OF ANY SUCH HAZARDOUS MATERIAL. FURTHERMORE, CMTA NOR ANY AFFILIATE HEREOF WILL NOT OFFER OR MAKE ANY RECOMMENDATIONS RELATIVE TO THE REMOVAL, HANDLING OR DISPOSAL OF SUCH MATERIAL.

C IF THE WORK WHICH IS TO BE PERFORMED INTERFACES, CONNECTS OR RELATES IN ANY PHYSICAL WAY WITH OR TO EXISTING COMPONENTS WHICH CONTAIN OR BEAR ANY HAZARDOUS MATERIAL, ASBESTOS BEING ONE, THEN IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO CONTACT THE OWNER AND SO ADVISE THEM IMMEDIATELY.

D THE CONTRACTOR BY EXECUTION OF THE CONTRACT FOR ANY WORK AND/OR BY THE ACCOMPLISHMENT OF ANY WORK THEREBY AGREE TO BRING NO CLAIM RELATIVE TO HAZARDOUS MATERIALS FOR NEGLIGENCE, BREACH OF CONTRACT, INDEMNITY, OR ANY OTHER SUCH ITEM AGAINST CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS OR CONSULTANTS. ALSO, THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS AND CONSULTANTS HARMLESS FROM ANY SUCH RELATED CLAIMS WHICH MAY BE BROUGHT BY ANY SUBCONTRACTORS, SUPPLIERS OR ANY OTHER THIRD PARTIES.

E THE CONTRACTOR IS DIRECTED TO THE SPECIFICATIONS FOR FURTHER INFORMATION.

SPRINKLER DESIGN CRITERIA

DESIGN DENSITY (GPM/SF)	CALCULATION AREA (SF)	HOSE ALLOWANCE (GPM)	MAX AREA (SF)
NFPA 13 LIGHT HAZARD OCCUPANCY			
AREAS: GENERAL AREAS, PUBLIC AREA CORRIDORS, TOILET ROOMS AND ALL OTHER AREAS NOT DEFINED			
0.10	1500	250	225
NFPA 13 ORDINARY HAZARD GROUP 1 OCCUPANCY			
AREAS: DATA ROOMS, ELECTRICAL ROOMS, MECHANICAL ROOMS, AND STORAGE AREAS WITH STOCKPILES UP TO 8'-0" IN HEIGHT.			
0.15	1500	250	130
NFPA 13 ORDINARY HAZARD GROUP 2 OCCUPANCY			
AREAS: LOADING DOCKS, NON-CONSTRUCTED SHELL AREAS, STAGES AND STORAGE AREAS WITH STOCKPILES UP TO 12'-0" IN HEIGHT.			
0.20	1500	250	130

FIRE PROTECTION GENERAL NOTES

A COORDINATE THE LOCATION OF DRAINS, THERMOSTATS, GAS OUTLETS, ETC., WITH ALL CASEWORK EQUIPMENT, MECHANICAL ROOM EQUIPMENT, ETC., PRIOR TO COMMENCING INSTALLATION. WORK NOT SO COORDINATED SHALL BE REMOVED AND PROPERLY INSTALLED AT THE EXPENSE OF THE CONTRACTOR.

B THE CONTRACTOR SHALL EXERCISE EXTREME CARE IN THE COURSE OF THEIR WORK SO AS TO ENSURE THAT THEY DO NOT INTERRUPT ANY EXISTING SERVICE. FOR SAFETY PURPOSES, PAY PARTICULAR ATTENTION TO THIS PRECAUTION RELATIVE TO NATURAL GAS AND ELECTRICAL LINES. VERIFY THE LOCATION, SIZE, TYPE, ETC., OF EACH UNDERGROUND OR OVERHEAD UTILITY. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL FEDERAL, STATE AND/OR LOCAL RULES, REGULATIONS, STANDARD AND SAFETY REQUIREMENTS. UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE MUNICIPALITY OR UTILITY COMPANY STANDARDS. IN ALL CASES, THE MOST STRINGENT REQUIREMENT SHALL APPLY.

C ALL NEW WORK SHALL BE HUNG FROM STRUCTURE, NOT FROM THE WORK OF OTHER TRADES.

D COORDINATE ALL WORK WITH PROJECT PHASING REQUIREMENTS.

E OBSERVE ALL APPLICABLE CODES, RULES AND REGULATIONS THAT MAY APPLY TO THE WORK UNDER THIS CONTRACT. (CITY, COUNTY, LOCAL, FEDERAL, MUNICIPALITY, UTILITY COMPANY, STATE OF CONNECTICUT, ETC.)

F ALL PENETRATIONS OF FIRE AND SMOKE RATED ASSEMBLIES SHALL BE APPROPRIATELY FIRE STOPPED PER AN APPROVED U.L. LISTED STANDARD. CONTRACTOR SHALL PAY PARTICULAR ATTENTION TO INSULATED PIPING PENETRATIONS.

G ALL WORK REQUIRING DOWNTIME OF ANY AREA IN THE BUILDING SHALL BE SCHEDULED 2 WEEKS IN ADVANCE, AND SHALL COMPLY WITH INTERIM LIFE SAFETY MEASURES.

H ALL PIPING IN ROOMS WITH CEILINGS SHALL BE ABOVE CEILING EXCEPT AS NOTED.

I NO WORK SHALL BE INSTALLED IN VIOLATION OF ANY GOVERNING CODES. ANY WORK SHOWN ON THE DRAWINGS WHICH IS IN VIOLATION OF SUCH CODES SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK.

J LOCATIONS OF PIPING AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. DO NOT SCALE THE DRAWINGS.

K ALL OFFSETS IN PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.

L THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY COMPANY FEES OR OTHER COSTS THAT ANY UTILITY COMPANY MAY REQUIRE TO COMPLETE THEIR WORK.

M INSTALL ALL PIPING AND EQUIPMENT IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTION. IF IN CONFLICT WITH THE DESIGN INDICATED IN CONTRACT DOCUMENTS, ADVISE THE ENGINEERS PRIOR TO INSTALLATION FOR CLARIFICATION. PROVIDE RECOMMENDED ACCESS AND SERVICE CLEARANCES FOR ALL EQUIPMENT.

N SEAL AIRTIGHT AROUND ALL PIPING PENETRATIONS THROUGH WALLS, FLOORS AND ROOF. PROVIDE FIRE STOPPING IN FIRE PARTITION.

O WHERE MOUNTING HEIGHTS ARE NOT INDICATED OR ARE IN CONFLICT WITH ANY OTHER BUILDING SYSTEM, CONTACT THE ENGINEERS BEFORE INSTALLATION. REFER ALSO TO ARCHITECTURAL WALL INTERIOR AND EXTERIOR WALL ELEVATIONS, CEILING HEIGHTS AND OTHER DETAIL OF THESE DOCUMENTS.

P ANY VIBRATING, OSCILLATING OR OTHER NOISE OR MOTION PRODUCING EQUIPMENT SHALL BE ISOLATED FROM SURROUNDING SYSTEMS IN AN APPROVED MANNER. NOISY OR STRUCTURALLY DAMAGING INSTALLATIONS SHALL BE SATISFACTORILY REPLACED OR REPAIRED AT THE INSTALLING CONTRACTOR'S EXPENSE. THE FINAL DECISION ON THE SUITABILITY OF A PARTICULAR INSTALLATION'S ACCEPTABILITY SHALL BE THAT OF THE ENGINEER.

Q DEVIATIONS IN SIZE, CAPACITIES, FIT, FINISH, ETC. FOR EQUIPMENT FROM THAT USED AS BASIS OF DESIGN SHALL BE THE RESPONSIBILITY OF THE PURCHASER OF THAT EQUIPMENT. ANY PROVISIONS REQUIRED TO ACCOMMODATE A DEVIATION, WHETHER APPROVED BY THE ENGINEERS OR NOT, SHALL BE THE RESPONSIBILITY OF THE PURCHASER.

R VALVES REQUIRING ACCESS SHALL NOT BE LOCATED ABOVE A HARD CEILING. IF THIS IS NOT POSSIBLE, THEN AN APPROPRIATELY SIZED ACCESS DOOR SHALL BE PLACED UNDER THE ITEM TO ALLOW EASY MAINTENANCE AND ADJUSTMENT. ADDITIONALLY ALL SUCH ITEMS SHALL NOT BE LOCATED AN UNREASONABLE DISTANCE ABOVE THE CEILINGS. IN GENERAL ALL SUCH ITEMS UNLESS INDICATED OTHERWISE SHALL BE MOUNTED SIX TO TWELVE INCHES ABOVE THE CEILING. IF IN DOUBT, CONTACT ENGINEER PRIOR TO INSTALLING.

S ALL MANHOLES, VAULTS AND SIMILAR UNDERGROUND STRUCTURES SHALL HAVE THE TOP ELEVATION SET FLUSH WITH FINISHED GRADE UNLESS SPECIFICALLY NOTED OTHERWISE.

T WHEN RUNNING ANY TYPE OF PIPING BELOW A FOOTER, OR IN THE ZONE OF INFLUENCE THE PIPING SHALL BE BACKFILLED WITH CEMENTITIOUS FLOWABLE FILL PER SPECIFICATIONS. WHENEVER POSSIBLE, LOCATE PIPING OUTSIDE OF THE ZONE OF INFLUENCE. THE ZONE OF INFLUENCE IS THE AREA UNDER THE FOOTER WITHIN A 45 DEGREE ANGLE PROJECTING DOWN FROM THE BOTTOM EDGE OF THE FOOTER OF ALL SIDES OF THE FOOTER. ADDITIONALLY, GREASE TRAPS, MANHOLES, VAULTS AND OTHER UNDERGROUND STRUCTURES SHALL BE HELD AWAY FROM BUILDING WALLS FAR ENOUGH TO BE OUTSIDE OF THE ZONE OF INFLUENCE.

U WORK IN CONFINED AREAS SHALL BE IN ACCORDANCE WITH THE OWNER'S SAFETY POLICY REQUIREMENTS.

Sheet List - Fire Suppression

SHEET #	SHEET NAME
FP0.01	FIRE PROTECTION LEGEND
FP1.01C	LOWER LEVEL FIRE PROTECTION PLAN - AREA C
FP1.02A	MAIN LEVEL FIRE PROTECTION PLAN - AREA A
FP1.02B	MAIN LEVEL FIRE PROTECTION PLAN - AREA B
FP1.02C	MAIN LEVEL FIRE PROTECTION PLAN - AREA C
FP1.03C	UPPER LEVEL FIRE PROTECTION PLAN - AREA C
FP4.01	FIRE PROTECTION DETAILS

ABBREVIATIONS

ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
ANSI	AMERICAN NATIONAL STANDARD INSTITUTE
CLG	CEILING
CTE	CONNECT TO EXISTING
DN	DOWN
ENGR	ENGINEER
EQ	EQUAL
ETBR	EXISTING TO BE REMOVED
ETR	EXISTING TO REMAIN
FACP	FIRE ALARM CONTROL PANEL
FCVA	FLOOR CONTROL VALVE ASSEMBLY
FDC	FIRE DEPARTMENT CONNECTION
FDV	FIRE DEPARTMENT VALVE
FDVC	FIRE DEPARTMENT VALVE CABINET
FFE	FINISH FLOOR ELEVATION
FHC	FIRE HOSE CABINET
FL	FLOOR
FLEX	FLEXIBLE CONNECTION
FP	FIRE PUMP
FPC	FIRE PROTECTION CONTRACTOR
FS	FLOW SWITCH
FT	FEET **OR** FOOT
GA	GAGE/GAUGE
GAL	GALLON (-S)
GC	GENERAL CONTRACTOR
HP	HORSEPOWER
HZ	HERTZ
IN	INCH (-ES)
INV	INVERT
KW	KILOWATT
MAX	MAXIMUM
MC	MECHANICAL CONTRACTOR
MIN	MIN (-IMUM, -UTE)
MISC	MISCELLANEOUS
N/A	NOT APPLICABLE
NC	NOISE CRITERIA **OR** NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN **OR** NUMBER
NTS	NOT TO SCALE
OD	OUTSIDE DI (-AMETER, -MENSION)
PC	PLUMBING CONTRACTOR
PH	PHASE
PC	PLUMBING CONTRACTOR
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PSIG	PSI GAUGE
RPM	REVOLUTIONS PER MINUTE
S	SLOPE
SF	SQUARE FEET **OR** FOOT
SP	SPRINKLER

ABBREVIATIONS (CONTINUED)

SPD	SPRINKLER DRAIN
TEMP	TEMPERATURE
TS	TAMPER SWITCH
TYP	TYPICAL
VIV	VALVE IN VERTICAL
W/	WITH
W/O	WITHOUT
%	PERCENT
℄	CENTERLINE

ABBREVIATIONS - PIPING SYSTEMS

DRY	SPRINKLER (DRY PIPE)
F	FIRE MAIN / STANDPIPE
FTST	TEST HEADER
PRE	SPRINKLER (PRE-ACTION)
SP	SPRINKLER (WET PIPE)
SPD	SPRINKLER DRAIN

GENERAL SYMBOLS

#	TAGGED NOTE DESIGNATOR
X	REVISION TRIANGLE
	POINT OF CONNECTION / CONNECT TO EXISTING
	POINT OF DEMOLITION

FIRE PROTECTION PIPING LEGEND

	PIPE ELBOW TURNING UP
	PIPE ELBOW TURNING DOWN
	PIPE TEE; CONNECTION ON TOP
	PIPE TEE; CONNECTION ON BOTTOM
	PIPE CAP
	EXISTING PIPING TO BE DEMOLISHED
	EXISTING PIPING
	NEW PIPING
	STRAINER
	GENERIC VALVE
	CHECK VALVE
	REDUCED PRESSURE BACKFLOW PREVENTER
	OS&Y (GATE) VALVE
	PRESSURE REDUCING VALVE (STEAM, GAS, WATER, ETC.)
	FLEXIBLE PIPE CONNECTION
	PIPING UNION
FS	FLOW SWITCH
PS	PRESSURE SWTICH
TS	TAMPER SWITCH
	EXISTING SPRINKLER TO REMAIN
	EXISTING SPRINKLER TO REMAIN
	CONCEALED TYPE SPRINKLER HEAD
	PENDENT/SEMI-RECESSED/RECESSED TYPE SPRINKLER HEAD
	UPRIGHT TYPE SPRINKLER HEAD
	SIDEWALL TYPE SPRINKLER HEAD
	EXISTING SIDEWALL SPRINKLER TO REMAIN
	EXISTING SIDEWALL SPRINKLER TO BE REMOVED
	WINDOW TYPE SPRINKLER
	DRY ALARM VALVE
	WET ALARM VALVE

APPLICABLE BUILDING CODES

APPLICABLE BUILDING CODES	DOCUMENT	YEAR
FIRE SPRINKLER CODE	NFPA 13	2016

HYDRANT TEST RESULTS

STATIC PRESSURE:	RESIDUAL PRESSURE:	FLOW RATE (GPM)
DANIELS FARM ROAD #480		
09/29/2025		
100 PSI	80 PSI	1,682

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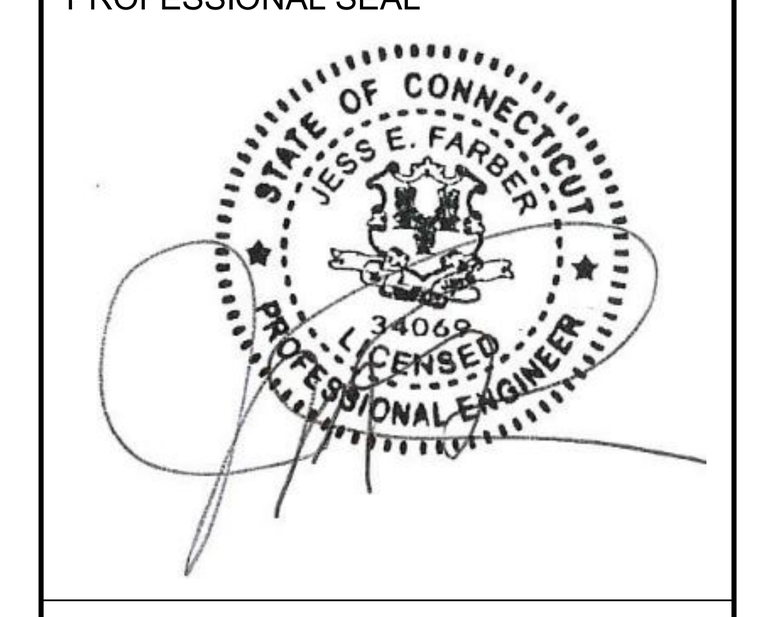
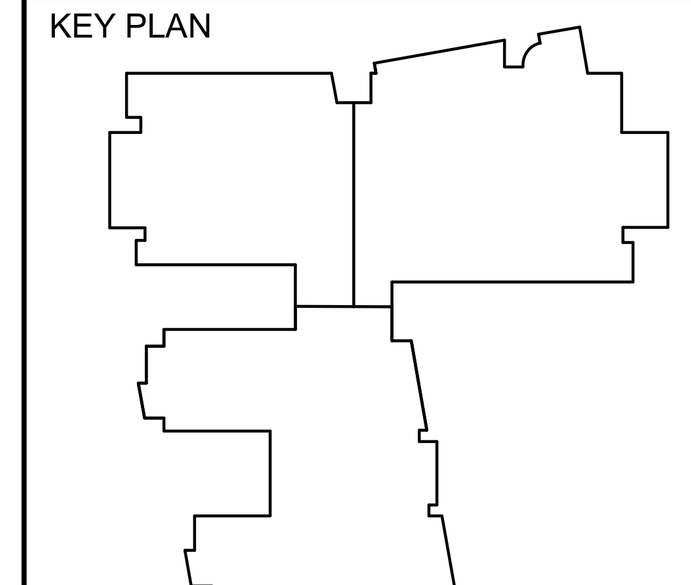


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

FIRE PROTECTION LEGEND

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FP0.01

5/18/2026 11:31:16 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt



TAGGED NOTES

F1 PLUMBING CONTRACTOR SHALL PROVIDE 6" FIRE SERVICE PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION TO CITY FIRE WATER WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER. 6" FIRE SERVICE TO BE BURIED 5'-0" BELOW GRADE

F2 6" DOUBLE CHECK VALVE ASSEMBLY

F3 PROVIDE ZONE CONTROL VALVE ASSEMBLY AT THIS LOCATION. ROUTE DRAIN TO FLOOR DRAIN. REFER TO FIRE PROTECTION DETAILS FOR MORE INFORMATION.

F7 PROVIDE SPRINKLER HEAD IN ELEVATOR PIT PER NFPA 13. COORDINATE LOCATION WITH ELEVATOR VENDOR.

1 LOWER LEVEL FIRE PROTECTION PLAN - AREA C
1/8" = 1'-0"

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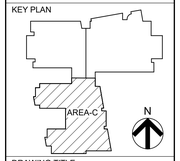
STATE OF CONNECTICUT
JESS E. FARLEY
24540
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL FIRE PROTECTION PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
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FP1.01C

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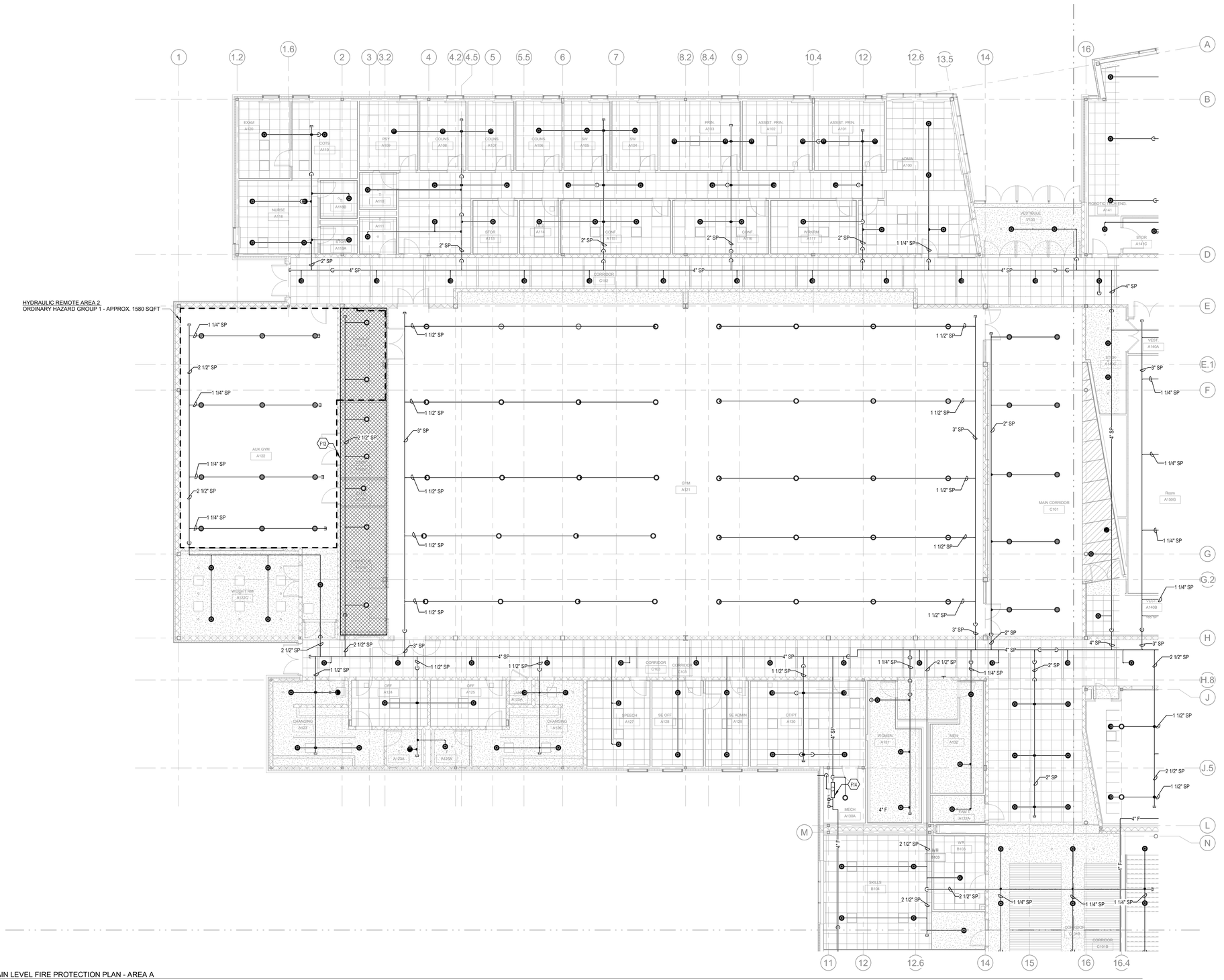
TAGGED NOTES

F13 PROVIDE SPRINKLER HEADS ON MEZZANINE LEVEL.
F14 PROVIDE ZONE CONTROL VALVE ASSEMBLY AT THIS LOCATION. ROUTE DRAIN TO EXTERIOR. REFER TO FIRE PROTECTION DETAILS FOR MORE INFORMATION.



1 MAIN LEVEL FIRE PROTECTION PLAN - AREA A
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL FIRE PROTECTION PLAN - AREA A

STATE PROJ. NO.	144-0108N
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FP1.02A

5/18/2026 11:31:26 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

F4	PROVIDE WALL MOUNTED FIRE DEPARTMENT CONNECTION. COORDINATE EXACT LOCATION WITH ARCHITECTURAL DRAWINGS AND LOCAL AHJ.
F5	WET CHEMICAL SUPPRESSION STSYEM TO BE FURNINSHED AND INSTALLED BY FOOD SERVICE CONTRACTOR FOR KITCHEN HOOD.
F6	PROVIDE CLASS III STANDPIPE WITH 1-1/2" HOSE CONNECTION. COORDINATE LOCATION OF STANDPIPE WITH ALL STAGE EQUIPMENT AND RIGGING.
F8	PROVIDE DRY BARREL SPRINKLER HEADS IN FREEZER AND COOLER ENCLOSURES. COORDINATE EXACT LOCATIONS WITH FOOD SERVICE VENDOR.
F9	COORDINATE SPRINKLER HEAD LOCATIONS WITH GARAGE DOORS. PROVIDE ADDITIONAL HEADS UNDERNEATH DOOR AS REQUIRED BY NFPA 13.
F11	COORDINATE SPRINKLER HEAD AND PIPING WITH ALL THEATER EQUIPMENT AND RIGGING, CATWALKS, AND ACCOUSTICAL CLOUD PANELS.
F13	PROVIDE SPRINKLER HEADS ON MEZZANINE LEVEL.

1 MAIN LEVEL FIRE PROTECTION PLAN - AREA B
1/8" = 1'-0"

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STATE OF CONNECTICUT — JESS E. FAIRCHILD — 34042 — LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

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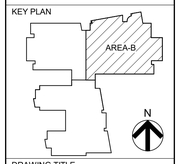

DRAWING TITLE

MAIN LEVEL FIRE PROTECTION PLAN - AREA B

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TAGGED NOTES

F3 PROVIDE ZONE CONTROL VALVE ASSEMBLY AT THIS LOCATION. ROUTE DRAIN TO FLOOR DRAIN. REFER TO FIRE PROTECTION DETAILS FOR MORE INFORMATION.

TYPICAL SCIENCE ROOM SPRINKLER LAYOUT

TYPICAL CLASSROOM SPRINKLER LAYOUT

1 MAIN LEVEL FIRE PROTECTION PLAN - AREA C
1/8" = 1'-0"

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STATE OF CONNECTICUT
JESUS E. FANDIÑO
34040
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

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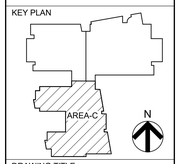

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3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FP1.02C

5/18/2026 11:31:35 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

F10 PROVIDE SPRINKLER HEAD AT TOP OF ELEVATOR HOISTWAY PER NFPA 13. COORDINATE LOCATION WITH ELEVATOR VENDOR.



1 UPPER LEVEL FIRE PROTECTION PLAN - AREA C
1/8" = 1'-0"

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CMTA
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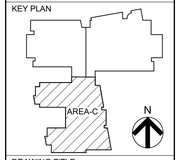
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL FIRE PROTECTION PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FP1.03C

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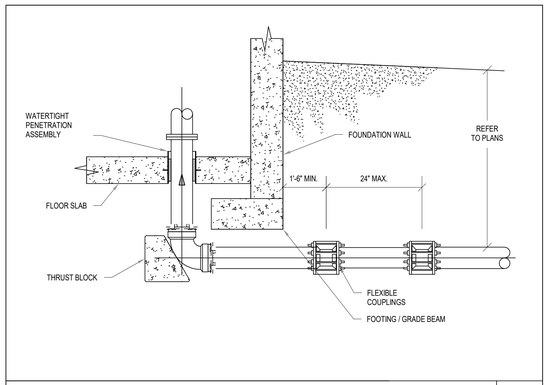
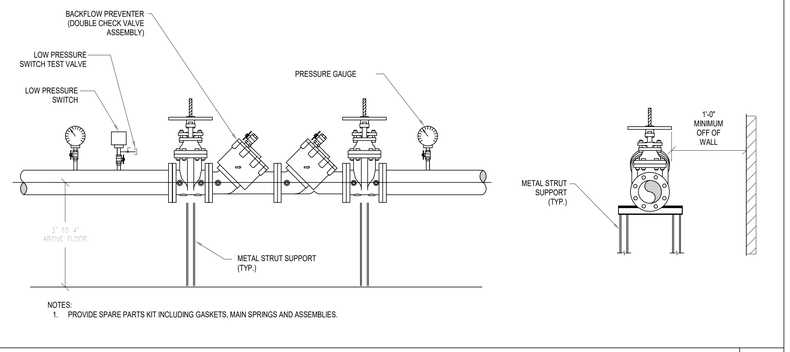
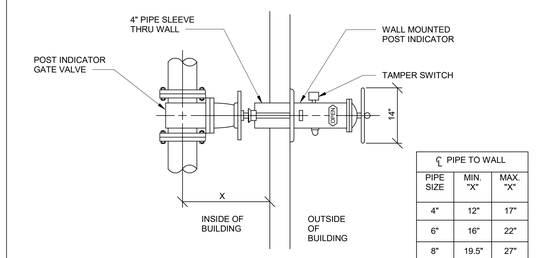


UNDERGROUND FIRE SERVICE | NTS



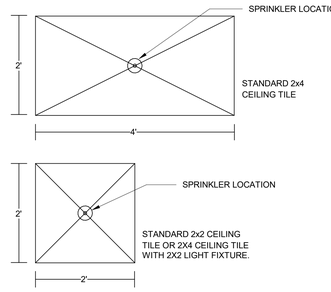
NOTES:
1. PROVIDE SPARE PARTS KIT INCLUDING GASKETS, MAIN SPRINGS AND ASSEMBLIES.

DOUBLE CHECK VALVE ASSEMBLY | NTS



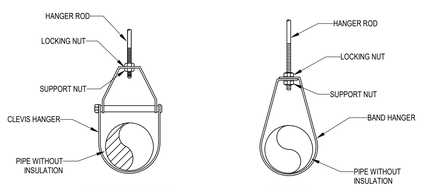
℄ PIPE TO WALL		
PIPE SIZE	MIN. "X"	MAX. "X"
4"	12"	17"
6"	16"	22"
8"	19.5"	27"

TYPICAL WALL MOUNTED POST INDICATOR VALVE (WPIV) DETAIL | NTS



NOTE:
1. ARCHITECT HAS FINAL APPROVAL OF SPRINKLER LOCATIONS.

SPRINKLER HEAD LOCATIONS IN CEILING TILE DETAIL | NTS



TYPICAL PIPE HANGERS

MAXIMUM PIPE/TUBING SUPPORT SPACING, FEET								
NOM. SIZE	THRU 3/4"	1	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
PIPE	7 FT	7	7	9	10	11	12	14
TUBING	5 FT	6	7	8	8	9	10	12
NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE								

PIPE HANGERS | NTS

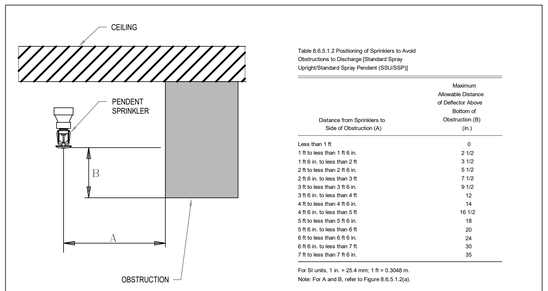
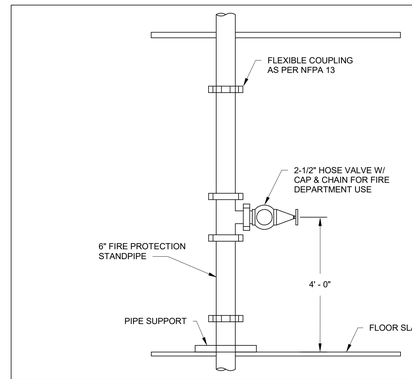


Table 8.6.5.1.2 Positioning of Sprinklers to Avoid Obstructions to Discharge [Standard Spray Upright/Standard Spray Pendent (SSU/SSP)]

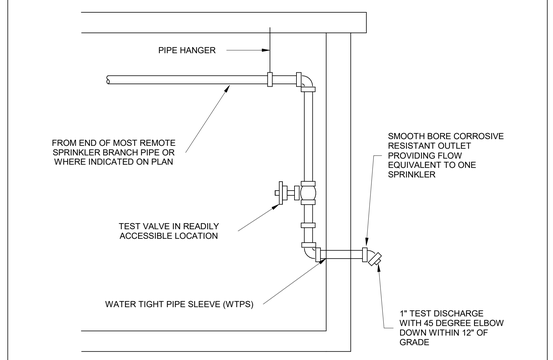
Distance from Sprinklers to Side of Obstruction (A)	Maximum Allowable Distance of Deflector Above Bottom of Obstruction (B) (in.)
Less than 1 ft	0
1 ft to less than 1 ft 6 in.	2 1/2
1 ft 6 in. to less than 2 ft	3 1/2
2 ft to less than 2 ft 6 in.	5 1/2
2 ft 6 in. to less than 3 ft	7 1/2
3 ft to less than 3 ft 6 in.	9 1/2
3 ft 6 in. to less than 4 ft	12
4 ft to less than 4 ft 6 in.	14
4 ft 6 in. to less than 5 ft	16 1/2
5 ft to less than 5 ft 6 in.	18
5 ft 6 in. to less than 6 ft	20
6 ft to less than 6 ft 6 in.	24
6 ft 6 in. to less than 7 ft	30
7 ft to less than 7 ft 6 in.	35

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m.
Note: For A and B, refer to Figure 8.6.5.1.2(a).

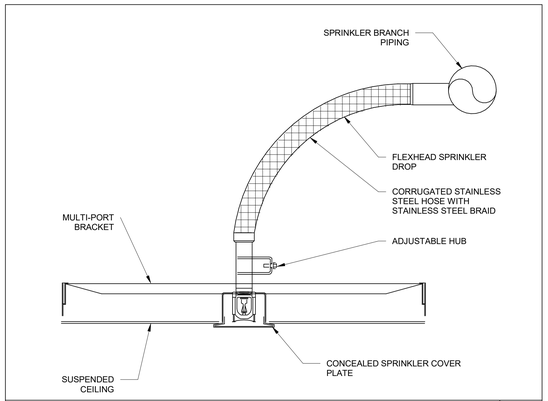
OBSTRUCTION DISCHARGE DETAIL (NFPA FIGURE 8.6.5.1.2(a)) | NTS



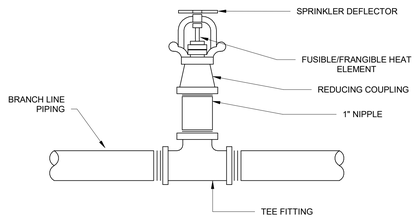
HOSE VALVE DETAIL | NTS



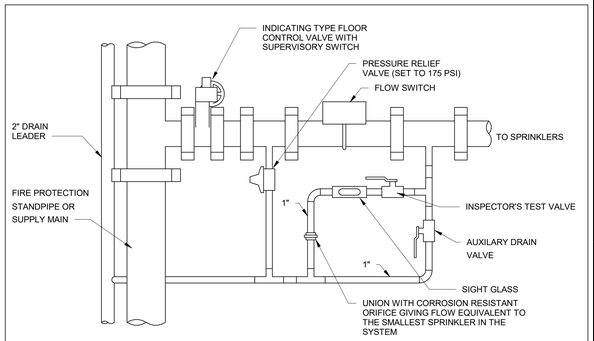
TYPICAL INSPECTOR TEST CONNECTION DETAIL | NTS



TYPICAL CONCEALED PENDENT SPRINKLER DETAIL | NTS



TYPICAL UPRIGHT SPRINKLER DETAIL | NTS



NOTES:

1. INSPECTOR'S TEST VALVES SHALL BE INSTALLED IN ACCESSIBLE LOCATION. MOUNT ADJACENT TO FIXED STRUCTURE IF LADDER ACCESS IS REQUIRED.

ZONE CONTROL VALVE ASSEMBLY DETAIL | NTS

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TRUMBULL HILLCREST MIDDLE SCHOOL

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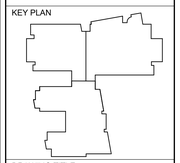
PROJECT STATUS

KEY PLAN



DRAWING TITLE

FIRE PROTECTION DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

FP4.01

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PLUMBING GENERAL NOTES

A COORDINATE THE LOCATION OF DRAINS, ETC., WITH ALL CASEWORK EQUIPMENT, MECHANICAL ROOM EQUIPMENT, ETC., PRIOR TO COMMENCING INSTALLATION. WORK NOT SO COORDINATED SHALL BE REMOVED AND PROPERLY INSTALLED AT THE EXPENSE OF THE CONTRACTOR.

B THE CONTRACTOR SHALL EXERCISE EXTREME CARE IN THE COURSE OF THEIR WORK SO AS TO ENSURE THAT THEY DO NOT INTERRUPT ANY EXISTING SERVICE. FOR SAFETY PURPOSES, PAY PARTICULAR ATTENTION TO THIS PRECAUTION RELATIVE TO NATURAL GAS AND ELECTRICAL LINES. VERIFY THE LOCATION, SIZE, TYPE, ETC., OF EACH UNDERGROUND OR OVERHEAD UTILITY. ALL WORK SHALL BE PERFORMED IN ACCORD WITH ALL FEDERAL, STATE AND/OR LOCAL RULES, REGULATIONS, STANDARD AND SAFETY REQUIREMENTS. UTILITIES SHALL BE INSTALLED IN ACCORD WITH THE APPLICABLE MUNICIPALITY OR UTILITY COMPANY STANDARDS. IN ALL CASES, THE MOST STRINGENT REQUIREMENT SHALL APPLY.

C ALL NEW WORK SHALL BE HUNG FROM STRUCTURE, NOT FROM THE WORK OF OTHER TRADES.

D COORDINATE ALL WORK WITH PROJECT PHASING REQUIREMENTS.

E OBSERVE ALL APPLICABLE CODES, RULES AND REGULATIONS THAT MAY APPLY TO THE WORK UNDER THIS CONTRACT. (CITY, COUNTY, LOCAL, FEDERAL, MUNICIPALITY, UTILITY COMPANY, STATE OF CONNECTICUT, ETC.)

F ALL PENETRATIONS OF FIRE AND SMOKE RATED ASSEMBLIES SHALL BE APPROPRIATELY FIRE STOPPED PER AN APPROVED U.L. LISTED STANDARD. CONTRACTOR SHALL PAY PARTICULAR ATTENTION TO INSULATED PIPING PENETRATIONS.

G ALL PIPING IN ROOMS WITH CEILINGS SHALL BE ABOVE CEILING EXCEPT AS NOTED.

H NO WORK SHALL BE INSTALLED IN VIOLATION OF ANY GOVERNING CODES. ANY WORK SHOWN ON THE DRAWINGS WHICH IS IN VIOLATION OF SUCH CODES SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK.

I LOCATIONS OF PIPING AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. DO NOT SCALE THE DRAWINGS.

J ALL OFFSETS IN PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.

K THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY COMPANY FEES OR OTHER COSTS THAT ANY UTILITY COMPANY MAY REQUIRE TO COMPLETE THEIR WORK. (SEWER, WATER, ETC.).

L INSTALL ALL PIPING AND EQUIPMENT IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTION. IF IN CONFLICT WITH THE DESIGN INDICATED IN CONTRACT DOCUMENTS, ADVISE THE ENGINEERS PRIOR TO INSTALLATION FOR CLARIFICATION. PROVIDE RECOMMENDED ACCESS AND SERVICE CLEARANCES FOR ALL EQUIPMENT.

M PROVIDE A WATER HAMMER ARRESTOR ON HOT AND COLD-WATER LINES AT ENDS OF MAINS, AT ENDS OF BRANCH LINES, AT END OF LINES SERVING GROUPS OF PLUMBING FIXTURES AND FOR ALL QUICK CLOSING VALVES. SIZE AND INSTALL ARRESTORS AS RECOMMENDED BY PDI WH-201 TO ELIMINATE WATER HAMMER. INSTALL WHERE ACCESSIBLE FOR SERVICE AND PROVIDE ISOLATION VALVE AND ACCESS DOOR IF REQUIRED.

N PLUMBING PIPING IS NOT PERMITTED TO RUN ABOVE ANY ELECTRICAL SWITCH GEAR, MOTOR CONTROL CENTERS OR PANELS (INCLUDING ACCESS/CLEARANCE SPACE), UNDER ANY CIRCUMSTANCES. LOCATION OF NEW ITEMS OF THESE TYPES TO BE DETERMINED AND CONFIRMED FROM INDICATION BY THE PROJECT ELECTRICAL DOCUMENTATION, AND ACTUAL INSTALLATION CONFIRMED WITH THE ELECTRICAL CONTRACTOR PRIOR TO START OF WORK.

O WHERE MOUNTING HEIGHTS ARE NOT INDICATED OR ARE IN CONFLICT WITH ANY OTHER BUILDING SYSTEM, CONTACT THE ENGINEERS BEFORE INSTALLATION. REFER ALSO TO ARCHITECTURAL WALL INTERIOR AND EXTERIOR WALL ELEVATIONS, CEILING HEIGHTS AND OTHER DETAIL OF THESE DOCUMENTS.

P ANY VIBRATING, OSCILLATING OR OTHER NOISE OR MOTION PRODUCING EQUIPMENT SHALL BE ISOLATED FROM SURROUNDING SYSTEMS IN AN APPROVED MANNER. NOISY OR STRUCTURALLY DAMAGING INSTALLATIONS SHALL BE SATISFACTORILY REPLACED OR REPAIRED AT THE INSTALLING CONTRACTOR'S EXPENSE. THE FINAL DECISION ON THE SUITABILITY OF A PARTICULAR INSTALLATION'S ACCEPTABILITY SHALL BE THAT OF THE ENGINEER.

Q DEVIATIONS IN SIZE, CAPACITIES, FIT, FINISH, ETC. FOR EQUIPMENT FROM THAT USED AS BASIS OF DESIGN SHALL BE THE RESPONSIBILITY OF THE PURCHASER OF THAT EQUIPMENT. ANY PROVISIONS REQUIRED TO ACCOMMODATE A DEVIATION, WHETHER APPROVED BY THE ENGINEERS OR NOT, SHALL BE THE RESPONSIBILITY OF THE PURCHASER.

R VALVES, OR ANY MECHANICAL/ELECTRICAL ITEM REQUIRING ACCESS SHALL NOT BE LOCATED ABOVE A HARD CEILING. IF THIS IS NOT POSSIBLE, THEN AN APPROPRIATELY SIZED ACCESS DOOR SHALL BE PLACED UNDER THE ITEM TO ALLOW EASY MAINTENANCE AND ADJUSTMENT. ADDITIONALLY ALL SUCH ITEMS SHALL NOT BE LOCATED AN UNREASONABLE DISTANCE ABOVE THE CEILINGS. IN GENERAL ALL SUCH ITEMS UNLESS INDICATED OTHERWISE SHALL BE MOUNTED SIX TO TWELVE INCHES ABOVE THE CEILING. IF IN DOUBT, CONTACT ENGINEER PRIOR TO INSTALLING.

S ALL MANHOLES, VAULTS AND SIMILAR UNDERGROUND STRUCTURES SHALL HAVE THE TOP ELEVATION SET FLUSH WITH FINISHED GRADE UNLESS SPECIFICALLY NOTED OTHERWISE.

T WHEN RUNNING ANY TYPE OF PIPING BELOW A FOOTER, OR IN THE ZONE OF INFLUENCE THE PIPING SHALL BE BACKFILLED WITH CEMENTITIOUS FLOWABLE FILL PER SPECIFICATIONS. WHENEVER POSSIBLE, LOCATE PIPING OUTSIDE OF THE ZONE OF INFLUENCE. THE ZONE OF INFLUENCE IS THE AREA UNDER THE FOOTER WITHIN A 45 DEGREE ANGLE PROJECTING DOWN FROM THE BOTTOM EDGE OF THE FOOTER OF ALL SIDES OF THE FOOTER. ADDITIONALLY, GREASE TRAPS, MANHOLES, VAULTS AND OTHER UNDERGROUND STRUCTURES SHALL BE HELD AWAY FROM BUILDING WALLS FAR ENOUGH TO BE OUTSIDE OF THE ZONE OF INFLUENCE.

U WORK IN CONFINED AREAS SHALL BE IN ACCORDANCE WITH THE OWNER'S SAFETY POLICY REQUIREMENTS.

V THE MINIMUM SIZES OF SANITARY, VENT AND WATER BRANCH PIPING TO SINGLE FIXTURES SHALL BE AS SCHEDULED IN THE PLUMBING FIXTURE SCHEDULE.

W CONTRACTOR TO PROVIDE MISCELLANEOUS STEEL AS REQUIRED TO SUPPORT EQUIPMENT AND ASSOCIATED COMPONENTS SUCH AS CONTROL PANELS, TANKS, VALVES, PIPING, VARIABLE SPEED DRIVES, ETC. MISCELLANEOUS STEEL TO CONSIST OF GALVANIZED STRUT, ANGLE IRON, CHANNELS OR OTHER STANDARD GLAVANIZED STEEL ELEMENTS. ALL WELDED CONNECTIONS TO BE GROUND AND COLD GALVANIZED IN THE FIELD.

X PROVIDE BACKFLOW PREVENTER OR VACUUM BREAKER IN DOMESTIC WATER LINES, WHERE BACKFLOW OR BACK PRESSURE MAY OCCUR, AS REQUIRED BY THE STATE OR LOCAL JURISDICTION. EQUIPMENT SUCH AS STERILIZERS, COFFEE MAKERS, CARBONATED VENDING MACHINES, ICE MAKERS, HVAC EQUIPMENT, HOSE BIBBS AND WALL HYDRANTS ARE TO INCLUDE BACKFLOW PREVENTION DEVICES IN THE WATER LINES THAT SERVE THEM.

PLUMBING HAZARDOUS MATERIALS NOTES

A THE CONTRACTOR IT IS HEREBY ADVISED THAT IS POSSIBLE THAT ASBESTOS AND/OR OTHER HAZARDOUS MATERIALS ARE OR WERE PRESENT IN THIS BUILDING(S). ANY WORKER, OCCUPANT, VISITOR, ETC., WHO ENCOUNTERS ANY MATERIAL OF WHOSE CONTENT THEY ARE NOT CERTAIN SHALL PROMPTLY REPORT THE EXISTENCE AND LOCATION OF THAT MATERIAL TO THE OWNER. FURTHERMORE, THE CONTRACTOR SHALL INSURE THAT NO ONE COMES NEAR TO OR IN CONTACT WITH ANY SUCH MATERIAL OR FUMES THEREFROM UNTIL ITS CONTENT CAN BE ASCERTAINED TO BE NON-HAZARDOUS.

B CMTA, INC. HAS NO EXPERTISE IN THE DETERMINATION OF THE PRESENCE OF ANY HAZARDOUS MATERIAL. THEREFORE, NO ATTEMPT HAS BEEN MADE BY CMTA TO IDENTIFY THE EXISTENCE OR LOCATION OF ANY SUCH HAZARDOUS MATERIAL. FURTHERMORE, CMTA NOR ANY AFFILIATE HEREOF WILL NOT OFFER OR MAKE ANY RECOMMENDATIONS RELATIVE TO THE REMOVAL, HANDLING OR DISPOSAL OF SUCH MATERIAL.

C IF THE WORK WHICH IS TO BE PERFORMED INTERFACES, CONNECTS OR RELATES IN ANY PHYSICAL WAY WITH OR TO EXISTING COMPONENTS WHICH CONTAIN OR BEAR ANY HAZARDOUS MATERIAL, ASBESTOS BEING ONE, THEN IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO CONTACT THE OWNER AND SO ADVISE HIM IMMEDIATELY.

D THE CONTRACTOR BY EXECUTION OF THE CONTRACT FOR ANY WORK AND/OR BY THE ACCOMPLISHMENT OF ANY WORK THEREBY AGREE TO BRING NO CLAIM RELATIVE TO HAZARDOUS MATERIALS FOR NEGLIGENCE, BREACH OF CONTRACT, INDEMNITY, OR ANY OTHER SUCH ITEM AGAINST CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS OR CONSULTANTS. ALSO, THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS AND CONSULTANTS HARMLESS FROM ANY SUCH RELATED CLAIMS WHICH MAY BE BROUGHT BY ANY SUBCONTRACTORS, SUPPLIERS OR ANY OTHER THIRD PARTIES.

E THE CONTRACTOR IS DIRECTED TO THE SPECIFICATIONS FOR FURTHER INFORMATION.

ABBREVIATIONS

AC	ALTERNATING CURRENT
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
AMP	AMPERE (AMP, AMPS)
ANSI	AMERICAN NATIONAL STANDARD INSTITUTE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS
AVG	AVERAGE
BAS	BUILDING AUTOMATION SYSTEM
BTU	BRITISH THERMAL UNIT
CAP	CAPACITY
CD	CONDENSATE DRAIN
CFM	CUBIC FEET PER MINUTE
C.I.	CAST IRON
CLG	CEILING
CLR	CLEAR
CO	CARBON MONOXIDE
COND	CONDENS (-ER, -ING, -ATION, -ATE)
CTE	CONNECT TO EXISTING
CU FT	CUBIC FEET
CU IN	CUBIC INCHES
CV	VALVE FLOW COEFFICIENT
dB	DECIBEL
DB	DRY BULB
DC	DIRECT CURRENT
DEG	DEGREE (-S)
DIA	DIAMETER (-S)
DN	DOWN
DSN	DOWNSPOUT
DWG	DRAWING
EC	ELECTRICAL CONTRACTOR
EEW	EMERGENCY EYEWASH
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
ENGR	ENGINEER
EQ	EQUAL
ETBR	EXISTING TO BE REMOVED
ETR	EXISTING TO REMAIN
EXT	EXTERIOR
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FL	FLOOR
FS	FLOOR SINK

ABBREVIATIONS (CONTINUED)

FPC	FIRE PROTECTION CONTRACTOR
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FT	FEET **OR** FOOT
FUT	FUTURE
GA	GAGE/GAUGE
GAL	GALLON (-S)
GC	GENERAL CONTRACTOR
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HB	HOSEBIBB
HD	HEAD
HG	MERCURY
HORIZ	HORIZONTAL
HP	H (-ORSEPOWER, -EAT PUMP)
HR	HOUR (-S)
HVAC	HEATING, VENTILATING, & AIR-CONDITIONING
Hz	HERTZ
ID	I (-DENTIFICATION, -NSIDE DIAMETER, -NSIDE DIMENSION)
IN	INCH (-ES)
INSUL	INSULAT (-ED, -ION)
INT	INTER (-IOR, -ERVAL)
kW	KILOWATT
kWh	KILOWATT HOUR
LBS	POUNDS
L	LAVATORY
LBS	POUNDS
LF	LINEAR FEET/FOOT
MAX	MAXIMUM
MB	MOP BASIN
MBH	BTU PER HOUR [THOUSANDS]
MFG	MANUFACTURER
MIN	MIN (-IMUM, -UTE)
MISC	MISCELLANEOUS
MTG	MOUNTING
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN **OR** NUMBER
NTS	NOT TO SCALE

ABBREVIATIONS (CONTINUED)

OC	ON CENTER
OD	OUTSIDE DI (-AMETER, -MENSION)
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OD	OVER FLOW DRAIN
OFOI	OWNER FURNISHED, OWNER INSTALLED
OZ	OUNCE (-S)
PC	PLUMBING CONTRACTOR
PD	PRESSURE DROP
PH	PHASE [ELECTRICAL]
PLBG	PLUMBING
PPM	PARTS PER MILLION
PRS	PRESSURE REDUCING STATION
PRV	PRESSURE REDUCING VALVE (STEAM, WATER, GAS)
PSI	POUNDS PER SQUARE INCH
PSIG	PSI GAUGE
RD	ROOF DRAIN
SB	SUPPLY BOX
SK	SINK
ST	STORAGE TANK
SQ	SQUARE
SQ FT	SQUARE FEET **OR** FOOT
SQ IN	SQUARE INCH **OR** INCHES
TAB	TESTING AND BALANCING
TBD	TO BE DETERMINED
TE	TOP ELEVATION
TEMP	TEMPERATURE
TPA	TRAP PRIMER ADAPTER
TYP	TYPICAL
UR	URINAL
W	WATT (-AGE, -S)
WB	WASHER BOX
WC	WATER CLOSET
WH	WALL HYDRANT
V	VOLT (-AGE, -S)
VAR	VARI (-ABLE, -IES)
VEL	VELOCITY
VFD	VARIABLE FEQUENCY DRIVE
W	WATT (-AGE, -S)
WT	WEIGHT
W/	WITH
W/O	WITHOUT
%	PERCENT
ΔP	DIFFERENTIAL PRESSURE
ΔT	TEMPERATURE DIFFERENCE
℄	CENTERLINE

GENERAL SYMBOLS

#	TAGGED NOTE DESIGNATOR
X	REVISION TRIANGLE
	POINT OF CONNECTION / CONNECT TO EXISTING
	POINT OF DEMOLITION

VALVE SYMBOL LEGEND

	TWO-WAY CONTROL VALVE
	THREE-WAY CONTROL VALVE
	STRAINER
	GENERAL SERVICE VALVE (SEE SPECIFICATIONS FOR VALVE TYPE PER APPLICATION)
	PRESSURE REDUCING VALVE (GAS, WATER, ETC.)
	CHECK VALVE
	REDUCED PRESSURE BACKFLOW PREVENTER
M	MANUAL BALANCE VALVE

PLUMBING PIPING LEGEND

	PIPE ELBOW TURNING UP
	PIPE ELBOW TURNING DOWN
	PIPE TEE; CONNECTION ON TOP
	PIPE TEE; CONNECTION ON BOTTOM
	PIPE CAP
AVT	ACID VENT
AW	ACID WASTE
CA	COMPRESSED AIR
DCW	DOMESTIC COLD WATER (DCW)
DHW DHW(#°F)	DOMESTIC HOT WATER (DHW)
DHWR DHWR(#°F)	DOMESTIC HOT WATER RETURN(DHWR)
GW	GREASE WASTE
GV	GREASE VENT
IW	INDIRECT WASTE
LA	LAB AIR
LAI	LAB AIR INTAKE
LVAC	LAB VACUUM
LVE	LAB VACUUM EXHAUST
NHWR	NON-POTABLE HOT WATER RETURN
NCW	NON-POTABLE COLD WATER
NHW	NON-POTABLE HOT WATER
NHWR	NON-POTABLE HOT WATER RETURN
PD	PUMPED DISCHARGE
ST	STORM
SST	SECONDARY STORM
S	SANITARY
V	VENT

PLUMBING SYMBOL LEGEND

	FLEXIBLE PIPE CONNECTION
	PIPING UNION
	THERMOMETER
	PETE'S PLUG; TEMPERATURE/PRESSURE PORT
	FLOOR DRAIN OR FLOOR SINK
M	METER
	EXPANSION JOINT
1 P5.10	RISER OR STACK DESIGNATION & SHEET NUMBER

Sheet List - Plumbing

SHEET #	SHEET NAME
P0.01	PLUMBING LEGEND
P2.01A	UNDERGROUND PLUMBING DRAINAGE PLAN - AREA A
P2.01B	UNDERGROUND PLUMBING DRAINAGE PLAN - AREA B
P2.01C	UNDERGROUND PLUMBING DRAINAGE PLAN - AREA C
P2.02C	LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.03A	MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA A
P2.03B	MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA B
P2.03C	MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.04C	UPPER LEVEL PLUMBING DRAINAGE PLAN - AREA C
P2.05A	ROOF PLUMBING DRAINAGE PLAN - AREA A
P2.05B	ROOF PLUMBING DRAINAGE PLAN - AREA B
P2.05C	ROOF PLUMBING DRAINAGE PLAN - AREA C
P3.01C	LOWER LEVEL PLUMBING SUPPLY PLAN - AREA C
P3.02A	MAIN LEVEL PLUMBING SUPPLY PLAN - AREA A
P3.02B	MAIN LEVEL PLUMBING SUPPLY PLAN - AREA B
P3.02C	MAIN LEVEL PLUMBING SUPPLY PLAN - AREA C
P3.03C	UPPER LEVEL PLUMBING SUPPLY PLAN - AREA C
P4.01	PLUMBING DETAILS
P4.02	PLUMBING DETAILS
P4.03	PLUMBING DETAILS
P4.04	PLUMBING DETAILS
P5.01	PLUMBING STACK DIAGRAMS
P5.02	PLUMBING STACK DIAGRAMS
P5.03	PLUMBING STACK DIAGRAMS
P5.04	PLUMBING STACK DIAGRAMS
P5.05	PLUMBING STACK DIAGRAMS
P5.06	PLUMBING STACK DIAGRAMS
P5.07	PLUMBING STACK DIAGRAMS
P5.08	PLUMBING STORM DIAGRAMS
P5.09	PLUMBING STORM DIAGRAMS
P5.10	PLUMBING STORM DIAGRAMS
P5.11	PLUMBING DOMESTIC WATER DIAGRAMS
P5.12	PLUMBING DOMESTIC WATER DIAGRAMS
P5.13	PLUMBING DOMESTIC WATER DIAGRAMS
P5.14	PLUMBING DOMESTIC WATER DIAGRAMS
P6.01	PLUMBING SCHEDULES

APPLICABLE BUILDING CODES

APPLICABLE BUILDING CODES	DOCUMENT	YEAR
INTERNATIONAL PLUMBING CODE (IPC)	STATE EDITION	2019

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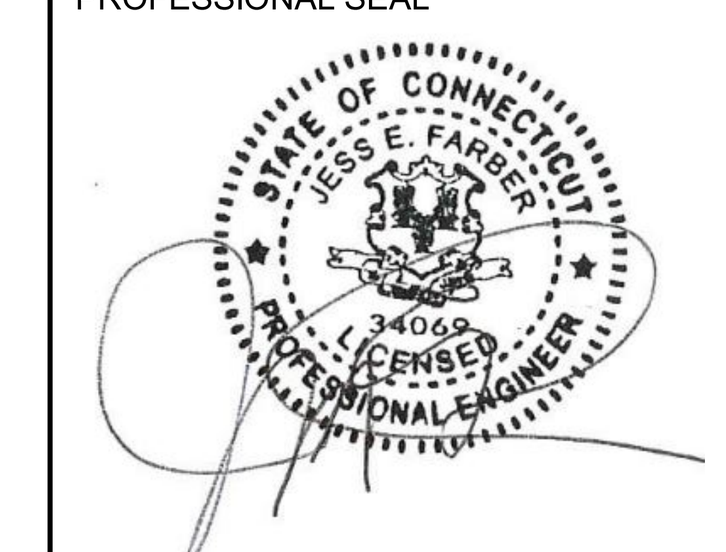
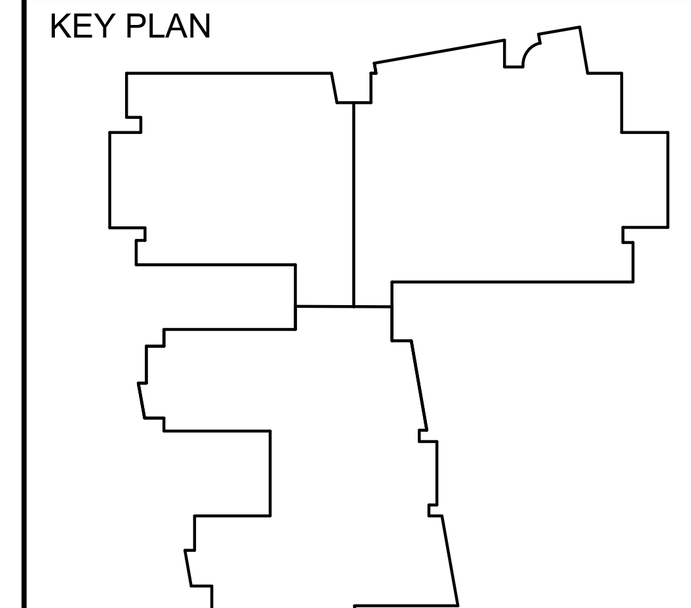


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

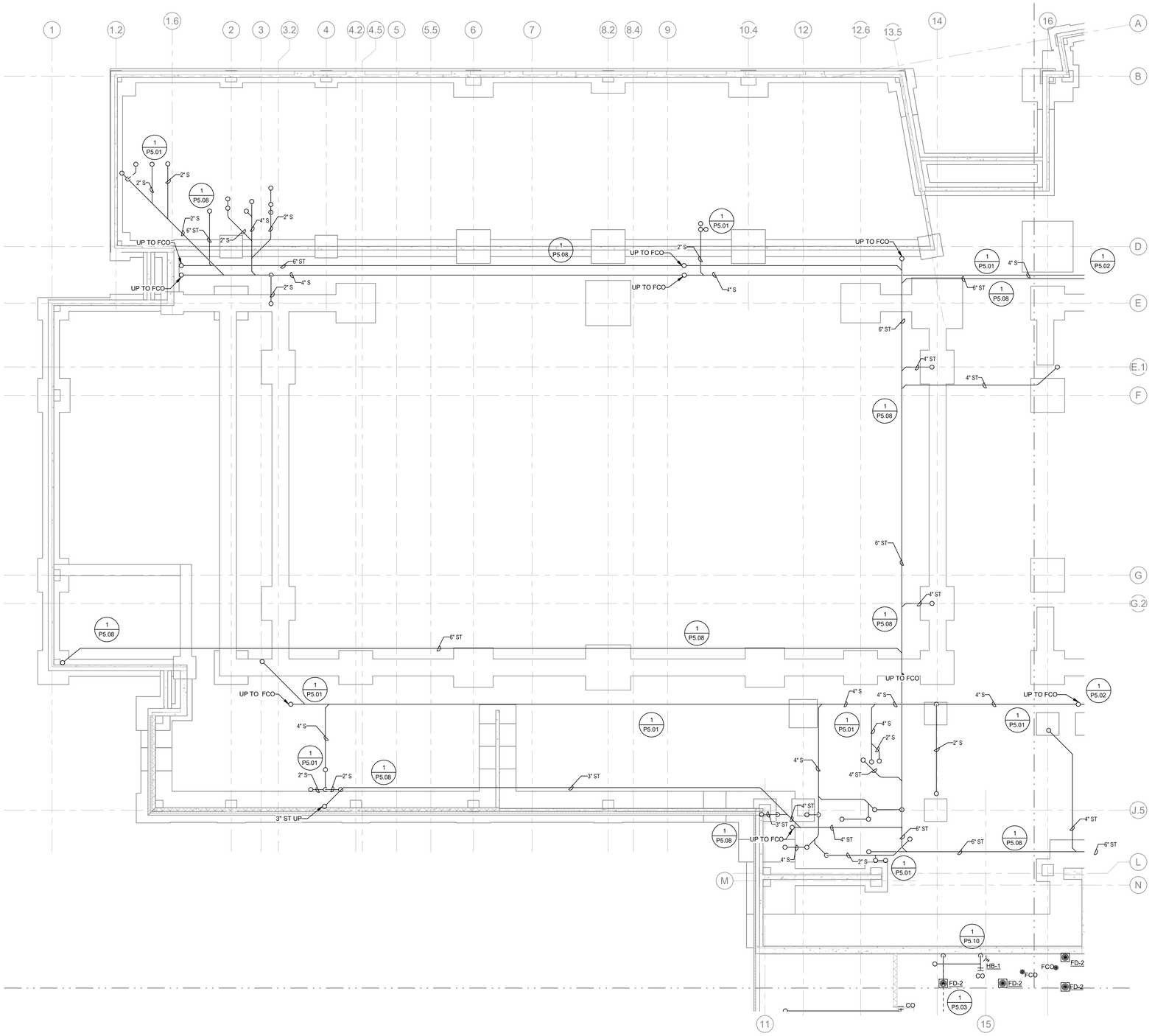
PLUMBING LEGEND

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P0.01



1 LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA A
1/8" = 1'-0"

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24058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

UNDERGROUND PLUMBING DRAINAGE PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

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4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P2.01A

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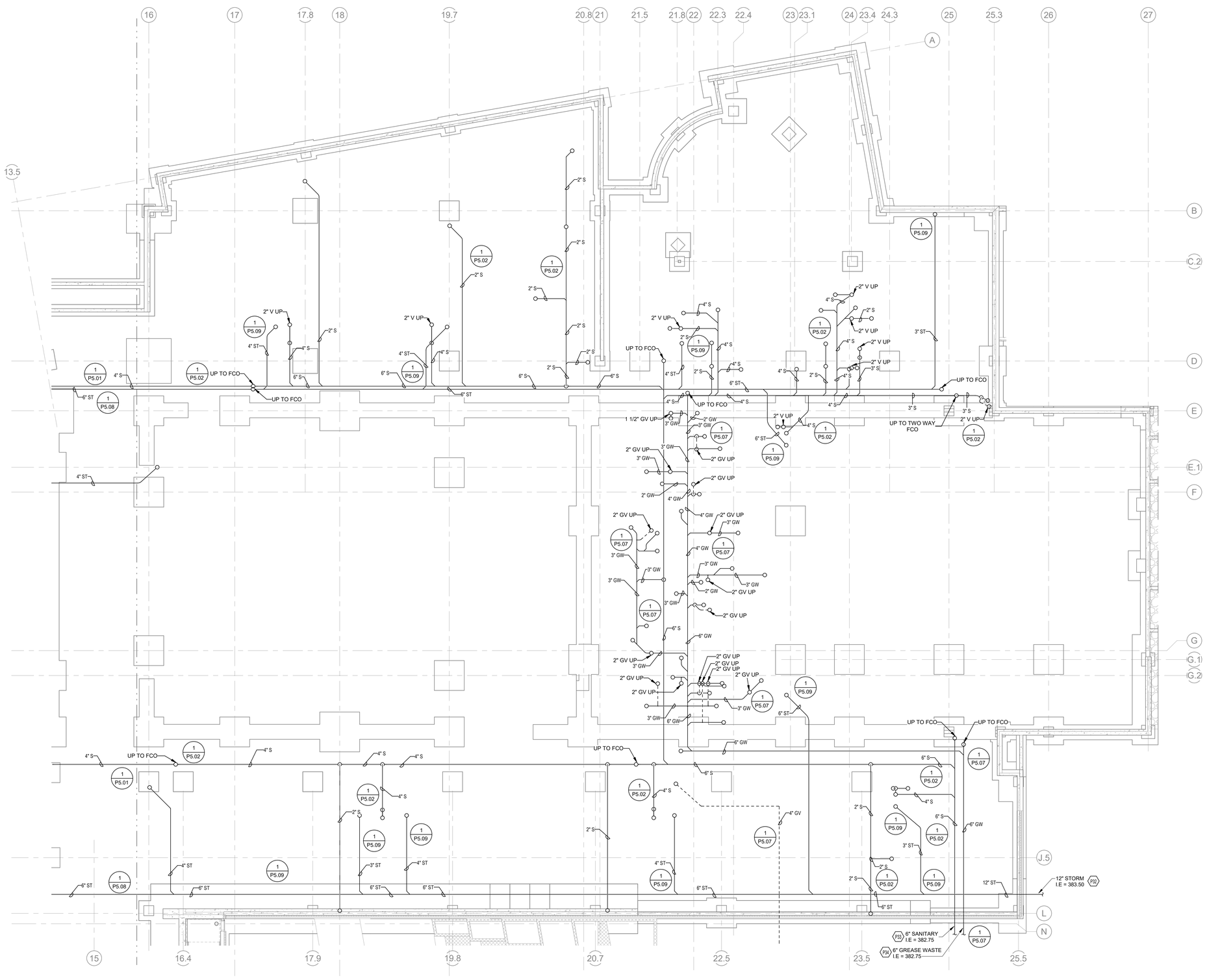
TAGGED NOTES

P32	PLUMBING CONTRACTOR SHALL PROVIDE 12" ST PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER.
P33	PLUMBING CONTRACTOR SHALL PROVIDE 6" S PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER.
P34	PLUMBING CONTRACTOR SHALL PROVIDE 6" GW PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER.



1 LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA B
1/8" = 1'-0"

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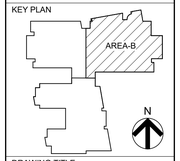
PROJECT STATUS

KEY PLAN



DRAWING TITLE

UNDERGROUND PLUMBING DRAINAGE PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
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ISSUE DATES

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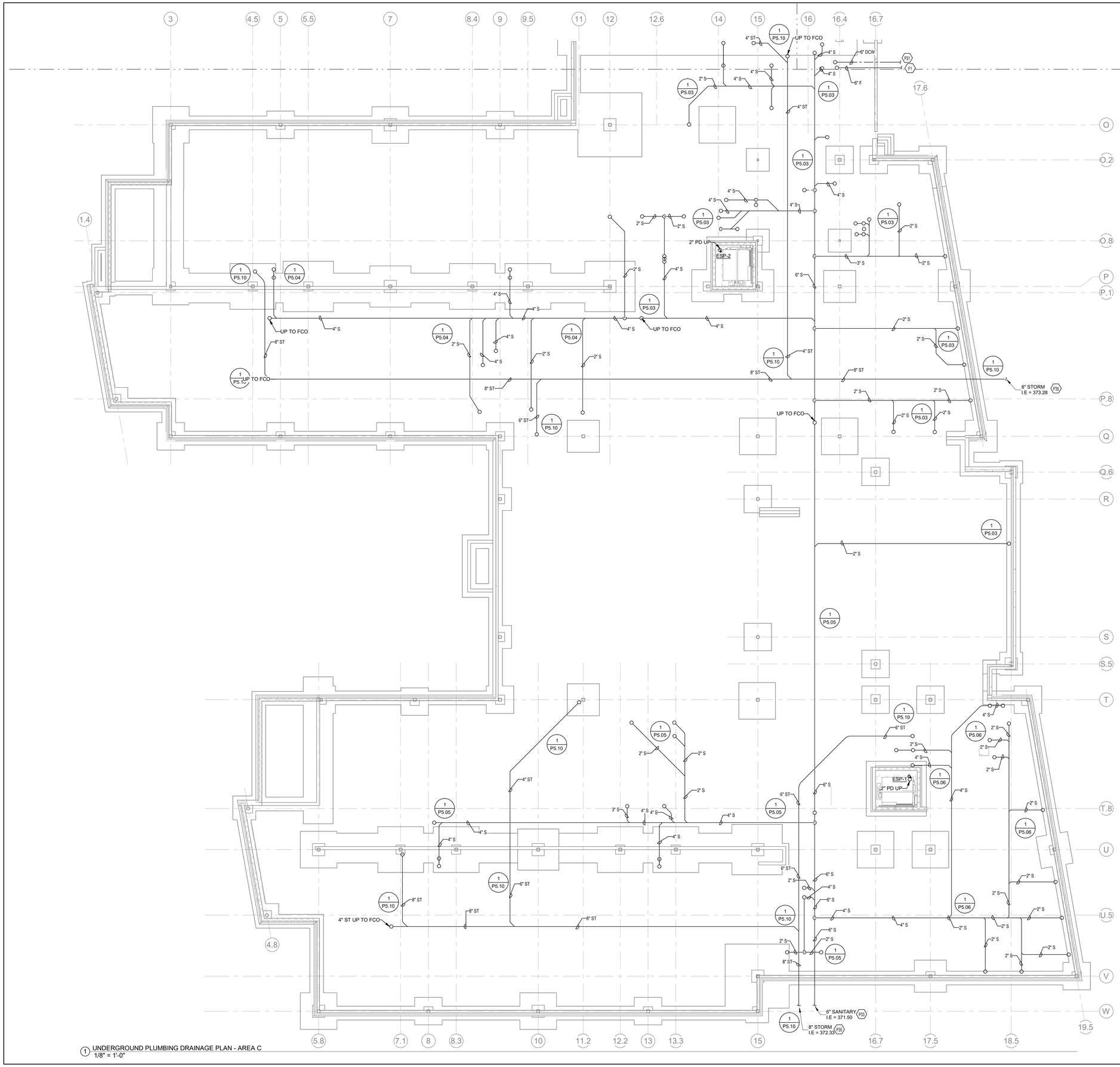

1 UNDERGROUND PLUMBING DRAINAGE PLAN - AREA C
1/8" = 1'-0"

TAGGED NOTES

F1 PLUMBING CONTRACTOR SHALL PROVIDE 6" FIRE SERVICE PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION TO CITY FIRE WATER WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER. 6" FIRE SERVICE TO BE BURIED 5'-0" BELOW GRADE

P31 PLUMBING CONTRACTOR SHALL PROVIDE 6" DOMESTIC WATER PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER. 6" DOMESTIC WATER TO BE 5'-0" BELOW GRADE.

P33 PLUMBING CONTRACTOR SHALL PROVIDE 6" S PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER.

P35 PLUMBING CONTRACTOR SHALL PROVIDE 8" ST PIPING 5'-0" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER.

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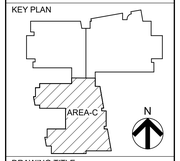
PROJECT STATUS

KEY PLAN



DRAWING TITLE

UNDERGROUND PLUMBING DRAINAGE PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

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P2.01C

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TAGGED NOTES

P27 ROUTE PUMP DISCHARGE INTO MOP BASIN.
P28 PROVIDE AIR ADMITTANCE VALVE IN CASEWORK FOR SINK.
P30 ROUTE PUMP DISCHARGE TO SANITARY. MAKE FINAL CONNECTION TO TOP OF PIPE.

1 LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA C
1/8" = 1'-0"

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24035
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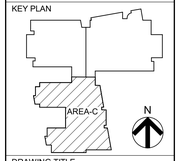
KEY PLAN



DRAWING TITLE

LOWER LEVEL PLUMBING DRAINAGE PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
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4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P2.02C

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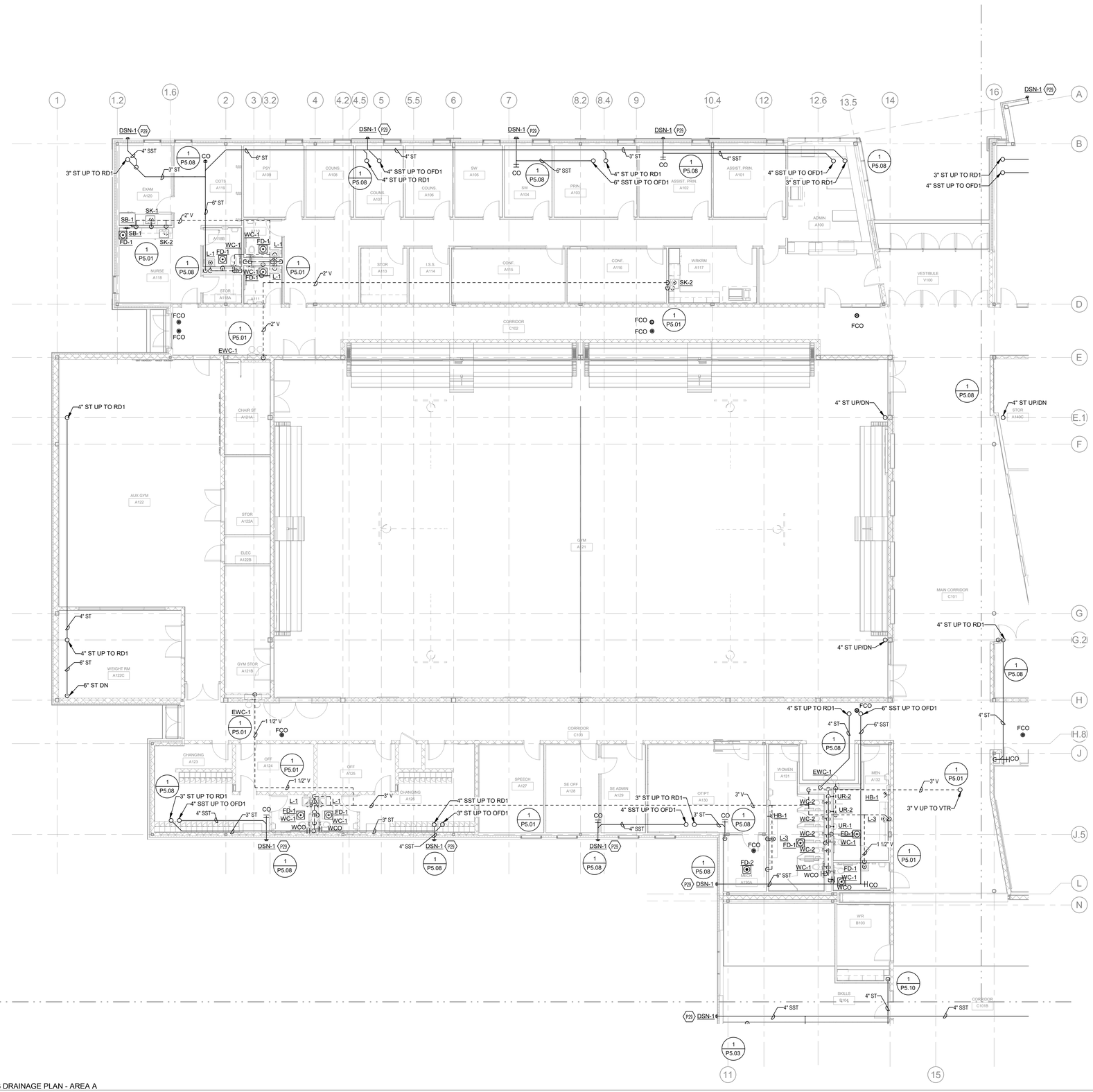
TAGGED NOTES

P29 DOWNSPOUT NOZZLE TO BE MOUNTED HIGH AND CENTERED. REFER TO ARCHITECTURAL ELEVATIONS FOR HEIGHT AND LOCATION.



1 MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA A
1/8" = 1'-0"

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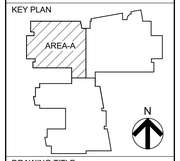
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P2.03A

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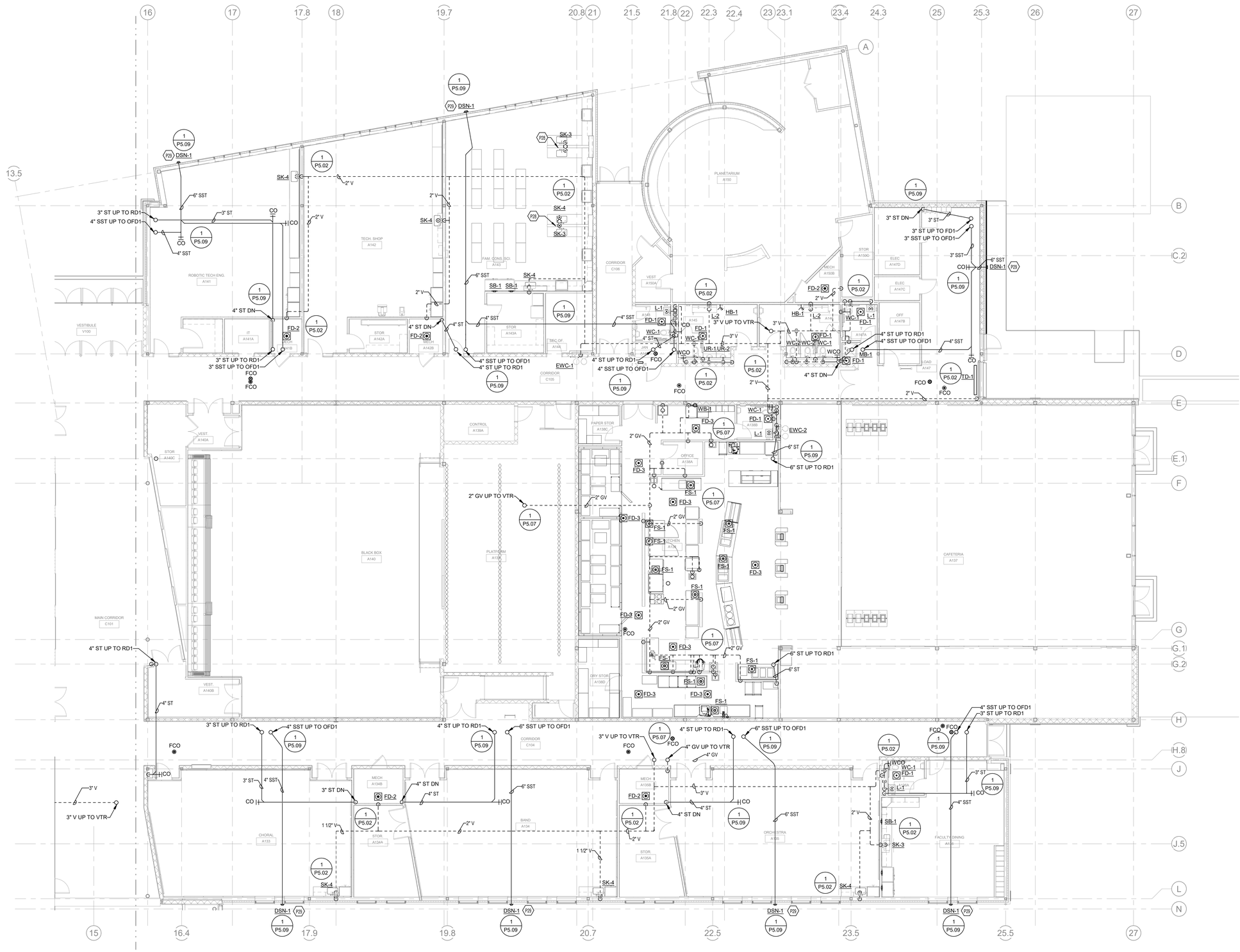
TAGGED NOTES

P28 PROVIDE AIR ADMITTANCE VALVE IN CASEWORK FOR SINK.
P29 DOWNSPOUT NOZZLE TO BE MOUNTED HIGH AND CENTERED. REFER TO ARCHITECTURAL ELEVATIONS FOR HEIGHT AND LOCATION.



1 MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA B
1/8" = 1'-0"

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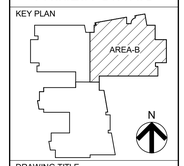
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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P2.03B

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TAGGED NOTES

P28 PROVIDE AIR ADMITTANCE VALVE IN CASEWORK FOR SINK.
P29 DOWNSPOUT NOZZLE TO BE MOUNTED HIGH AND CENTERED. REFER TO ARCHITECTURAL ELEVATIONS FOR HEIGHT AND LOCATION.



1 MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA C
1/8" = 1'-0"

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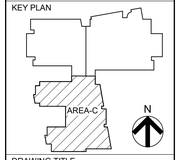
PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL PLUMBING DRAINAGE PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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P2.03C

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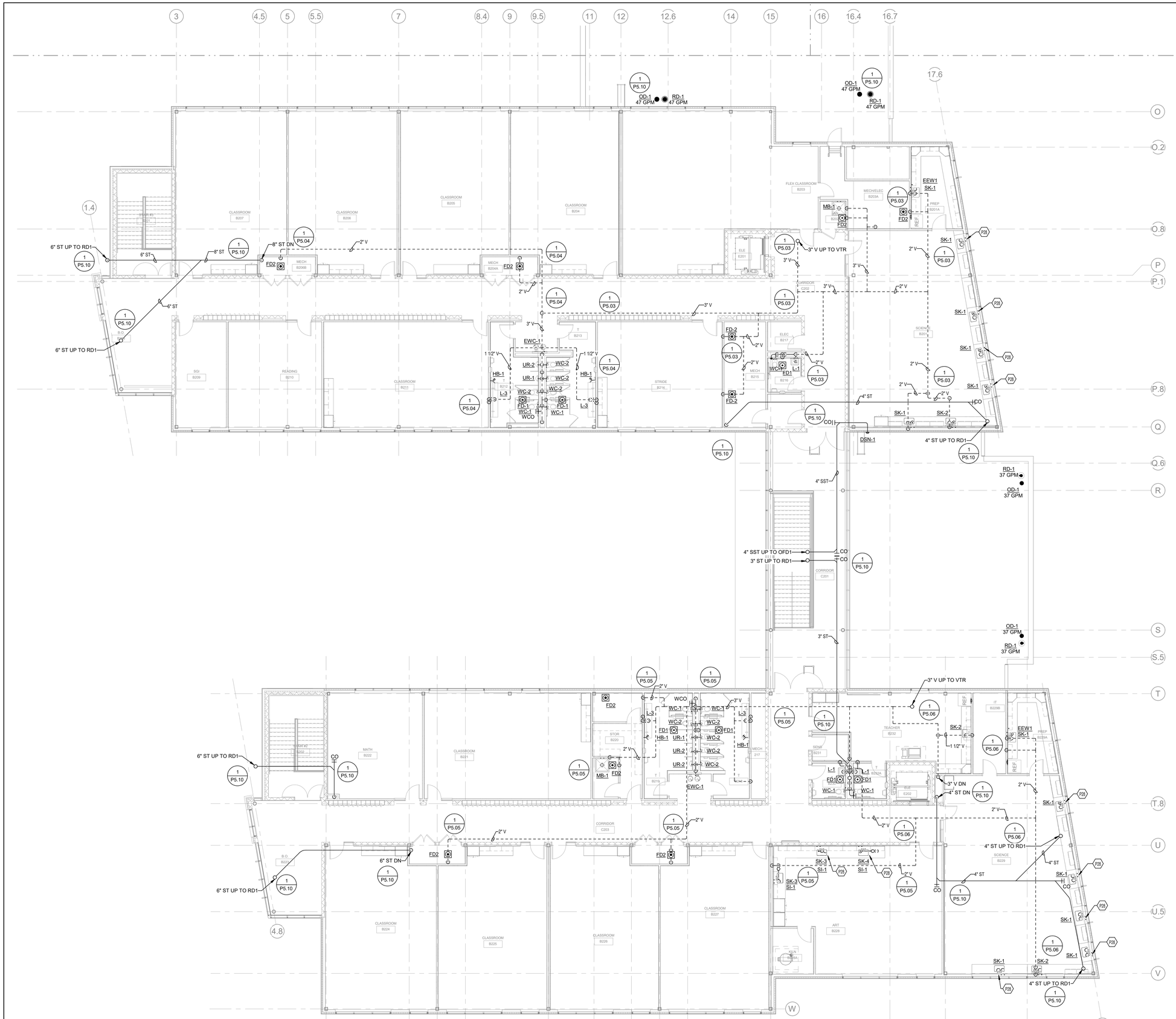
TAGGED NOTES

P28 PROVIDE AIR ADMITTANCE VALVE IN CASEWORK FOR SINK.



1 UPPER LEVEL PLUMBING DRAINAGE PLAN - AREA C
1/8" = 1'-0"

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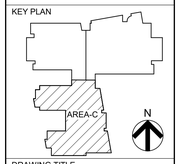
PROJECT STATUS

KEY PLAN



DRAWING TITLE

UPPER LEVEL PLUMBING DRAINAGE PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

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P2.04C

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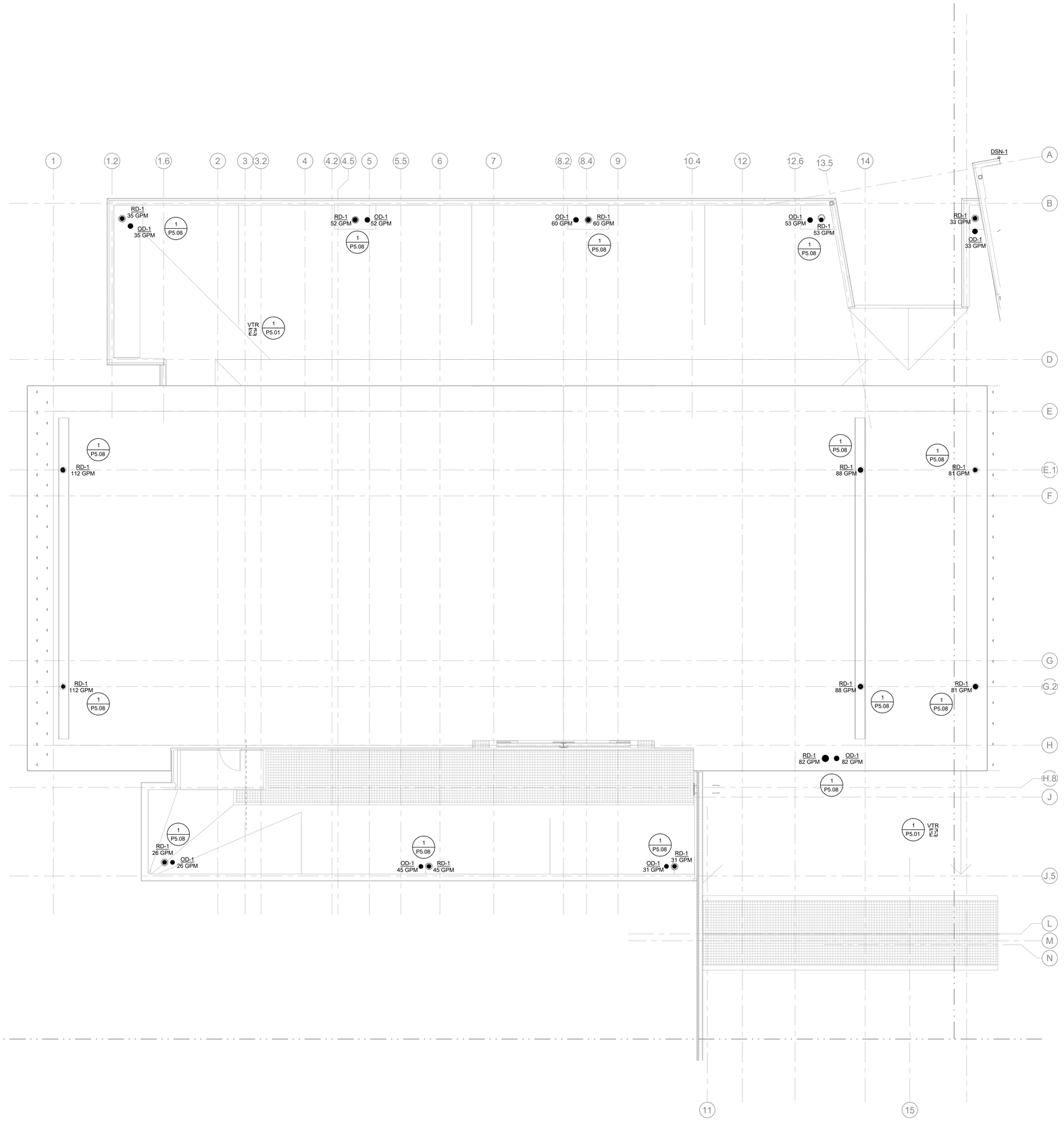

1 ROOF PLUMBING DRAINAGE PLAN - AREA A
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PROJECT STATUS

KEY PLAN



DRAWING TITLE

ROOF PLUMBING
DRAINAGE PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
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P2.05A

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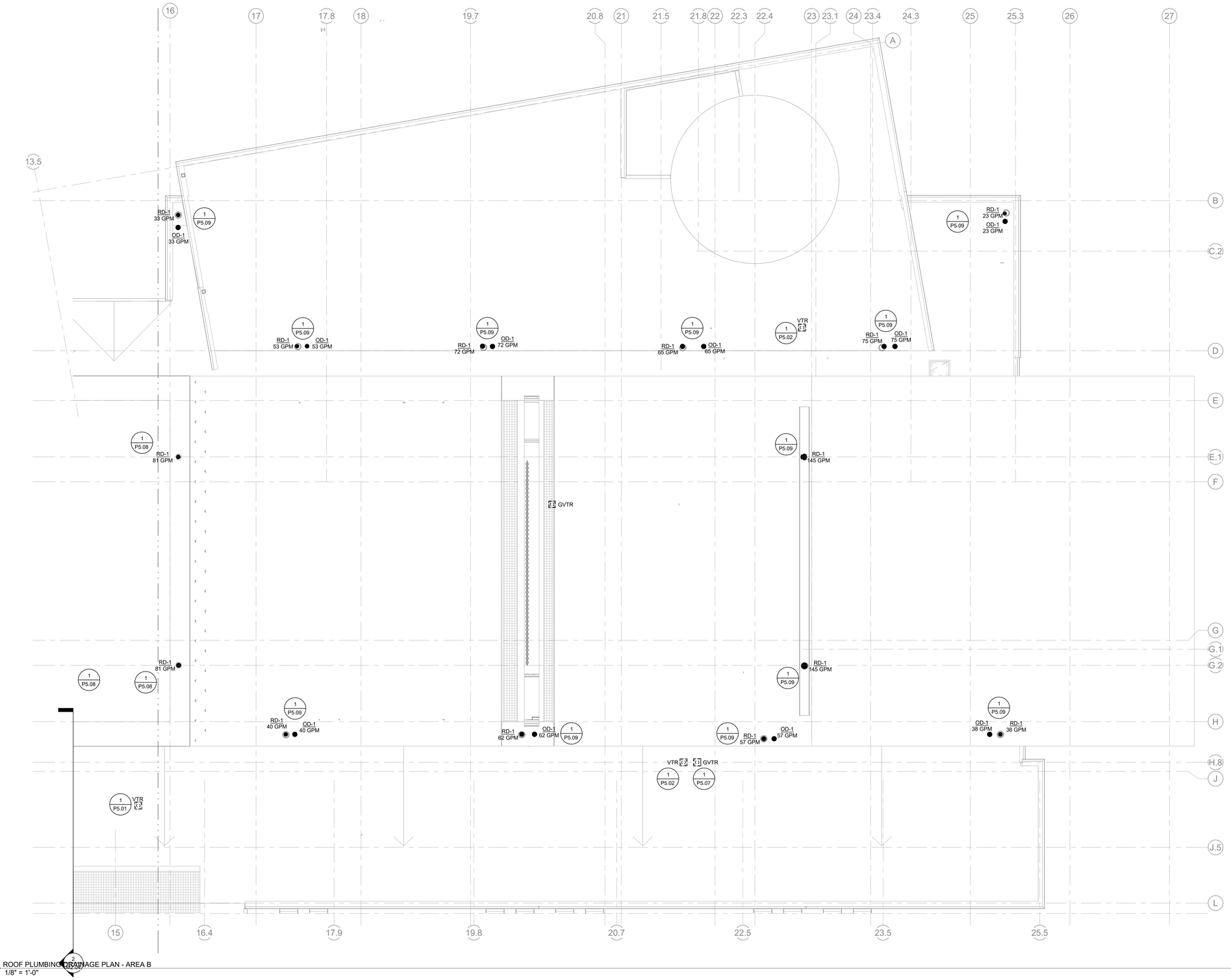

1 ROOF PLUMBING DRAINAGE PLAN - AREA B
1/8" = 1'-0"

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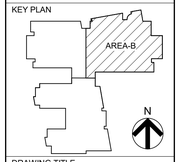
STATE OF CONNECTICUT
JACOB C. FARLEY
24058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

ROOF PLUMBING
DRAINAGE PLAN - AREA B

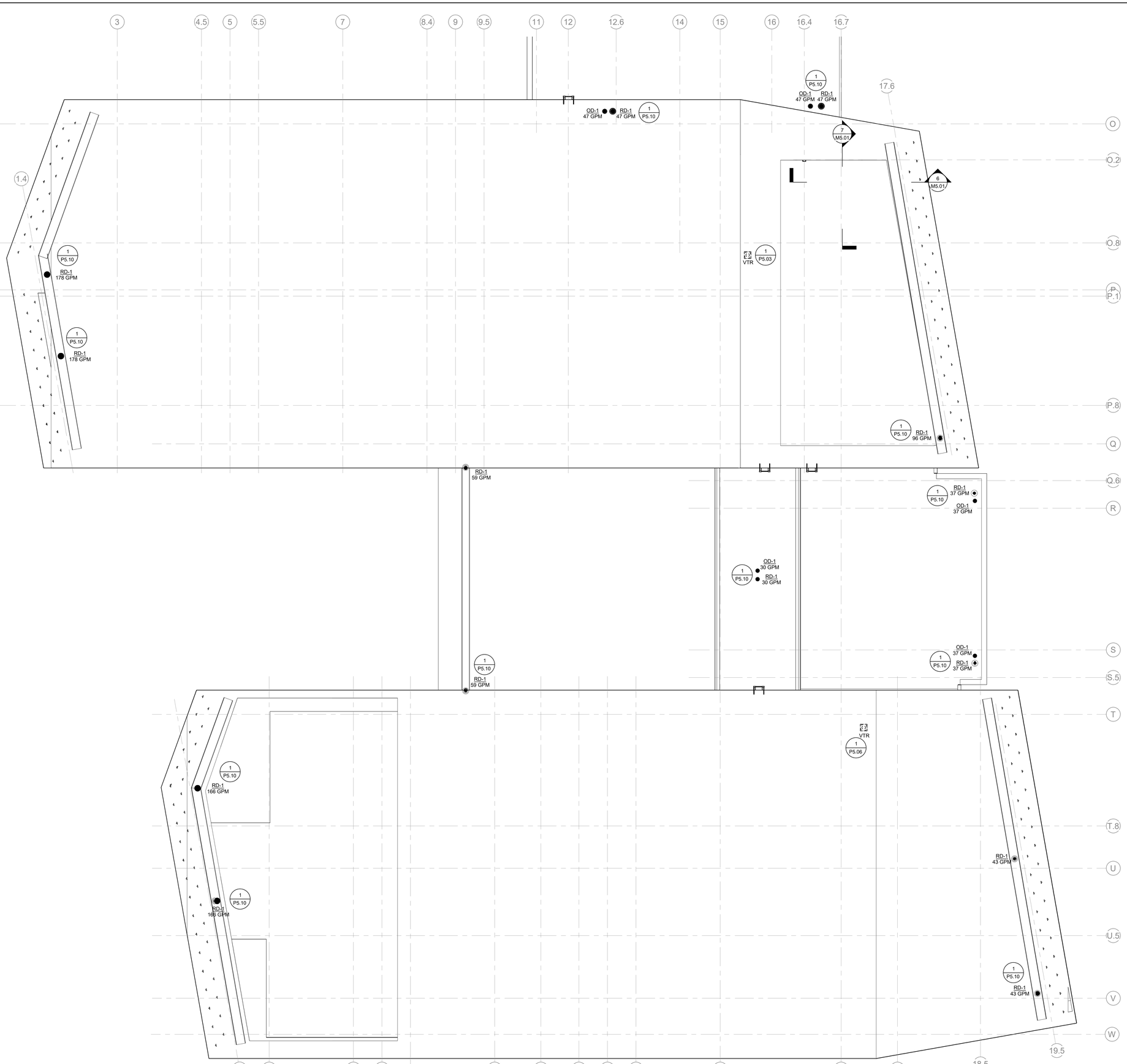
STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P2.05B

5/19/2026 11:26:00 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt



1 ROOF PLUMBING DRAINAGE PLAN - AREA C
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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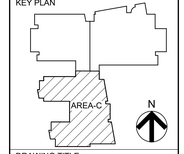

DRAWING TITLE

ROOF PLUMBING
DRAINAGE PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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DRAWN BY	TS
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5	5/19/2026	100% CD

P2.05C

TAGGED NOTES

P3	DROP IN CHASE 2-1/2" DCW. PROVIDE FINAL CONNECTIONS TO ELECTRIC WATER COOLER, WATER CLOSETS, AND URINALS. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P7	3" DCW, 1-1/2" DHW, 1" DHWR, 2" 140° DHW, AND 1" 140° DHWR UP.
P8	SET MANUAL BALANCE VALVE TO 0.50 GPM.
P9	DROP IN CHASE 2-1/2" DCW AND 1" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSETS, HOSE BIBBS, ELECTRIC WATER COOLER, AND LAVATORIES. CONNECT 1/2" DHWR TO THE END OF DHW WATER LINE. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P10	DROP IN WALL 1/2" DCW AND 1/2" DHW. ROUTE WATER LINES IN CASE WORK TO NEAREST SINK.
P11	PROVIDE LINE SIZE FLOW SPLITTER VALVE. REFER TO DETAIL.
P12	DROP IN CHASE 1-1/2" DCW, 1/2" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSET AND LAVATORY. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P13	DROP IN WALL 1/2" DCW TO SUPPLY BOX FOR REFRIGERATOR.
P14	DROP IN WALL 3/4" DCW AND 1/2" DHW. ROUTE WATER LINES TO SINK AND EMERGENCY EYEWASH.
P15	DROP IN WALL 3/4" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTONS TO LAVATORIES AND HOSE BIBB.
P16	REFER TO DOMESTIC HOT WATER HEATING DETAIL FOR PIPING AND VALVE SCHEMATIC.
P17	WATER UTILITY COMPANY TO PROVIDE WATER METER. PLUMBING CONTRACTOR TO INSTALL.
P31	PLUMBING CONTRACTOR SHALL PROVIDE 6" DOMESTIC WATER PIPING S-O" FROM INTERIOR FOUNDATION WALL AND COORDINATE CONNECTION WITH CIVIL ENGINEER. COORDINATE INVERT ELEVATION WITH CIVIL ENGINEER. 6" DOMESTIC WATER TO BE 5'-0" BELOW GRADE.
P51	PROVIDE LINE SIZE BUTTERFLY VALVES BEFORE AND AFTER THE METER.

1 LOWER LEVEL PLUMBING SUPPLY PLAN - AREA C
1/8" = 1'-0"

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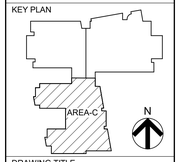
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

LOWER LEVEL PLUMBING SUPPLY PLAN - AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
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4	3/26/2026	PHASE 1
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P3.01C

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TAGGED NOTES

(##)

- P1 DROP IN WALL 1/2" DCW TO SUPPLY BOX FOR ICE MACHINE.
- P2 DROP IN CHASE 2" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSETS AND LAVATORIES. PROVIDE WATER HAMMER ARRESTOR DCW IN BRANCH LINE. SIZE PER PDI REQUIREMENTS.
- P3 DROP IN CHASE 2-1/2" DCW. PROVIDE FINAL CONNECTIONS TO ELECTRIC WATER COOLER, WATER CLOSETS, AND URINALS. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
- P5 ROUTE WATER LINES IN MEZZANINE.
- P8 SET MANUAL BALANCE VALVE TO 0.50 GPM.
- P11 PROVIDE LINE SIZE FLOW SPLITTER VALVE. REFER TO DETAIL.
- P12 DROP IN CHASE 1-1/2" DCW, 1/2" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSET AND LAVATORY. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
- P13 DROP IN WALL 1/2" DCW TO SUPPLY BOX FOR REFRIGERATOR.
- P15 DROP IN WALL 3/4" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTONS TO LAVATORIES AND HOSE BIBB.

1 MAIN LEVEL PLUMBING SUPPLY PLAN - AREA A
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL PLUMBING SUPPLY PLAN - AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

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P3.02A

5/18/2026 11:26:16 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

TAGGED NOTES

P8	SET MANUAL BALANCE VALVE TO 0.50 GPM.
P11	PROVIDE LINE SIZE FLOW SPLITTER VALVE. REFER TO DETAIL.
P12	DROP IN CHASE 1-1/2" DCW 1/2" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSET AND LAVATORY. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P13	DROP IN WALL 1/2" DCW TO SUPPLY BOX FOR REFRIGERATOR.
P15	DROP IN WALL 3/4" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTIONS TO LAVATORIES AND HOSE BIBB.
P18	PROVIDE DHW TO DISHWASHER. REFER TO DETAIL.
P19	DROP 3/4" DCW AND 3/4" DHW IN WALL. ROUTE WATER LINES IN CASEWORK TO SINKS.
P20	DROP IN CHASE 2" DCW. PROVIDE FINAL CONNECTIONS TO WATER CLOSETS AND URINALS. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P21	DROP IN CHASE 2" DCW. PROVIDE FINAL CONNECTIONS TO WATER CLOSETS. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P22	DROP IN CHASE 1-1/2" DCW 1/2" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSET, LAVATORY, AND ELECTRIC WATER COOLER. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
P23	DROP IN WALL 1/2" DCW AND 1/2" DHW TO SUPPLY BOX FOR CLOTHES WASHER.
P24	PROVIDE 3/4" DCW AND 3/4" DCW TO MOP BASIN. MOP BASIN PROVIDED BY KITCHEN CONSULTANT
P25	PROVIDE 1/2" DCW AND 1/2" DCW TO HAND SINK. PROVIDE ASSE 1070 TMV. SINK PROVIDED BY KITCHEN CONSULTANT.
P26	DROP IN WALL 1/2" DCW TO SUPPLY BOX FOR COFFEE MACHINE.
P37	DROP IN WALL 3/4" DHW AND 3/4" DCW TO THREE COMPARTMENT SINK PROVIDED BY OTHERS. PROVIDE ASSE 1070 TMV. MAKE FINAL CONNECTIONS. ROUTE 2" DRAIN MANIFOLD TO FLOOR SINK.
P38	DROP IN WALL 3/4" DCW AND 3/4" DCW TO VENTLESS WARE/WASHER WITH BOOSTER HEATER PROVIDED BY OTHERS. ROUTE 1/2" DCW TO DRAIN TEMPERING VALVE. MAKE FINAL CONNECTIONS. ROUTE 1-1/2" DRAIN TO FLOOR SINK.
P39	DROP IN WALL 1/2" DHW AND 1/2" DCW TO PREP TABLE WITH SINKS PROVIDED BY OTHERS. PROVIDE ASSE 1070 TMV. MAKE FINAL CONNECTIONS. ROUTE 2" DRAIN TO FLOOR SINK.
P40	DROP IN WALL 1/2" DHW AND 1/2" DCW TO ADA WORK TABLE WITH SINK PROVIDED BY OTHERS. MAKE FINAL CONNECTIONS. ROUTE 1-1/2" DRAIN TO FLOOR SINK.
P41	DROP IN WALL 1/2" DHW AND 1/2" DCW TO 40 GALLON TILT BRAISING PAN PROVIDED BY OTHERS. MAKE FINAL CONNECTIONS.
P42	FLOOR PAN AND GRATE. CONNECT 3" GW TO PAN 7" BELOW FINISHED FLOOR.
P43	FROM WATER FILETER ASSEMBLY, ROUTE (2) 3/4" FILTERED WATER TO STEAMER, TEN-PANS. MAKE FINAL CONNECTIONS. ROUTE 1-1/2" DRAIN TO FLOOR SINK.
P44	ROUTE 3/4" DCW TO WATER FILTER ASSEMBLY PROVIDED BY OTHERS. MAKE FINAL CONNECTIONS.
P45	ROUTE 3/4" DCW TO REVERSE OSMOSIS FILTRATION SYSTEM PROVIDED BY OTHERS AND MAVE FINAL CONNECTIONS.
P46	ROUTE 3/4" RO WATER AND 3/4" DCW TO COMBI-OVENS AND MAKE FINAL CONNECTIONS. ROUTE TWO 1" DRAINS TO FLOOR SINKS. PROVIDE PRESSURE REDUCING VALVE TO 30 PSI.
P47	DROP IN WALL 1/2" DHW AND 1/2" DCW TO PREP TABLE WITH SINKS PROVIDED BY OTHERS. PROVIDE ASSE 1070 TMV. MAKE FINAL CONNECTIONS. ROUTE (2) 2" DRAINS TO FLOOR SINK.
P48	FROM DROP-IN HEATED/REFRIGERATED FOOD WELLS, ROUTE 3/4" DRAIN TO FLOOR SINK.
P49	ROUTE 1/2" DCW UNDERSLAB AND STUB UP TO FILL FAUCET. PROVIDE SHUT-OFF VALVE. FILL FAUCET PROVIDED BY OTHERS. MAKE FINAL CONNECTIONS.
P50	DROP DOWN IN WALL WITH 1/2" DCW AND 1/2" DHW TO HOSE REEL ASSEMBLY PROVIDED BY OTHERS. PROVIDE ASSE 1070 TMV. MAKE FINAL CONNECTIONS.
P52	ELECTRIC TRAP PRIMER TO SERVE WATER TO ALL FLOOR DRAINS IN KITCHEN.
P53	PROVIDE LINE SIZE SUBMETER FOR THE KITCHEN DOMESTIC COLD WATER.

1 MAIN LEVEL PLUMBING SUPPLY PLAN - AREA B
1/8" = 1'-0"

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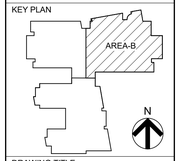
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

MAIN LEVEL PLUMBING SUPPLY PLAN - AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
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P3.02B

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TAGGED NOTES

(##)

- P3 DROP IN CHASE 2-1/2" DCW. PROVIDE FINAL CONNECTIONS TO ELECTRIC WATER COOLER, WATER CLOSETS, AND URINALS. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
- P8 SET MANUAL BALANCE VALVE TO 0.50 GPM.
- P10 DROP IN WALL 1/2" DCW AND 1/2" DHW. ROUTE WATER LINES IN CASE WORK TO NEAREST SINK.
- P11 PROVIDE LINE SIZE FLOW SPLITTER VALVE. REFER TO DETAIL.
- P12 DROP IN CHASE 1-1/2" DCW 1/2" DHW. PROVIDE FINAL CONNECTIONS TO WATER CLOSET AND LAVATORY. PROVIDE WATER HAMMER ARRESTOR IN DCW BRANCH LINE. SIZE PER PDI REQUIREMENTS.
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- P14 DROP IN WALL 3/4" DCW AND 1/2" DHW. ROUTE WATER LINES TO SINK AND EMERGENCY EYEWASH.
- P15 DROP IN WALL 3/4" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTIONS TO LAVATORIES AND HOSE BIBB.
- P23 DROP IN WALL 1/2" DCW AND 1/2" DHW TO SUPPLY BOX FOR CLOTHES WASHER.

1 MAIN LEVEL PLUMBING SUPPLY PLAN - AREA C
1/8" = 1'-0"

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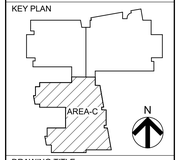
TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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MAIN LEVEL PLUMBING SUPPLY PLAN - AREA C

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- P15 DROP IN WALL 3/4" DCW AND 3/4" DHW. PROVIDE FINAL CONNECTONS TO LAVATORIES AND HOSE BIBB.

1 UPPER LEVEL PLUMBING SUPPLY PLAN - AREA C
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN

AREA-C

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DRAWING TITLE

UPPER LEVEL PLUMBING SUPPLY PLAN - AREA C

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P3.03C

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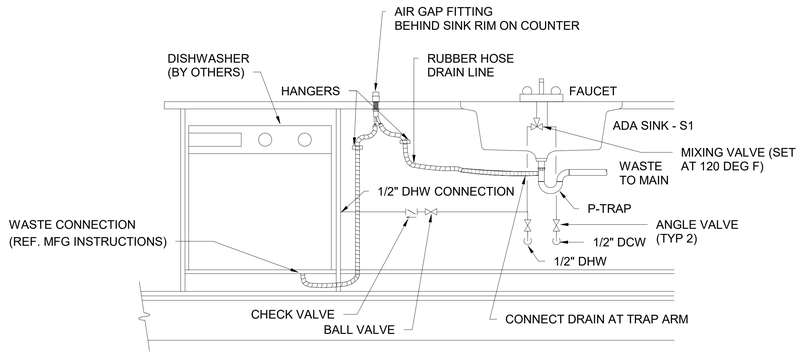
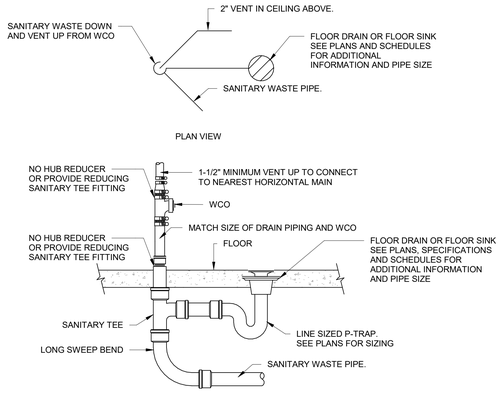
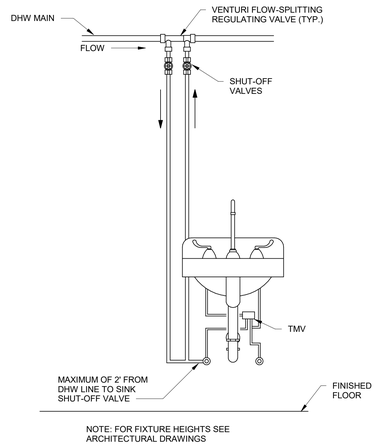


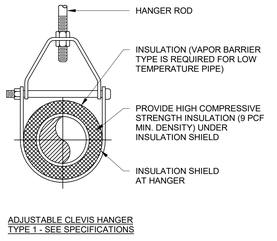
1 DISHWASHER CONNECTION DETAIL
SCALE: NONE



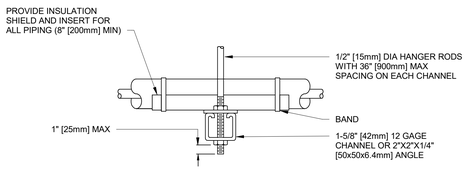
2 FLOOR DRAIN OFFSET DETAIL
SCALE: NONE



3 FLOW SPLITTER DETAIL
SCALE: NONE

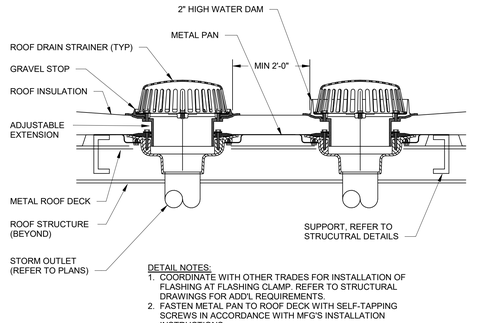


ADJUSTABLE CLEVIS HANGER
TYPE 1 - SEE SPECIFICATIONS



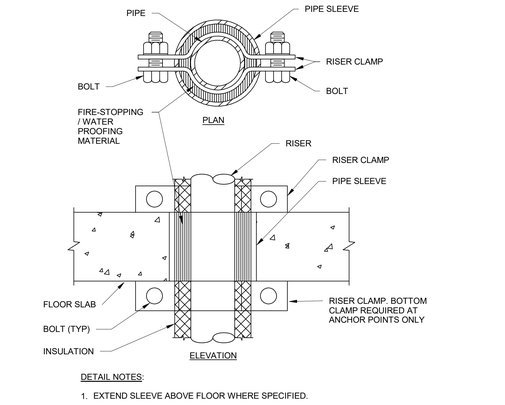
SIDE VIEW
TRAPEZE HANGER FOR UP
TO 1000 LB. UNIFORM LOAD

4 PIPE HANGER DETAIL
SCALE: NONE



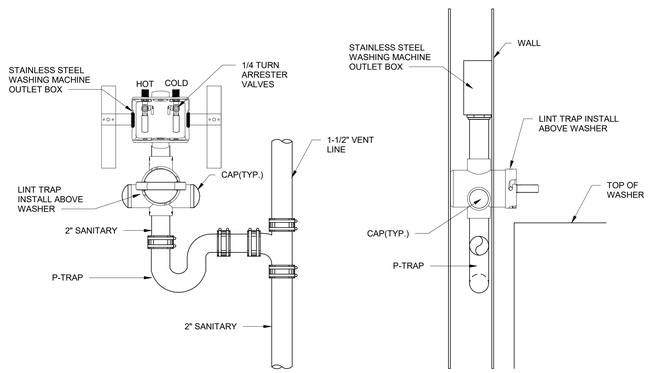
DETAIL NOTES:
1. COORDINATE WITH OTHER TRADES FOR INSTALLATION OF FLASHING AT FLASHING CLAMP. REFER TO STRUCTURAL DRAWINGS FOR ADD'L REQUIREMENTS.
2. FASTEN METAL PAN TO ROOF DECK WITH SELF-TAPPING SCREWS IN ACCORDANCE WITH MFG'S INSTALLATION INSTRUCTIONS.
3. INSULATE DRAIN BODY AND PIPING.

5 PRIMARY/SECONDARY ROOF DRAIN DETAIL
SCALE: NONE

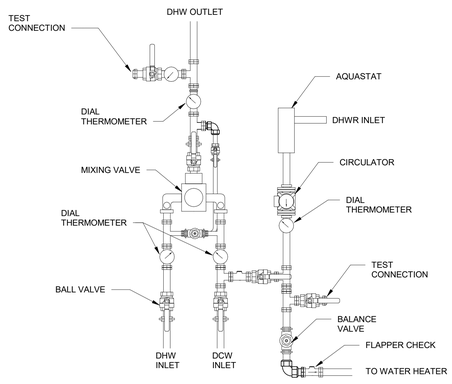


DETAIL NOTES:
1. EXTEND SLEEVE ABOVE FLOOR WHERE SPECIFIED.

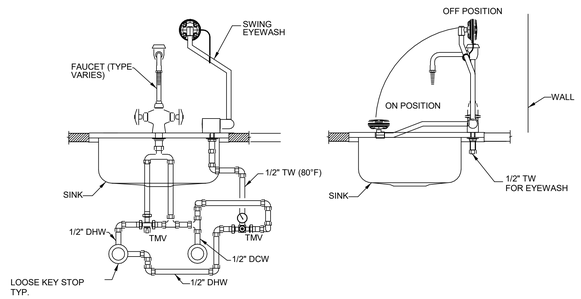
6 SUPPORT/ANCHOR FOR PIPE RISERS
SCALE: NONE



7 SIDEKICK WASHER DETAIL.
SCALE: NONE



8 THERMOSTATIC MIXING VALVE DETAIL
SCALE: NONE



9 TYPICAL SINK WITH EYEWASH.
SCALE: NONE

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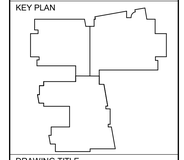
TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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PLUMBING DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
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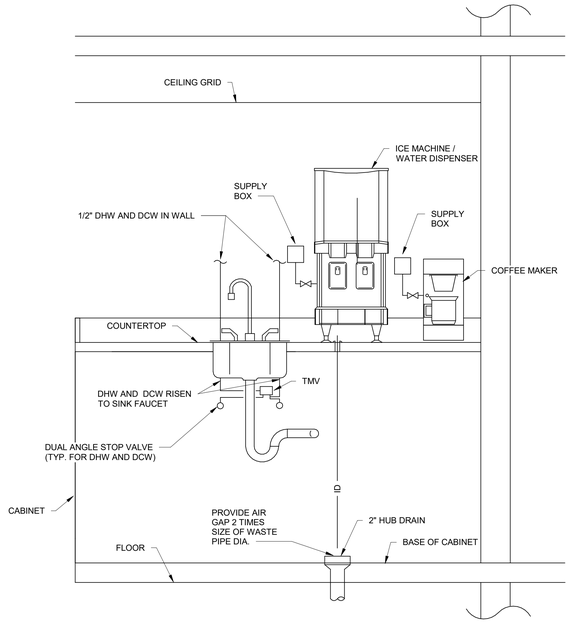
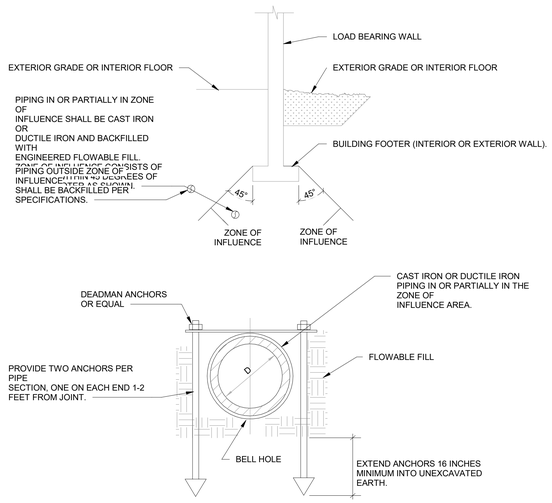
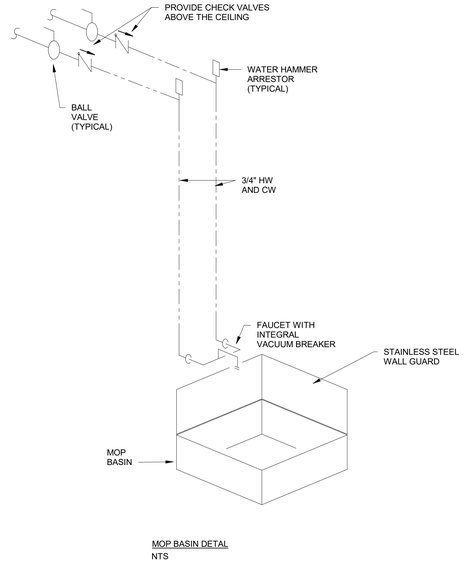


1 TYPICAL STAFF SINK WITH COFFEE MAKER AND ICE MACHINE.
SCALE: NONE

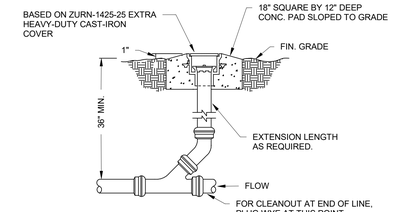


2 UNDERGROUND PIPING AND FOOTER COORDINATION SCHEMATIC
SCALE: NONE



MOP BASIN DETAL
NTS

3 MOP BASIC DETAIL
SCALE: NONE



4 GRADE CLEANOUT DETAIL
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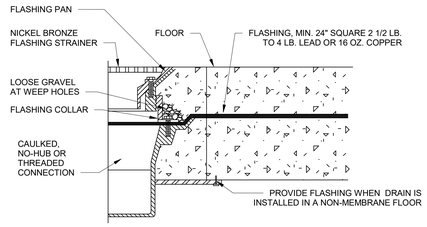
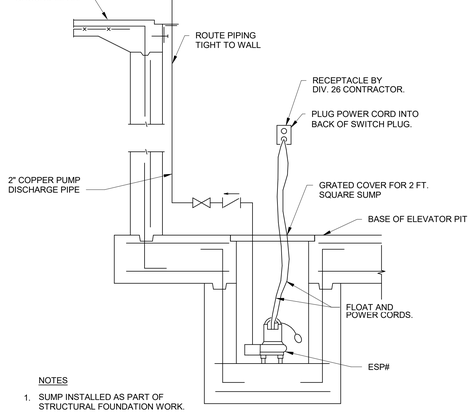
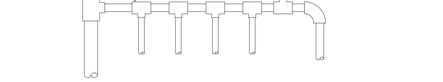


5 FLOOR DRAIN - UNFINISHED FLOOR DETAIL
SCALE: NONE



NOTES
1. SUMP INSTALLED AS PART OF STRUCTURAL FOUNDATION WORK.

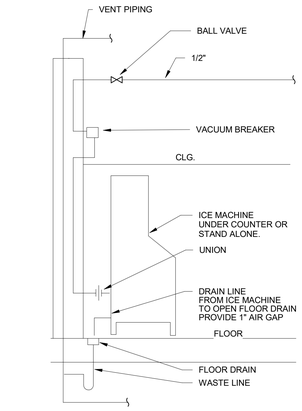
6 ELEVATOR SUMP PUMP ESP# DETAIL
SCALE: NONE



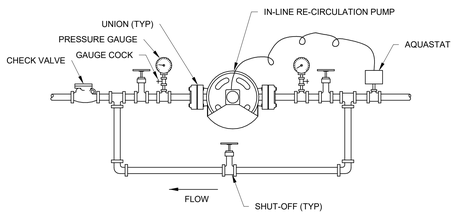
NOTES:
1. PREFERRED INSTALL WATER HAMMER ARRESTORS AT THE END OF BRANCH LINE BETWEEN THE LAST TWO FIXTURES SERVED.
2. ONE WATER HAMMER ARRESTOR PER 20' LINE, AND ANOTHER FOR BRANCHES OVER 20' IN LENGTH.
3. THE SUM OF FIXTURE UNIT RATING OF UNITS OVER 20' IN LENGTH SHALL BE EQUAL TO OR GREATER THAN THE DEMAND OF THE RANCHES.

WATER HAMMER ARRESTOR SCHEDULE						
PDI SYMBOL	A	B	C	D	E	F
FIXTURE UNIT RATING	1-11	12-32	33-60	61-113	114-154	155-330

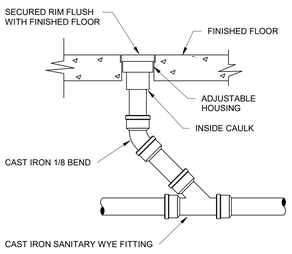
7 WATER HAMMER ARRESTOR INSTALLATION DETAIL
SCALE: NONE



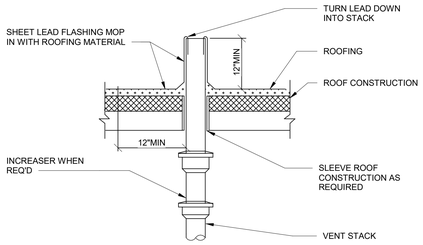
8 ICE MACHINE PIPING SCHEMATIC
SCALE: NONE



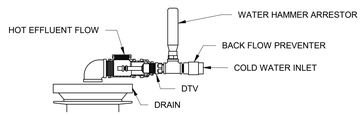
9 HOT WATER RECIRCULATION PUMP
SCALE: NONE



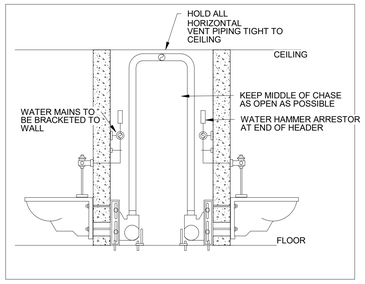
10 FLOOR CLEANOUT DETAIL
SCALE: NONE



11 VENT THROUGH ROOF DETAIL
SCALE: NONE



12 DRAIN TEMPERING VALVE DETAIL
SCALE: NONE



13 TOILET ROOM CHASE SECTION
SCALE: NONE

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STATE OF CONNECTICUT JESS C. FANTINI 34058 LICENSED PROFESSIONAL ENGINEER

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PROJECT STATUS

KEY PLAN

DRAWING TITLE

PLUMBING DETAILS

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APPROVED BY	JF

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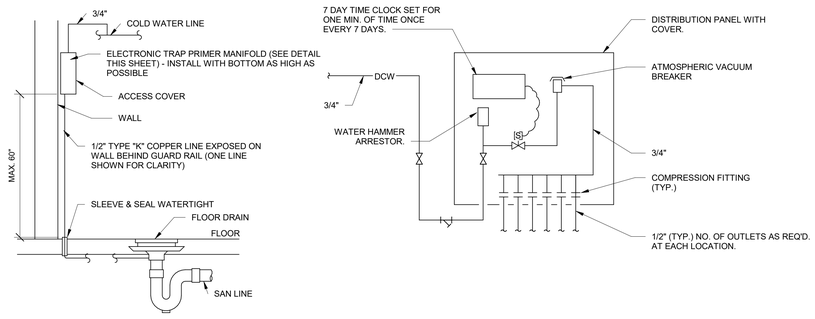
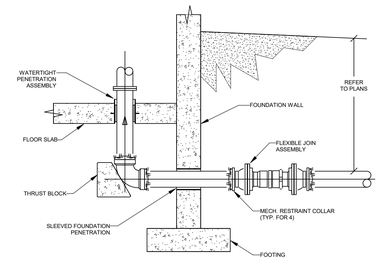
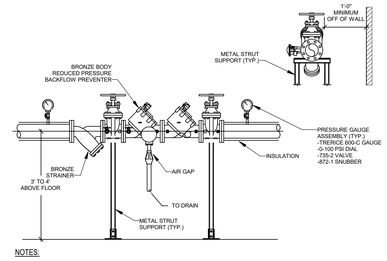


1 ELECTRONIC TRAP PRIMER TP-1 DISTRIBUTION SYSTEM DETAIL
SCALE: NONE



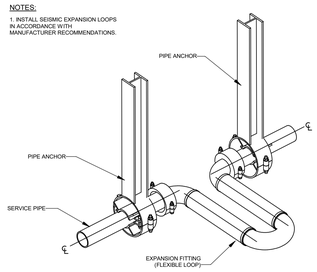
2 WATER SERVICE THRU FLOOR
SCALE: NONE



NOTES:
1. PROVIDE SPARE PARTS KIT FOR EACH UNIT OF SIZE INCLUDING GASKETS, SPRINGS, AND MAIN ASSEMBLIES.

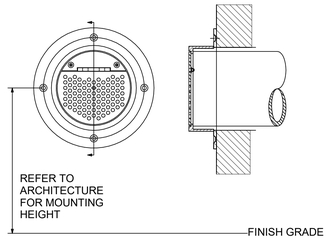
3 REDUCED PRESSURE BACKFLOW PREVENTER
SCALE: NONE

NOTES:
1. INSTALL SEISMIC EXPANSION LOOPS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.



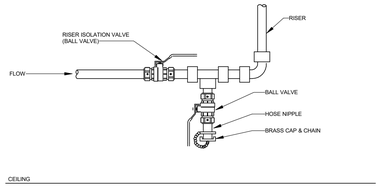
SEISMIC EXPANSION LOOP

4 SEISMIC EXPANSION LOOP
SCALE: NONE

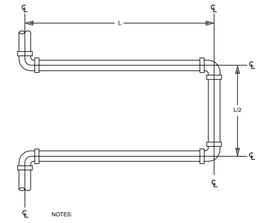


OVERFLOW SYSTEM DOWNSPOUT COVER

5 OVERFLOW SYSTEM DOWNSPOUT COVER
SCALE: NONE



6 BOTTOM OF WATER RISER TYPICAL CONNECTION
SCALE: NONE

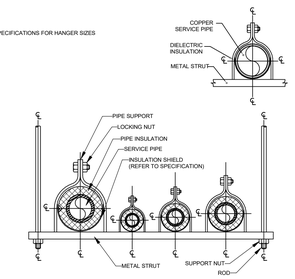


PIPE SIZE (IN)	DIMENSION L (IN)
3/4	40
1	45
1-1/2	55
2	60
2-1/2	65
3	75

NOTES:
1. LOOP LENGTH DESIGNED FOR A MAXIMUM LINEAL EXPANSION OF 1-1/2".
2. MAXIMUM DISTANCE BETWEEN ANCHORS SHALL BE 100 FT.

7 HOT WATER EXPANSION LOOP
SCALE: NONE

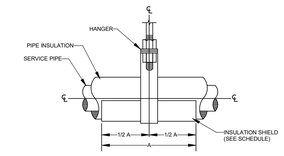
NOTES:
1. SEE SPECIFICATIONS FOR HANGER SIZES



PIPE HANGER SUPPORT

8 PIPE HANGER SUPPORT
SCALE: NONE

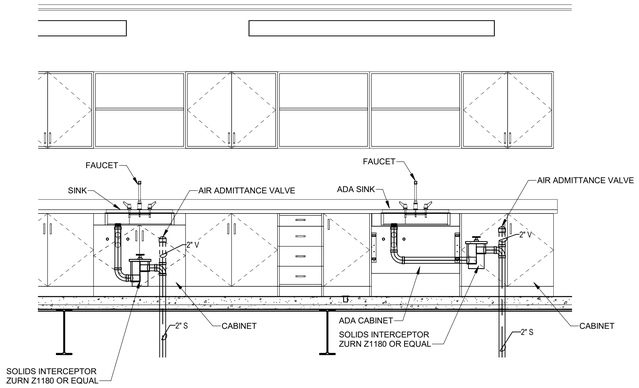
INSULATION SHIELD SCHEDULE			
PIPE SIZE	DIMENSION "A"	GAUGE OF SHIELD	SHIELD THICKNESS
1/2" TO 4"	12"	18	0.0490
5" TO 6"	18"	16	0.0600
ABOVE 6"	24"	14	0.0750



NOTES:
1. SEE SPECIFICATIONS FOR HANGER SIZES

PIPE HANGER SHIELD

9 PIPE HANGER SHIELD
SCALE: NONE



10 SOLIDS INTERCEPTOR IN CABINET DETAIL
SCALE: NONE

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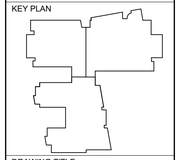
PROJECT STATUS

KEY PLAN



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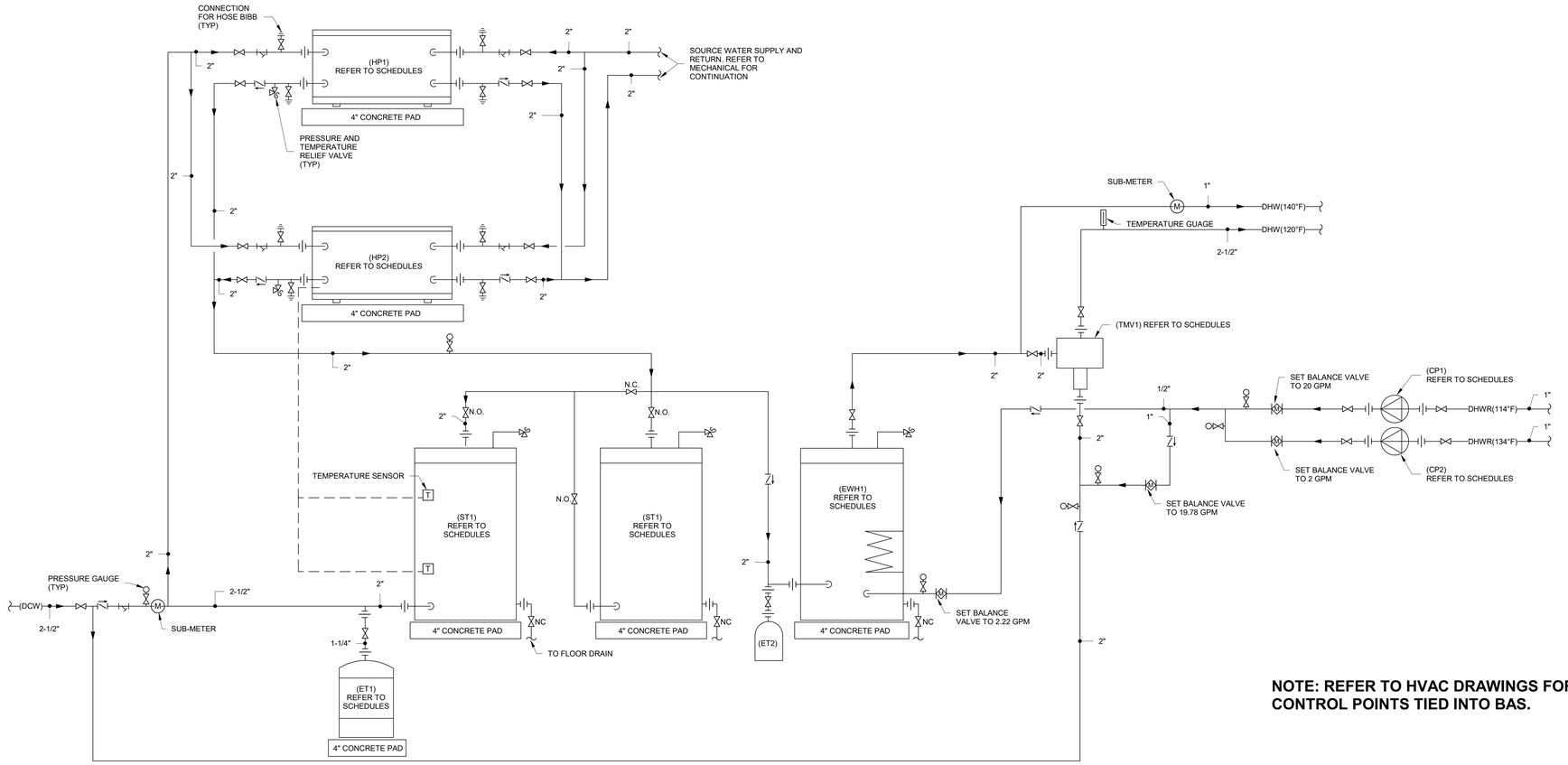

NOTE: REFER TO HVAC DRAWINGS FOR CONTROL POINTS TIED INTO BAS.

DOMESTIC WATER HEATER PIPING SCHEMATIC

1 SCALE: NONE

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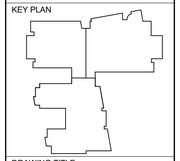

DRAWING TITLE

PLUMBING DETAILS

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OFFICE PROJ. NO.	250501
SCALE	1" = 1'-0"
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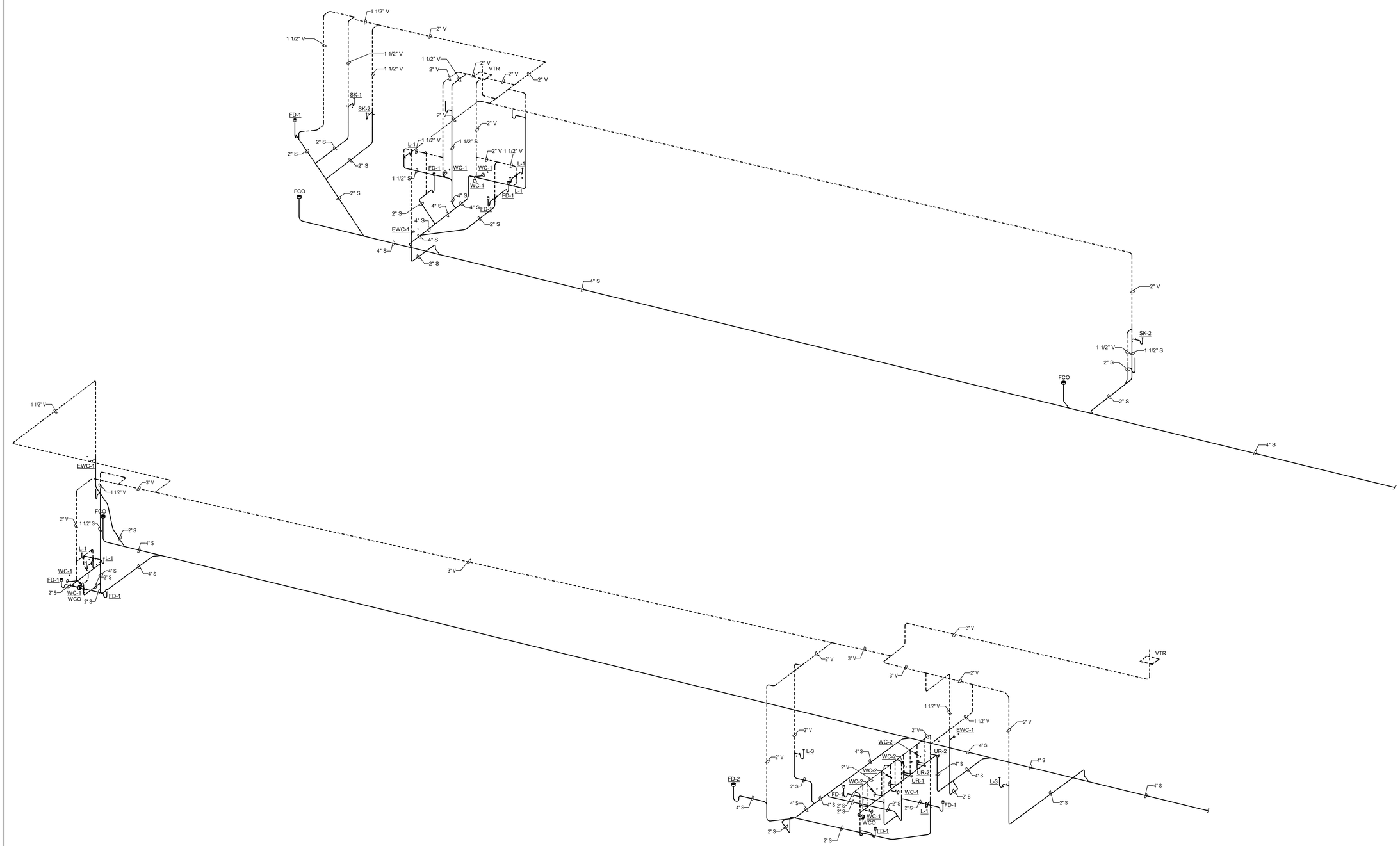

1 STACK AREA A
SCALE: NONE

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TRUMBULL HILLCREST MIDDLE SCHOOL

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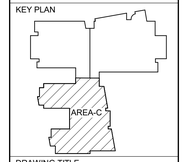

DRAWING TITLE

PLUMBING STACK DIAGRAMS

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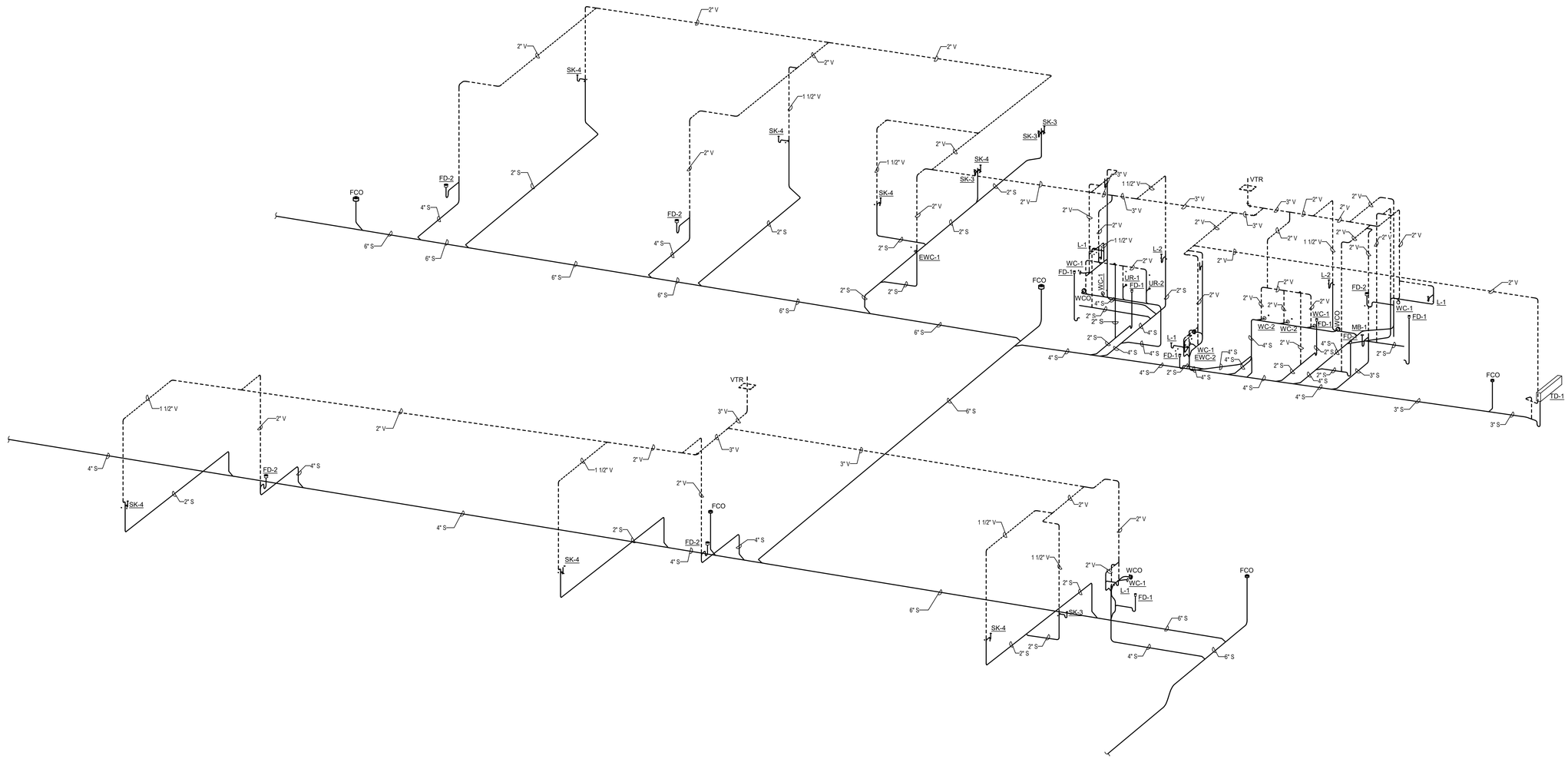

1 STACK AREA B
SCALE: NONE

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TRUMBULL HILLCREST MIDDLE SCHOOL

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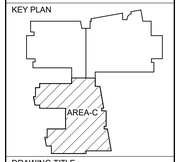
PROJECT STATUS

KEY PLAN



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PLUMBING STACK DIAGRAMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P5.02

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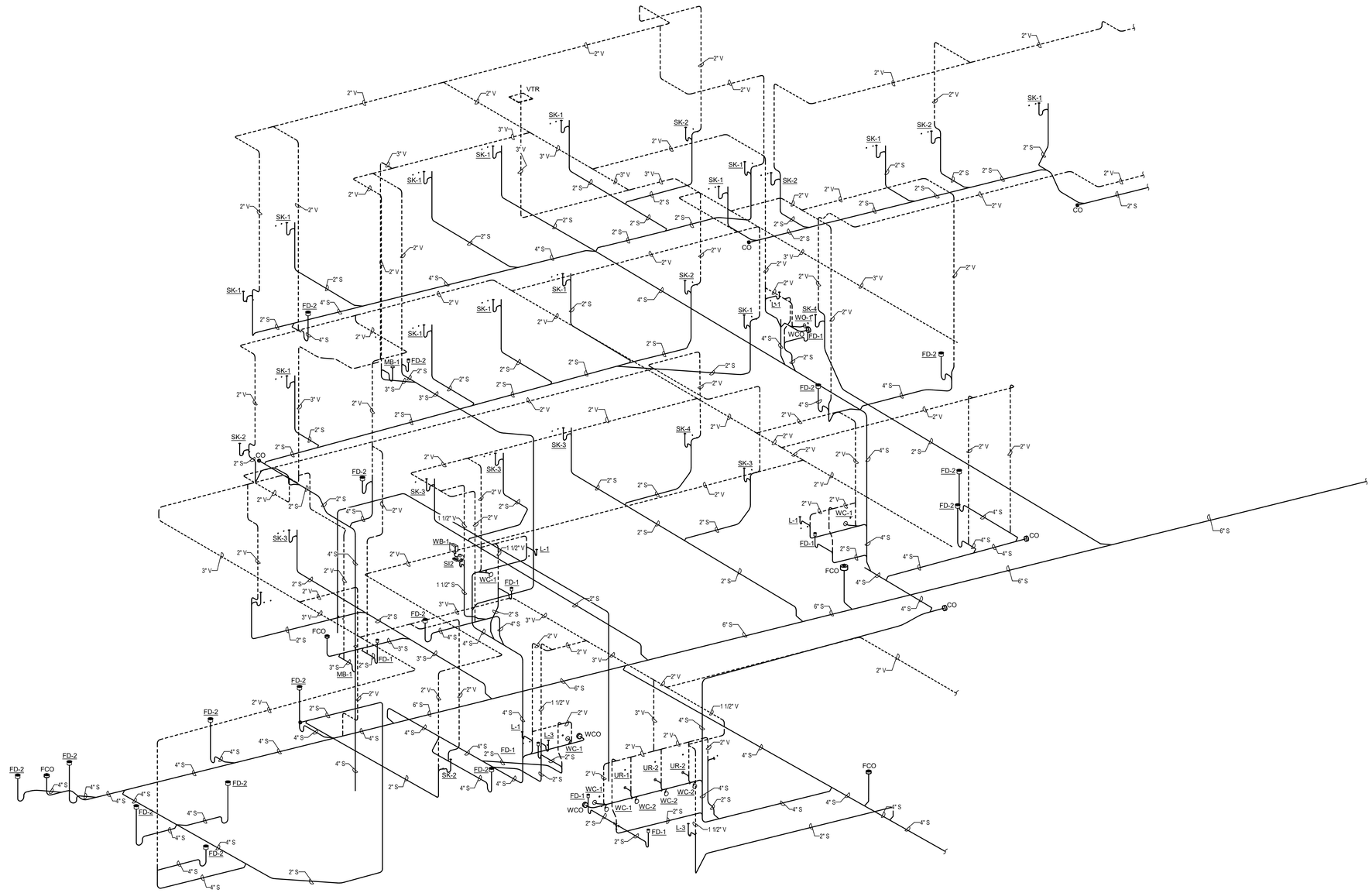

1 STACK DIAGRAM AREA C NORTHEAST
SCALE: NONE

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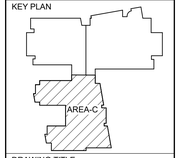
JOHN C. FARRELL
24058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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PLUMBING STACK DIAGRAMS

STATE PROJ. NO.	144-0108N
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SCALE	
DATE	5/19/2026
DRAWN BY	TS
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P5.03

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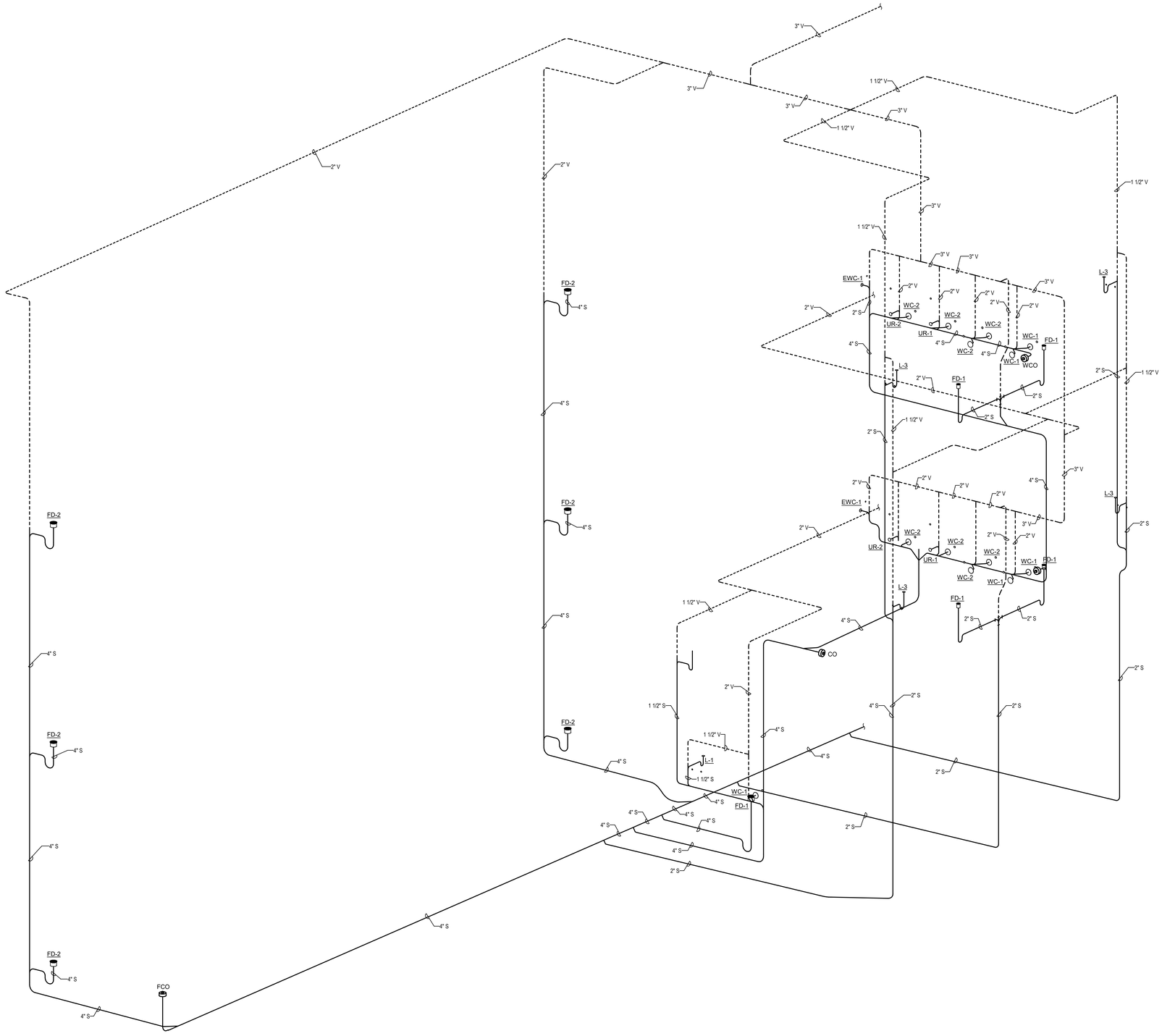

1 STACK DIAGRAM AREA C NORTHWEST
SCALE: NONE

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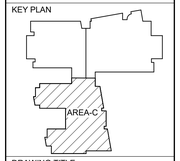

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P5.04

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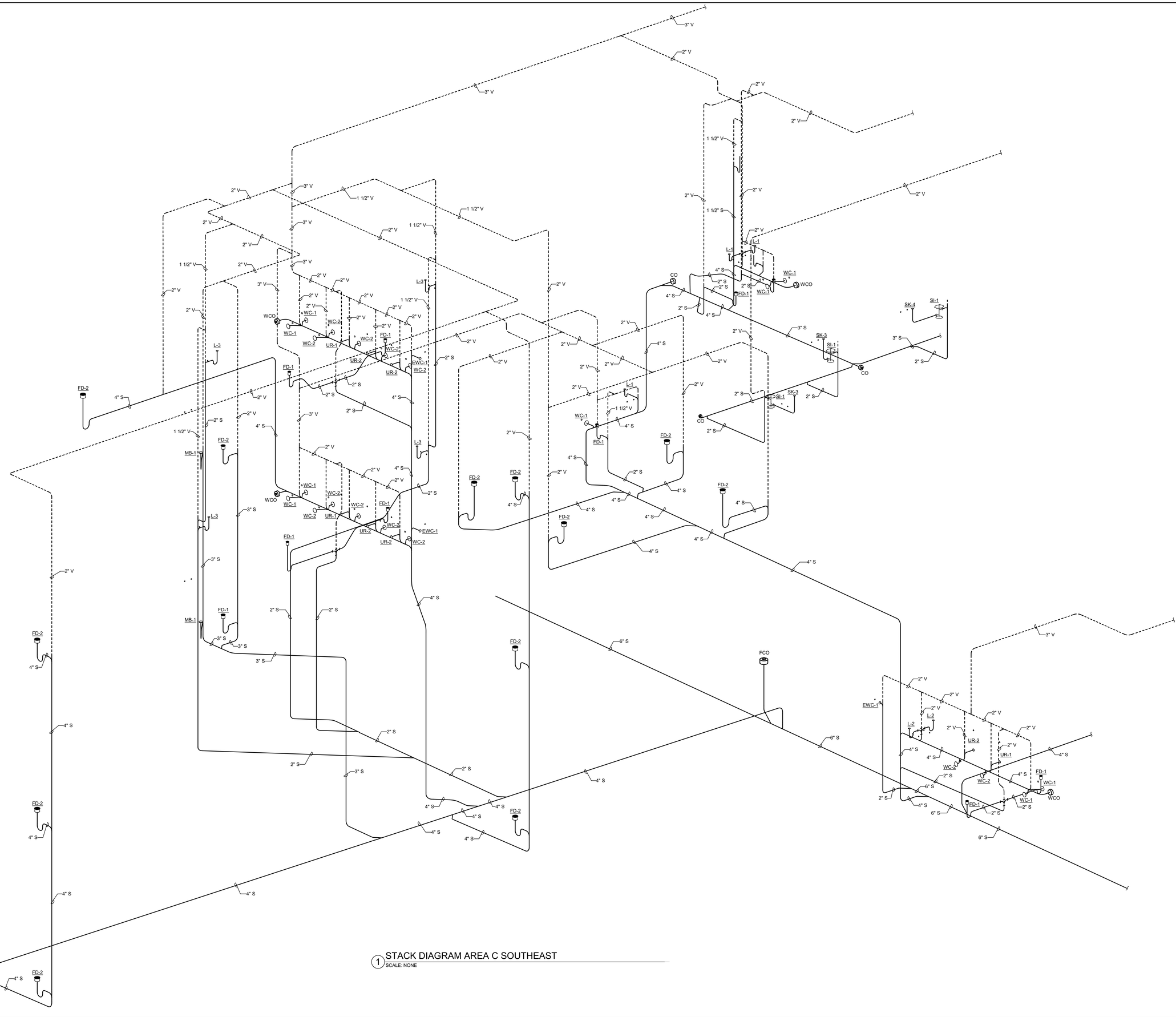

1 STACK DIAGRAM AREA C SOUTHEAST
SCALE: NONE

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LICENSED PROFESSIONAL ENGINEER

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PROJECT STATUS

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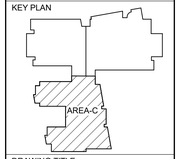

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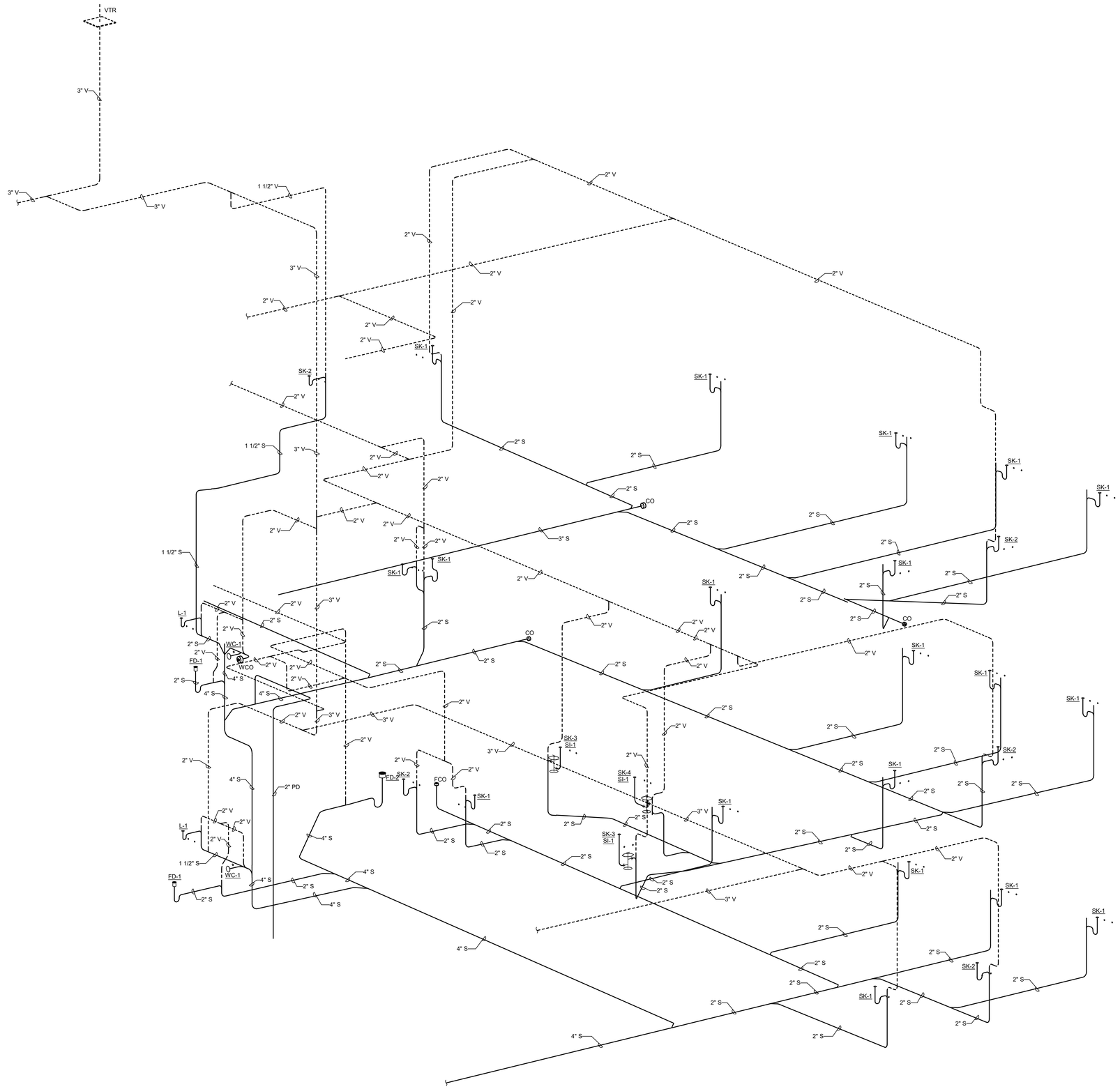

1 STACK DIAGRAM AREA C SOUTHWEST
SCALE: NONE

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24058
LICENSED PROFESSIONAL ENGINEER

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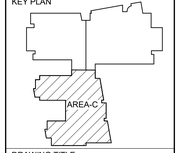
KEY PLAN



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P5.06

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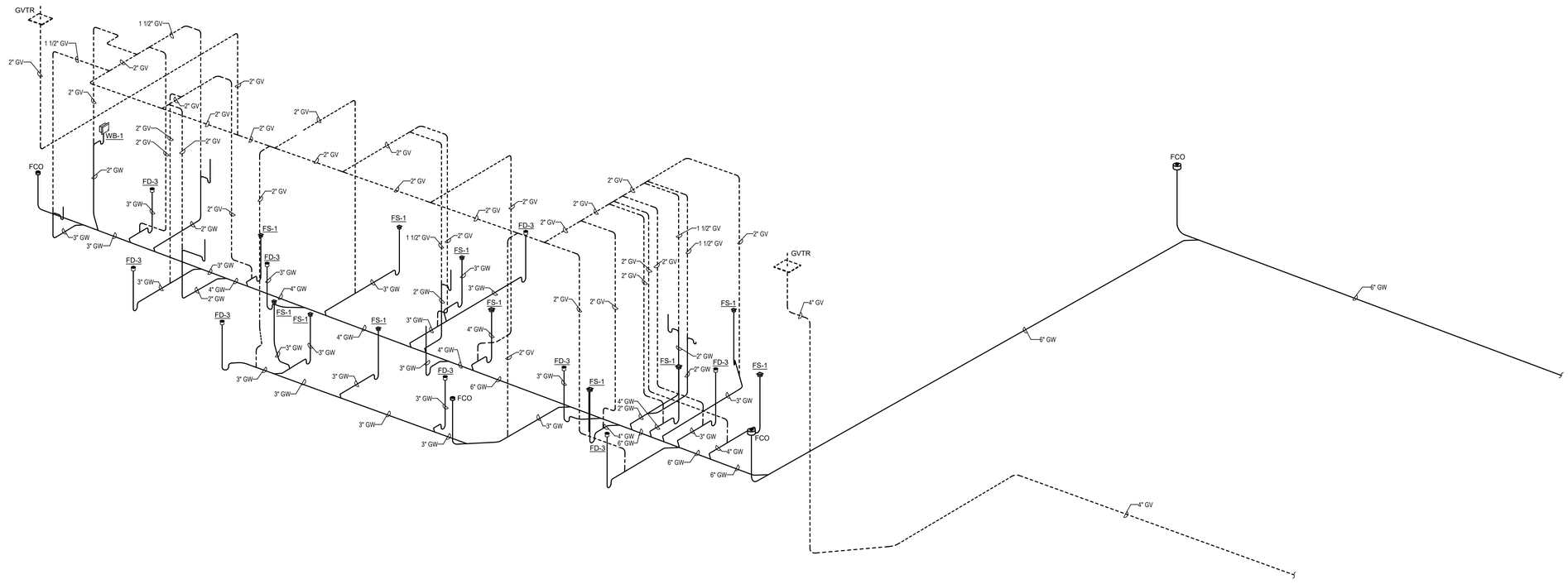

1 GREASE WASTE STACK
SCALE: NONE

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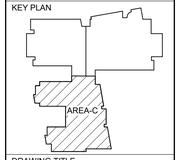

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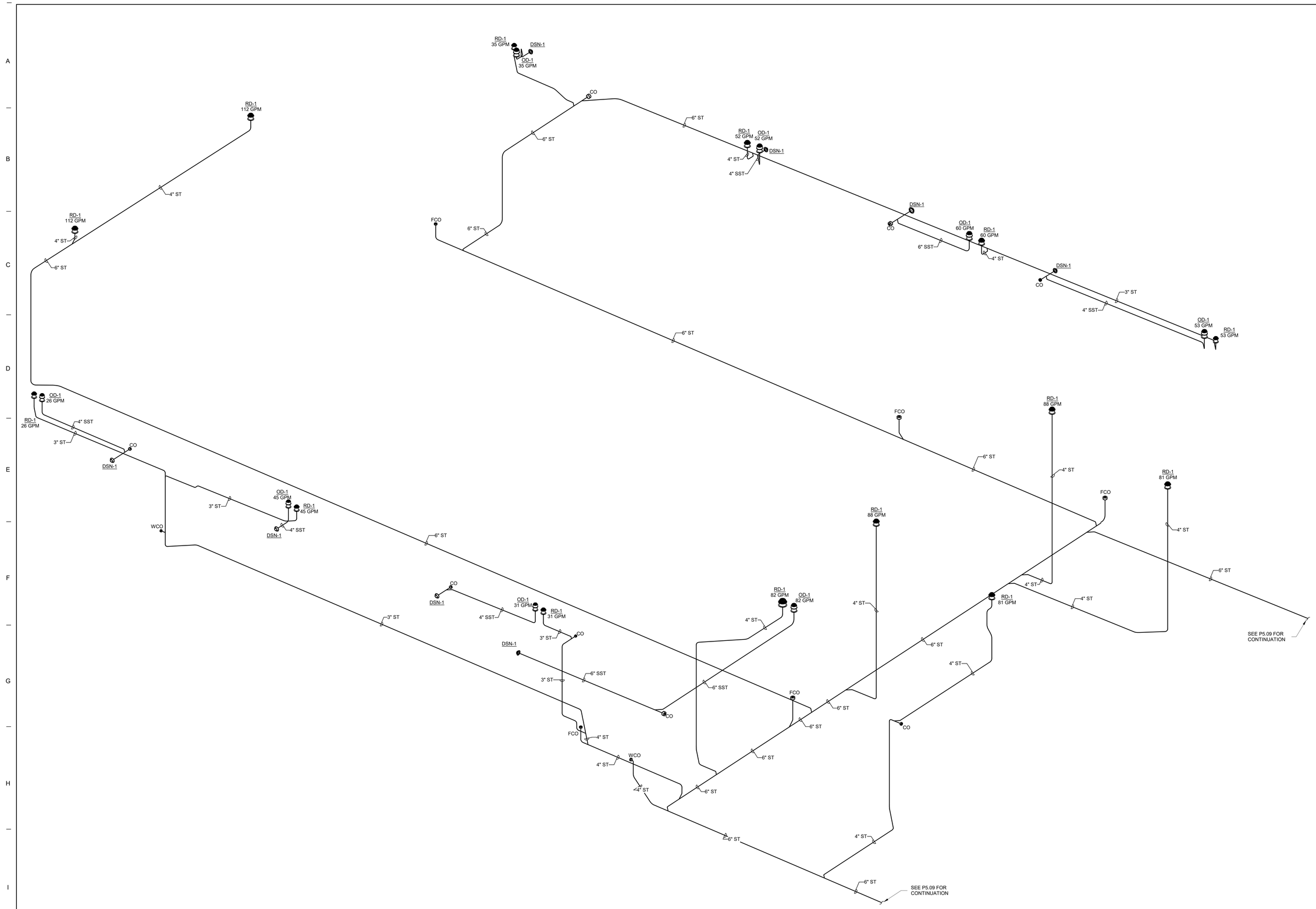

1 STORM DIAGRAM AREA A
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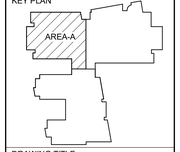
24058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



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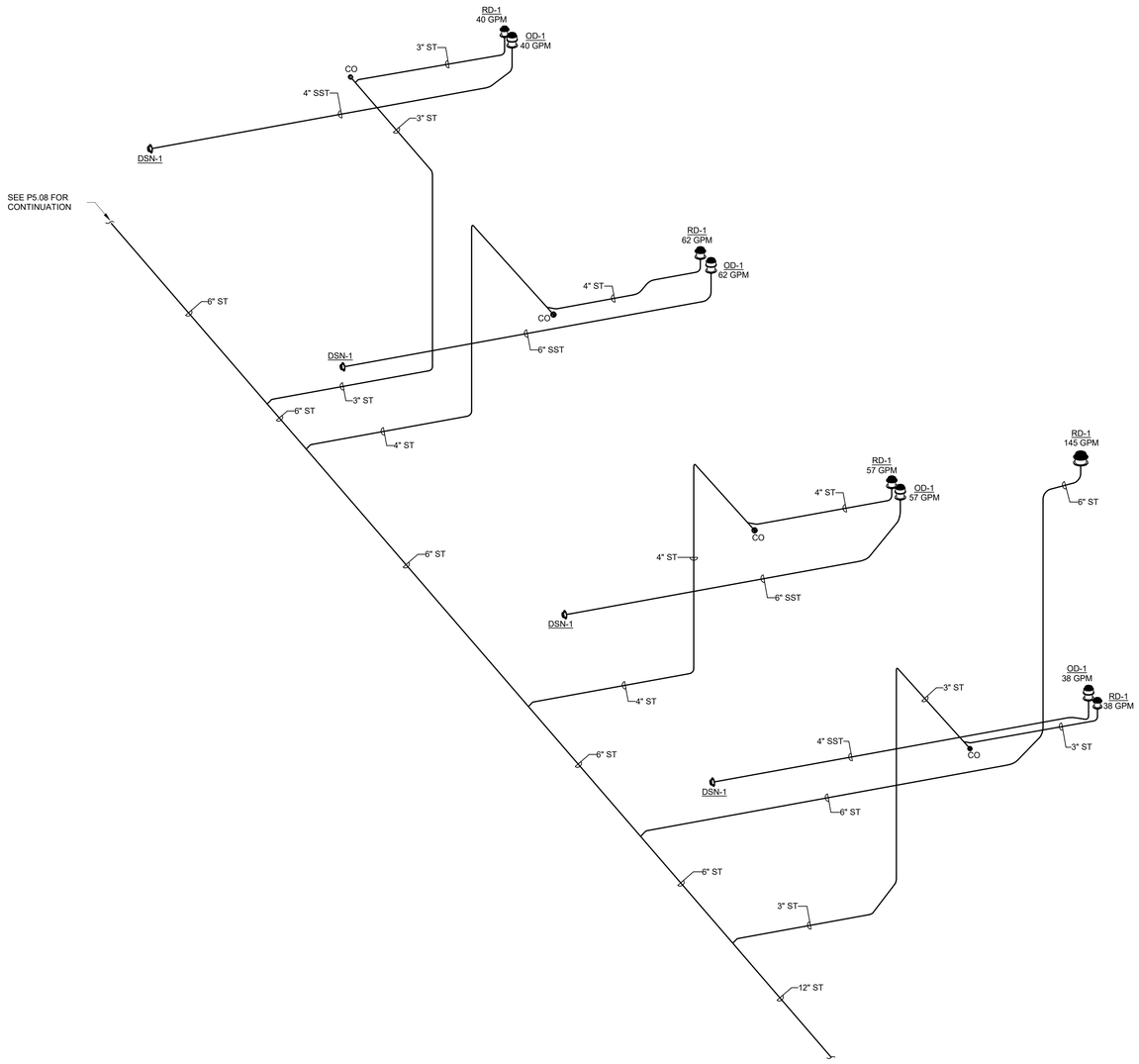

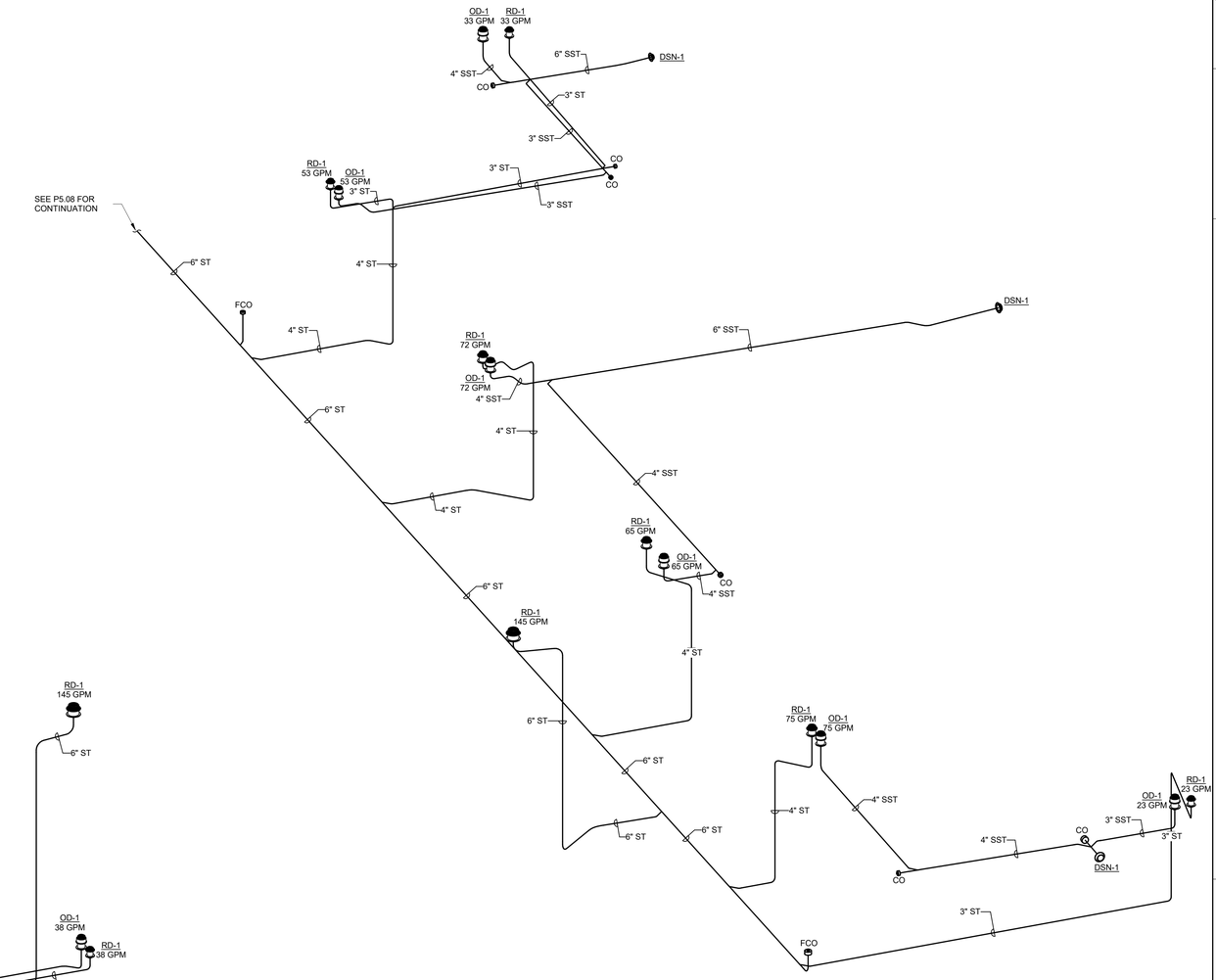

1 STORM DIAGRAM AREA B
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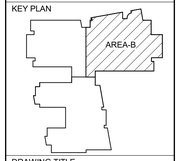
KEY PLAN



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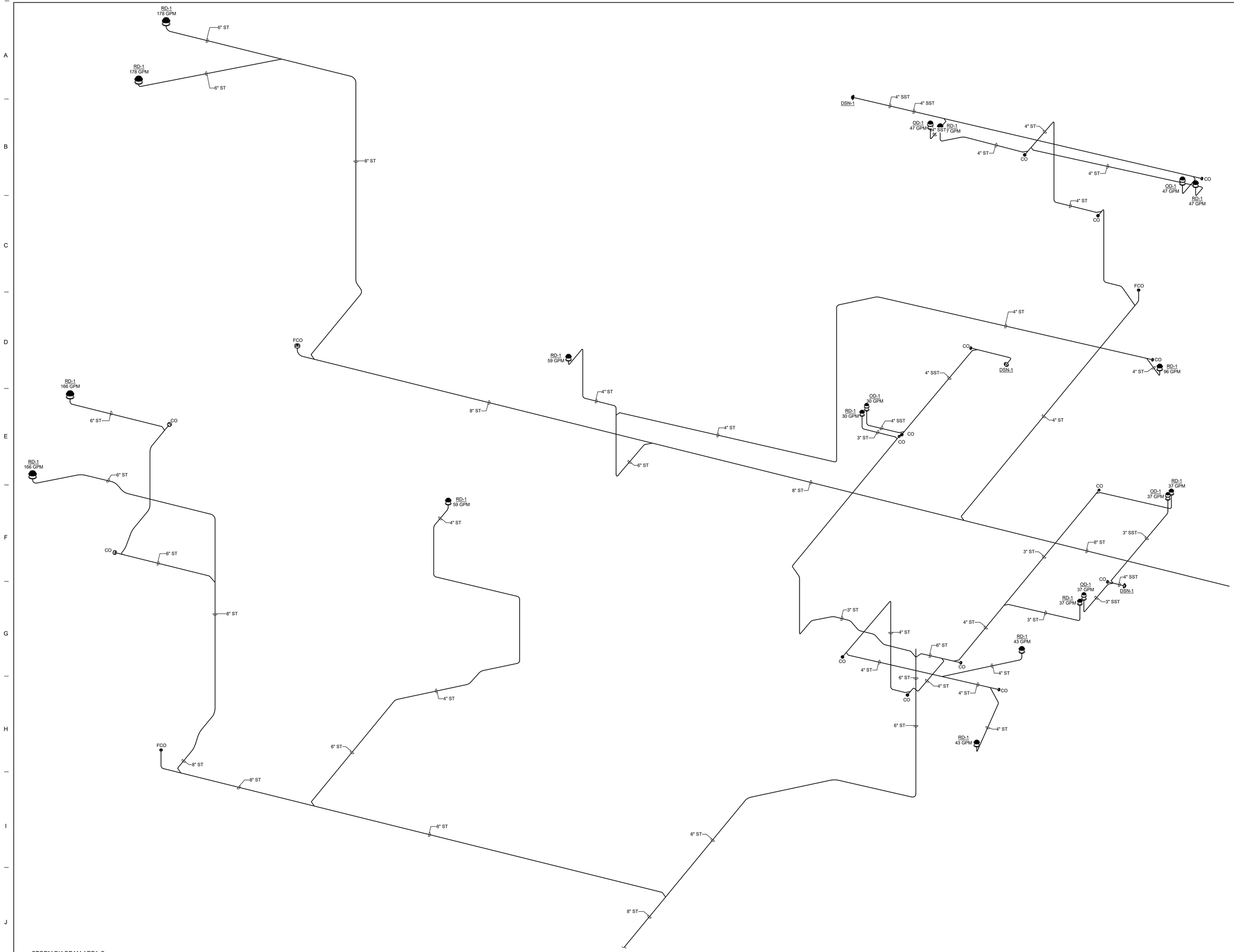

1 STORM DIAGRAM AREA C
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34058
LICENSED PROFESSIONAL ENGINEER

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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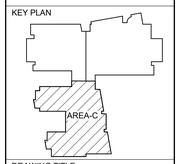

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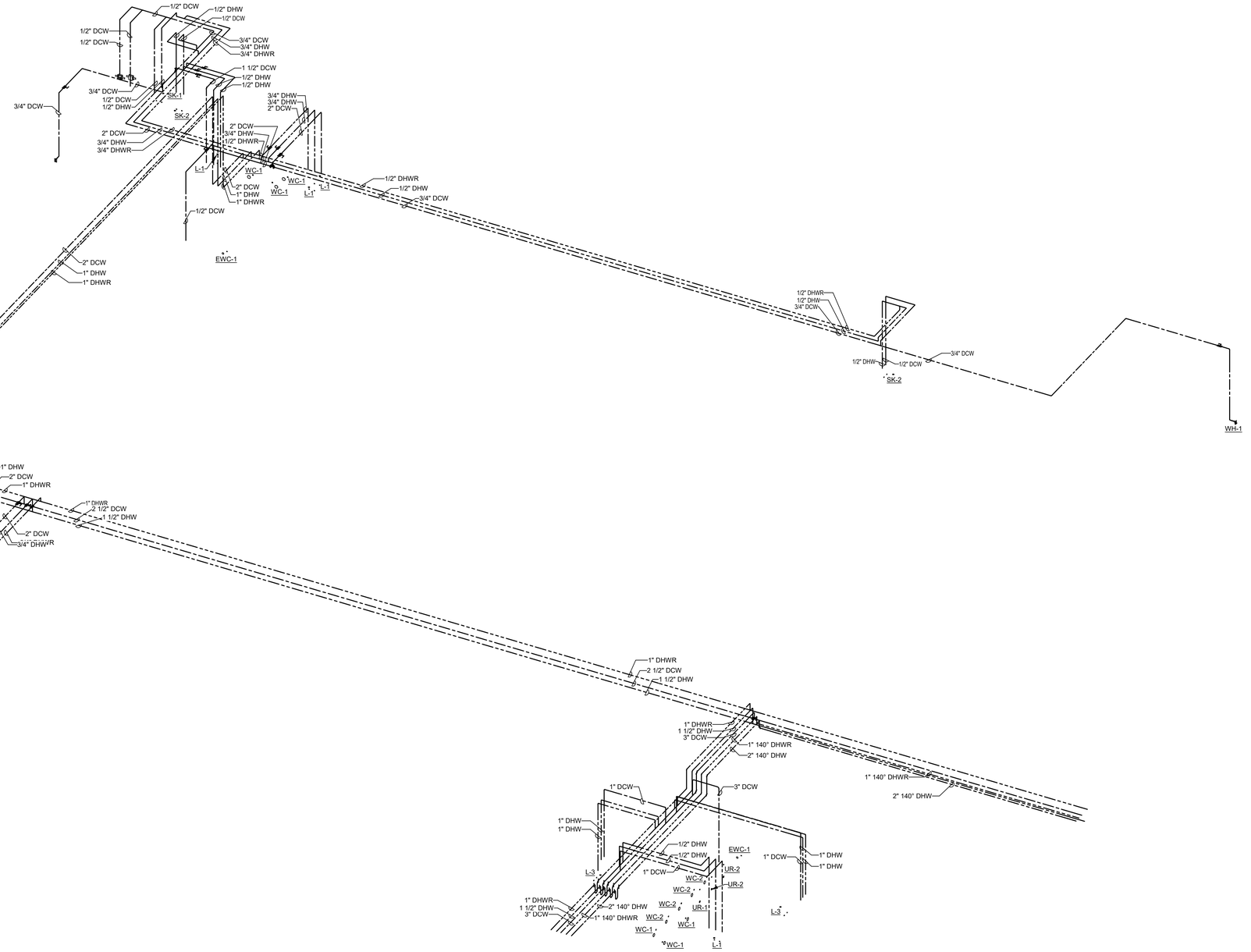

1 DOMESTIC WATER DIAGRAM AREA A
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LICENSED PROFESSIONAL ENGINEER

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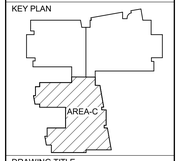

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PLUMBING DOMESTIC WATER DIAGRAMS

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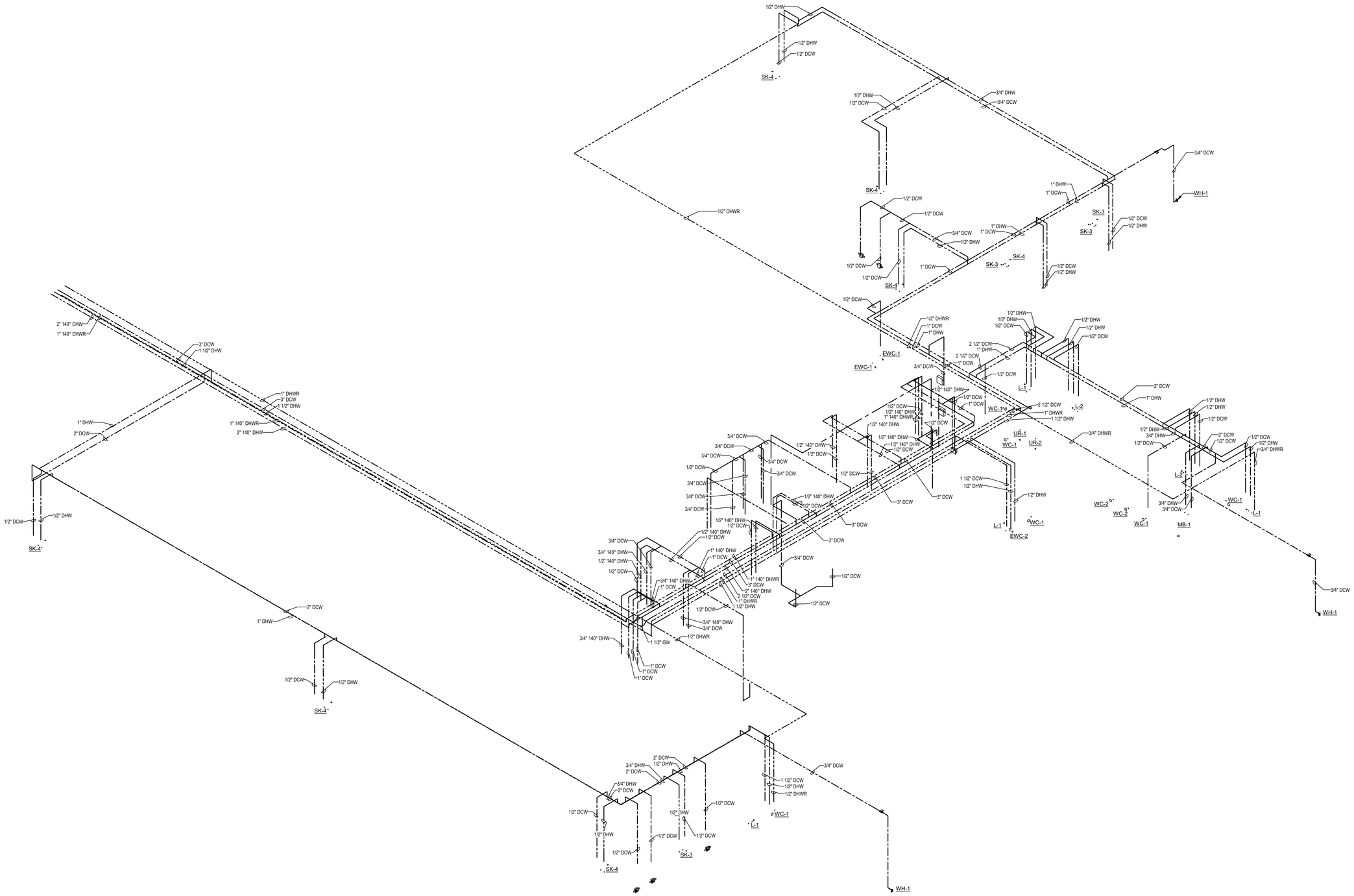

1 DOMESTIC WATER DIAGRAM AREA B
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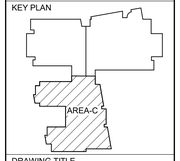

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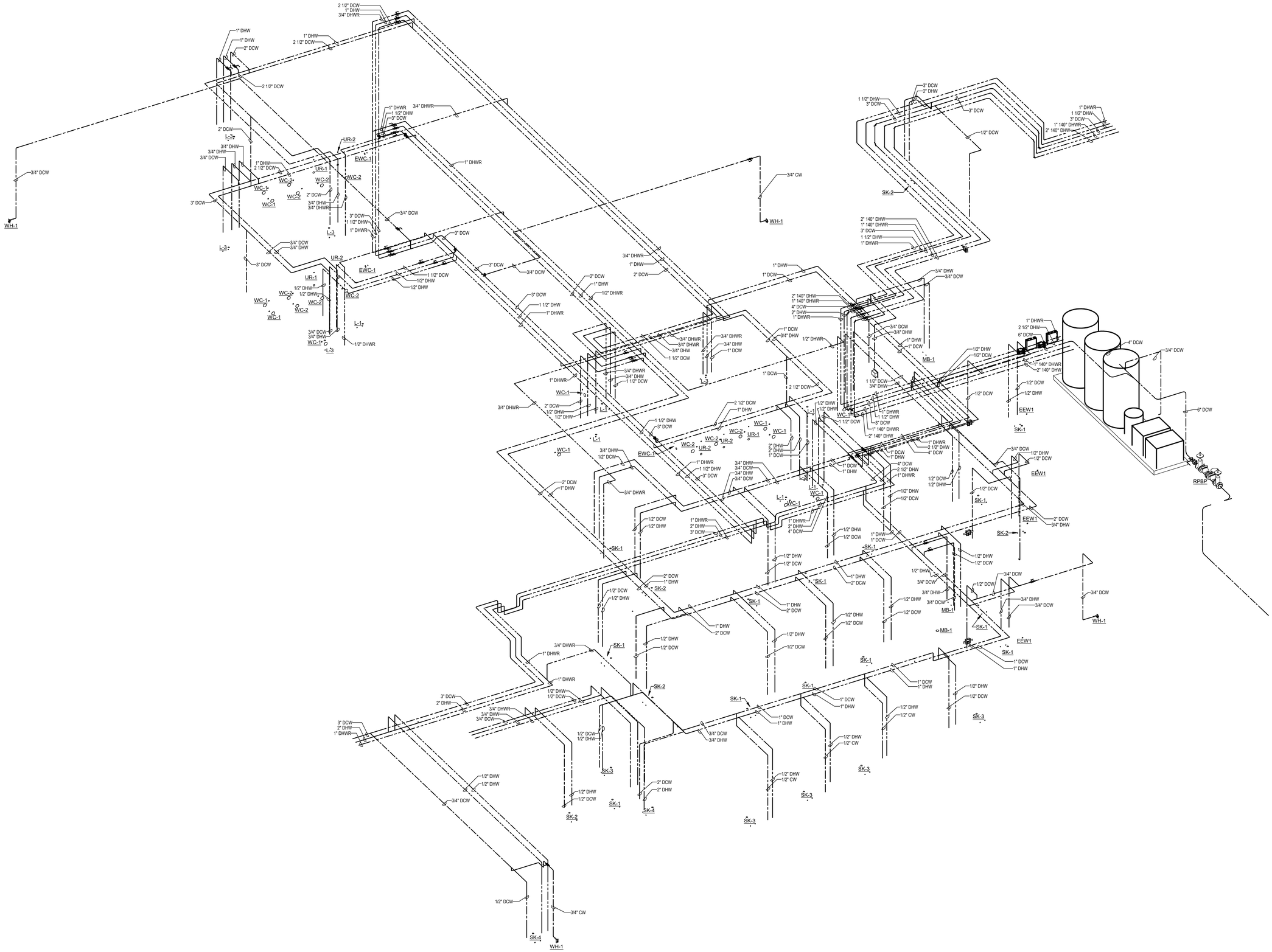

1 DOMESTIC WATER DIAGRAM AREA C NORTH
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LICENSED PROFESSIONAL ENGINEER

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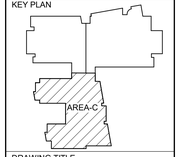

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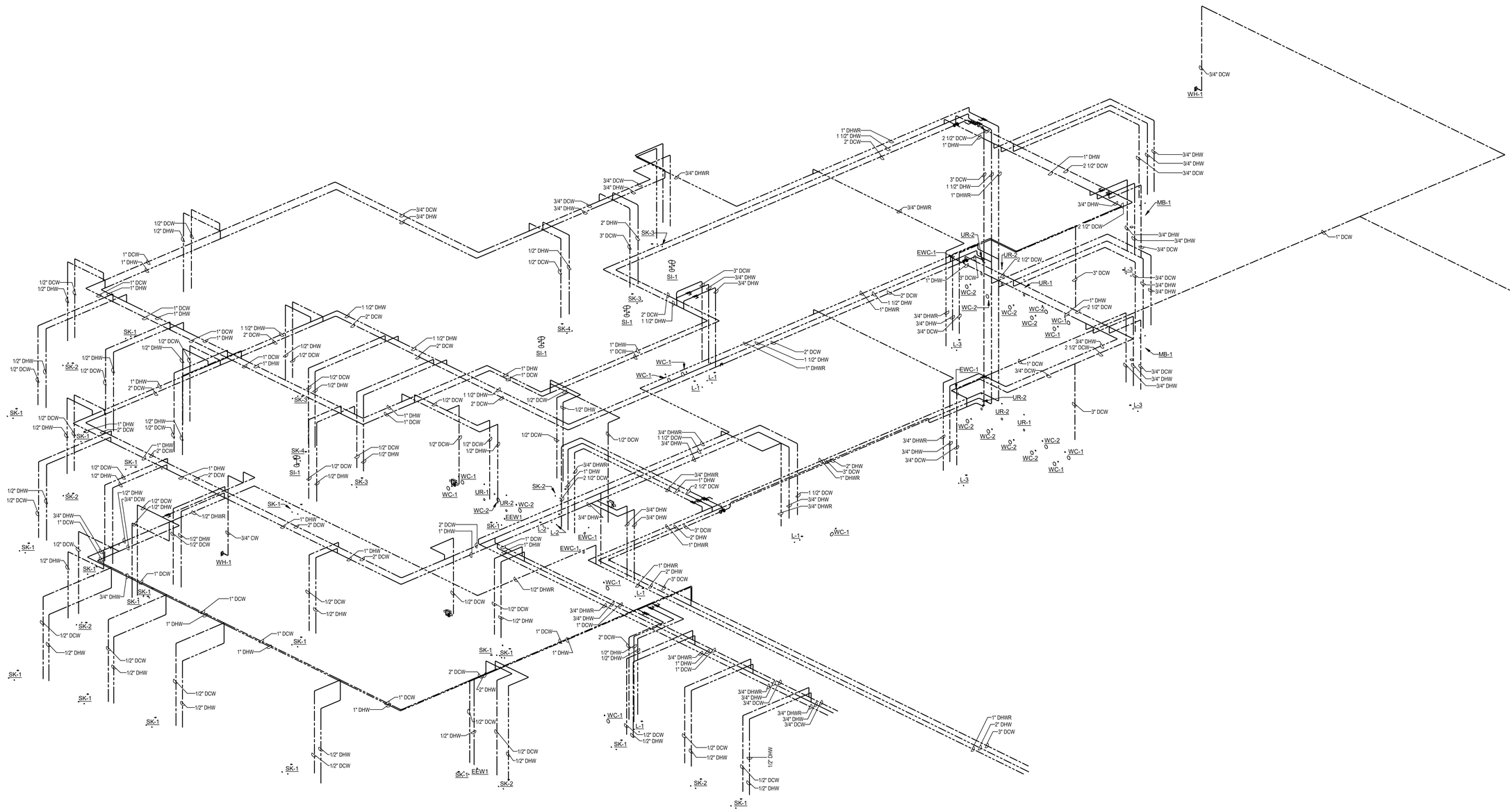

1 DOMESTIC WATER DIAGRAM AREA C SOUTH
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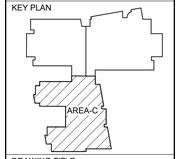
PROJECT STATUS

KEY PLAN



DRAWING TITLE

PLUMBING DOMESTIC WATER DIAGRAMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P5.14

5/19/2026 11:27:34 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

PLUMBING FIXTURE SCHEDULE

UNIT DATA			BASIS OF DESIGN		BASIS OF DESIGN TRIM		BASIS OF DESIGN SUPPLY/STOP		BASIS OF DESIGN P-TRAP		BASIS OF DESIGN MISC		ROUGH-IN SIZES (IN)				
TAG	FUNCTION	DESCRIPTION	MANUFACTURER	MODEL	MANUFACTURER	MODEL	MANUFACTURER	MODEL	MANUFACTURER	MODEL	MANUFACTURER	MODEL	DCW	DHW	SAN	V	SCHEDULE NOTES
EEW1	EMERGENCY EYEWASH	DECK MOUNTED AUTOFLOW, 90 SWIVEL, STAINLESS STEEL, RIGHT HAND MOUNTED. PROVIDE WITH ASSE 1071 MIXING VALVE.	GUARDIAN	G1895									1/2"	1/2"	0"	0"	
EWC-1	ELECTRIC WATER COOLER	IN WALL, TWO TIER WITH BOTTLE FILLER, ELECTRIC NON REFRIGERATED WATER COOLER. STAINLESS STEEL FINISH, INLET STRAINER, SELF CLOSING SEMI-CIRCULAR FRONT PUSH BAR, ONE PIECE BUBBLER WITH INTEGRAL HOOD, OVAL OR ROUND BASIN, SEALED COMPRESSOR USING R-134A. BOTTLE FILLER: SENSOR OPERATED, FRONT AND SIDE BUBBLER PUSHBAR. CAPACITY: 8 GPH OF 50 F WATER AT 90 F AMBIENT AND 80 F INLET WATER. PROVIDE SUPPLY PIPE WITH SHUT-OFF VALVE AND 1-1/4" WASTE PIPE WITH P-TRAP, ADA-COMPLIANT.	ELKAY	EZWS-EDFPBM 117K									1/2"	0"	2"	1 1/2"	
EWC-2	ELECTRIC WATER COOLER	IN WALL, TWO TIER WITH BOTTLE FILLER, ELECTRIC REFRIGERATED WATER COOLER. STAINLESS STEEL FINISH, INLET STRAINER, SELF CLOSING SEMI-CIRCULAR FRONT PUSH BAR, ONE PIECE BUBBLER WITH INTEGRAL HOOD, OVAL OR ROUND BASIN, SEALED COMPRESSOR USING R-134A. BOTTLE FILLER: SENSOR OPERATED, FRONT AND SIDE BUBBLER PUSHBAR. CAPACITY: 8 GPH OF 50 F WATER AT 90 F AMBIENT AND 80 F INLET WATER. PROVIDE SUPPLY PIPE WITH SHUT-OFF VALVE AND 1-1/4" WASTE PIPE WITH P-TRAP, ADA-COMPLIANT.	ELKAY	EZWS-ERPBM2 8K									1/2"	0"	2"	1 1/2"	
L-1	LAVATORY	QUARTZ SURFACE, WALL HUNG LAVATORY, REAR OVERFLOW. 1 FAUCET: MANUAL OPERATED, DECK MOUNTED, ONE PUNCH, 0.35 GPM FLOW RESTRICTOR. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. SUPPLY: 1/2" OD X 3/8" OD ANGLE SUPPLY, LOOSE KEY STOP, WALL FLANGE, CHROME PLATED. TRAP 1-1/4" X 1-1/2", 17 GAUGE ADJUSTABLE TRAP WITH CLEANOUT AND WALL FLANGE, CHROME FINISH. DRAIN: 1-1/4", 17 GAUGE, OFFSET DRAIN WITH OPEN GRID STRAINER, CHROME PLATED. ADA-COMPLIANT.	BRADLEY	LVLD1	GROHE	CONCETTO	MCGUIRE	165LK	MCGUIRE	8902C	GROHE	48191000	1/2"	1/2"	1 1/2"	1 1/2"	
L-2	LAVATORY	QUARTZ SURFACE, WALL HUNG LAVATORY, REAR OVERFLOW. 2 FAUCETS: MANUAL OPERATED, DECK MOUNTED, ONE PUNCH, 0.35 GPM FLOW RESTRICTOR. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. SUPPLY: 1/2" OD X 3/8" OD ANGLE SUPPLY, LOOSE KEY STOP, WALL FLANGE, CHROME PLATED. TRAP 1-1/4" X 1-1/2", 17 GAUGE ADJUSTABLE TRAP WITH CLEANOUT AND WALL FLANGE, CHROME FINISH. DRAIN: 1-1/4", 17 GAUGE, OFFSET DRAIN WITH OPEN GRID STRAINER, CHROME PLATED. ADA-COMPLIANT.	BRADLEY	LVLD2	GROHE	CONCETTO	MCGUIRE	165LK	MCGUIRE	8902C	GROHE	48191000	1/2"	1/2"	1 1/2"	1 1/2"	
L-3	LAVATORY	QUARTZ SURFACE, WALL HUNG LAVATORY, REAR OVERFLOW. 3 FAUCETS: MANUAL OPERATED, DECK MOUNTED, ONE PUNCH, 0.35 GPM FLOW RESTRICTOR. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. SUPPLY: 1/2" OD X 3/8" OD ANGLE SUPPLY, LOOSE KEY STOP, WALL FLANGE, CHROME PLATED. TRAP 1-1/4" X 1-1/2", 17 GAUGE ADJUSTABLE TRAP WITH CLEANOUT AND WALL FLANGE, CHROME FINISH. DRAIN: 1-1/4", 17 GAUGE, OFFSET DRAIN WITH OPEN GRID STRAINER, CHROME PLATED. ADA-COMPLIANT.	BRADLEY	LVLD3	GROHE	CONCETTO	MCGUIRE	165LK	MCGUIRE	8902C	GROHE	48191000	1/2"	1/2"	1 1/2"	1 1/2"	
MB-1	MOP BASIN	TERRAZZO 24" X 24" BASIN ONE-PIECE, CAST IN DRAIN WITH BODY AND STRAINER, STAINLESS STEEL CAPS, STAINLESS STEEL WALL GUARD. COMBINATION SERVICE SINK FITTING WITH VACUUM BREAKER, 3/4" HOSE THREADS ON SPOUT, 4 ARM HANDLES WITH ADJUSTABLE WALL BRACE, PAIL HOOK, AND 1/2" FLANGED FEMALE ADJUSTABLE ARMS WITH INTEGRAL STOPS, POLISHED CHROME PLATED. MOP HANGAR WITH 3 SPRING-LOADED RUBBER GRIPS, 30" RUBBER HOSE WITH 3/4" CHROME COUPLING, AND 302 STAINLESS STEEL BRACKET WITH SPRING-LOADED RUBBER GRIP.	FIAT	TSB-100	CHICAGO FAUCETS	897-CP			INTEGRAL		PVC	FIAT	832AA, 1239BB, MSG	1/2"	1/2"	3"	1 1/2"	
SK-1	SINK	SINGLE BOWL 19-1/2" X 19" X 10", 18 GA STAINLESS STEAL, DROP IN SINK. FAUCET: LEAD-FREE FAUCET WITH GOOSENECK SPOUT, LEVER HANDLES, 1.5 GPM LAMINAR FLOW CONTROL. 304 STAINLESS STEEL STRAINER BASKET AND 1-1/2" TAILPIECE. LEAD FREE SUPPLY PIPE WITH KEY STOPS. 1-1/2" X 1-1/2" CAST BRASS P-TRAP WITH CLEAN-OUT, STAINLESS STEEL FINISH. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE.	ELKAY	DLR191910	CHICAGO FAUCETS	895-GN6FCXK -317AB	MCGUIRE	165LK	MCGUIRE	8902C			1/2"	1/2"	1 1/2"	1 1/2"	
SK-2	SINK	SINGLE BOWL 19-1/2" X 19" X 5-1/2", 18 GA STAINLESS STEAL, DROP IN SINK. FAUCET: LEAD-FREE FAUCET WITH GOOSENECK SPOUT, LEVER HANDLES, 1.5 GPM LAMINAR FLOW CONTROL. 304 STAINLESS STEEL STRAINER BASKET AND 1-1/2" TAILPIECE. LEAD FREE SUPPLY PIPE WITH KEY STOPS. 1-1/2" X 1-1/2" CAST BRASS P-TRAP WITH CLEAN-OUT, STAINLESS STEEL FINISH. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. ADA-COMPLIANT.	ELKAY	LRAD191955	CHICAGO FAUCETS	895-GN6FCXK -317AB	MCGUIRE	165LK	MCGUIRE	8902C			1/2"	1/2"	1 1/2"	1 1/2"	
SK-3	SINK	SINGLE BOWL 25" X 22" X 12-1/8", 18 GA STAINLESS STEAL, DROP IN SINK. FAUCET: LEAD-FREE FAUCET WITH GOOSENECK SPOUT, LEVER HANDLES, 1.5 GPM LAMINAR FLOW CONTROL. 304 STAINLESS STEEL STRAINER BASKET AND 1-1/2" TAILPIECE. LEAD FREE SUPPLY PIPE WITH KEY STOPS. 1-1/2" X 1-1/2" CAST BRASS P-TRAP WITH CLEAN-OUT, STAINLESS STEEL FINISH. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. ADA-COMPLIANT.	ELKAY	DLR252212	CHICAGO FAUCETS	895-GN6FCXK -317AB	MCGUIRE	165LK	MCGUIRE	8902C			1/2"	1/2"	1 1/2"	1 1/2"	
SK-4	SINK	SINGLE BOWL 25" X 22" X 5-1/2", 18 GA STAINLESS STEAL, DROP IN SINK. FAUCET: LEAD-FREE FAUCET WITH GOOSENECK SPOUT, LEVER HANDLES, 1.5 GPM LAMINAR FLOW CONTROL. 304 STAINLESS STEEL STRAINER BASKET AND 1-1/2" TAILPIECE. LEAD FREE SUPPLY PIPE WITH KEY STOPS. 1-1/2" X 1-1/2" CAST BRASS P-TRAP WITH CLEAN-OUT, STAINLESS STEEL FINISH. PROVIDE ASSE 1070 THERMOSTATIC MIXING VALVE. ADA-COMPLIANT.	ELKAY	LRAD252255	CHICAGO FAUCETS	895-GN6FCXK -317AB	MCGUIRE	165LK	MCGUIRE	8902C			1/2"	1/2"	1 1/2"	1 1/2"	
UR-1	URINAL	WALL MOUNTED URINAL, 0.5 GALLON PER FLUSH, VITREOUS CHINA, DEEP SUMP, 3/4" TOP SPUD, WHITE. FLUSH VALVE: 0.125 GALLON FLUSH, MANUAL OPERATED, WATERSENSE, 3/4" TOP SPUD COUPLING, WALL AND SPUD FLANGES, VANDALPROOF TRIM, CHROME PLATED. ADA-COMPLIANT.	AMERICAN STANDARD	6590.001	SLOAN	ROYAL 186-0.125-CP							3/4"	0"	2"	1 1/2"	
UR-2	URINAL	WALL MOUNTED URINAL, 0.5 GALLON PER FLUSH, VITREOUS CHINA, DEEP SUMP, 3/4" TOP SPUD, WHITE. FLUSH VALVE: 0.125 GALLON FLUSH, MANUAL OPERATED, WATERSENSE, 3/4" TOP SPUD COUPLING, WALL AND SPUD FLANGES, VANDALPROOF TRIM, CHROME PLATED.	AMERICAN STANDARD	6590.001	SLOAN	ROYAL 186-0.125-CP							3/4"	0"	2"	1 1/2"	
WC-1	WATER CLOSET	FLOOR MOUNTED, REAR DISCHARGE. 1.28 GALLON FLUSH VALVE, VITREOUS CHINA, ELONGATED, SIPHON JET, 1 1/2" TOP SPUD, BOLT CAPS, WHITE. SEAT: COMMERCIAL GRADE, SOLID PLASTIC, ELONGATED, OPEN FRONT, STAINLESS STEEL CHECK HINGE, WHITE. FLUSH VALVE: 1.28 GALLON FLUSH, MANUAL OPERATED, WATERSENSE, 1 1/2" TOP SPUD COUPLING, WALL AND SPUD FLANGES, VANDALPROOF TRIM, CHROME PLATED. ADA-COMPLIANT.	AMERICAN STANDARD	3351.101	SLOAN	ROYAL 111-1.28					SEAT: CHURCH	295CT	1"	0"	4"	2"	
WC-2	WATER CLOSET	FLOOR MOUNTED, REAR DISCHARGE. 1.28 GALLON FLUSH VALVE, VITREOUS CHINA, ELONGATED, SIPHON JET, 1 1/2" TOP SPUD, BOLT CAPS, WHITE. SEAT: COMMERCIAL GRADE, SOLID PLASTIC, ELONGATED, OPEN FRONT, STAINLESS STEEL CHECK HINGE, WHITE. FLUSH VALVE: 1.28 GALLON FLUSH, MANUAL OPERATED, WATERSENSE, 1 1/2" TOP SPUD COUPLING, WALL AND SPUD FLANGES, VANDALPROOF TRIM, CHROME PLATED.	AMERICAN STANDARD	3351.101	SLOAN	ROYAL 111-1.28					SEAT: CHURCH	295CT	1"	0"	4"	2"	

PUMP SCHEDULE

UNIT DATA			BASIS OF DESIGN		PERFORMANCE DATA					MOTOR DATA						GENERAL DATA		
TAG	LOCATION	FUNCTION	MANUFACTURER	MODEL	PUMP TYPE	FLUID TYPE	FLOW (GPM)	EXT WPD (FT HD)	EWT (°F)	HP	PHASE	VOLTS	FLA	VFD	EMERGENCY POWER	REDUNDANT	WEIGHT (LBS)	SCHEDULE NOTES
CP-1	MECHANICAL ROOM	DHWR	BELL & GOSSETT	ECOCIRC XL N 55-45	CENTRIFUGAL	WATER	20	45.00	114	0.50	1	208	2	Yes	Yes	No	30	
CP-2	MECHANICAL ROOM	DHWR	BELL & GOSSETT	ECOCIRC XL N 55-45	CENTRIFUGAL	WATER	5	35.00	134	0.50	1	208	2	Yes	Yes	No	30	
ESP-1	ELEVATOR	ELEVATOR SUMP PUMP	ZOELLER	153-0027	SUBMERSIBLE	WATER	50	20.00	55	0.50	1	120	11	No	Yes	No	35	PROVIDE WITH OIL GUARD PUMP SWITCH AND ALARM PANEL PACKAGE.
ESP-2	ELEVATOR	ELEVATOR SUMP PUMP	ZOELLER	153-0027	SUBMERSIBLE	WATER	50	20.00	55	0.50	1	120	11	No	Yes	No	35	PROVIDE WITH OIL GUARD PUMP SWITCH AND ALARM PANEL PACKAGE.

HEAT PUMP WATER HEATER SCHEDULE

UNIT DATA			BASIS OF DESIGN			PERFORMANCE DATA				ELECTRICAL DATA				
TAG	LOCATION	FUNCTION	MANUFACTURER	MODEL	REFRIG TYPE	SOURCE WATER FLOW (GPM)	POTABLE WATER FLOW (GPM)	HEATING CAPACITY (TONS)	WATER CONNECTION (IN)	FLA	HORSEPOWER	VOLTS	PHASE	SCHEDULE NOTES
DWH-1	MECHANICAL ROOM	DOMESTIC HOT WATER	COLMAC	CXW-15	R-134A	20.0	3.2	12.1	6"	36.6	15	460	3	
DWH-2	MECHANICAL ROOM	DOMESTIC HOT WATER	COLMAC	CXW-15	R-134A	20.0	3.2	12.1	6"	36.6	15	460	3	

ELECTRIC WATER HEATER SCHEDULE

UNIT DATA			BASIS OF DESIGN		PERFORMANCE DATA			ELECTRICAL DATA				
TAG	LOCATION	FUNCTION	MANUFACTURER	MODEL	STORAGE CAPACITY (GAL)	RECOVERY @100°F RISE (GAL/HR)	WATER CONNECTION (IN)	FLA	CAPACITY (KW)	VOLTS	PHASE	SCHEDULE NOTES
EWH-1	MECHANICAL ROOM	DOMESTIC HOT WATER	NILES	JEV300-18	300.0	74	2"	22	18	460	3	TANK SHALL BE PROVIDED WITH TWO TEMPERATURE SENSORS.

THERMOSTATIC MIXING VALVE SCHEDULE

UNIT DATA			BASIS OF DESIGN		PERFORMANCE DATA					GENERAL DATA			
TAG	LOCATION	FUNCTION	MANUFACTURER	MODEL	MIN FLOW (GPM)	MAX FLOW (GPM)	FLOW (GPM)	WPD (PSI)	LWT (°F)	INLET SIZE (IN)	OUTLET SIZE (IN)	WEIGHT (LBS)	SCHEDULE NOTES
TMV-1	MECHANICAL ROOM	DHW MIXING	BRADLEY	S59-3200	5	91	61	10.00	130	2"	2"	15.00	
TMV-2	MECHANICAL ROOM	DHW MIXING	BRADLEY	S59-3080	2	36	12	10.00	140	1"	1 1/4"	15.00	

EXPANSION TANK SCHEDULE

UNIT DATA		BASIS OF DESIGN		PERFORMANCE DATA						
TAG	FUNCTION	MANUFACTURER	MODEL	TANK VOLUME (GAL)	MAX ACCEPTANCE VOLUME (GAL)	AIR PRECHARGE (PSIG)	TOTAL SYSTEM VOLUME (GAL)	CONNECTION SIZE (IN)	WEIGHT (LBS)	SCHEDULE NOTES
ET-1	HOT WATER EXPANSION	AMTROL	ST-80VC	53.0	35	55.00	1570.0	1 1/4"	515.00	
ET-2	HOT WATER EXPANSION	AMTROL	ST-30VC-DD	16.5	11.3	55.00	300.0	3/4"	515.00	

STORAGE TANK SCHEDULE

UNIT DATA			BASIS OF DESIGN		PERFORMANCE DATA			
TAG	LOCATION	FUNCTION	MANUFACTURER	MODEL	TANK VOLUME (GAL)	MAX ACCEPTANCE PRESSURE (PSIG)	WATER CONNECTION (IN)	SCHEDULE NOTES
ST-1	MECHANICAL ROOM	DOMESTIC HOT WATER	NILES	JS-42-084	504.0	160	3"	
ST-2	MECHANICAL ROOM	DOMESTIC HOT WATER	NILES	JS-42-084	504.0	160	3"	

PLUMBING SPECIALTIES SCHEDULE

UNIT DATA			BASIS OF DESIGN		
TAG	FUNCTION	DESCRIPTION	MANUFACTURER	MODEL	SCHEDULE NOTES
DSN-1	DOWNSPOUT	DOWNSPOUT COVER, ROUND FABRICATED STAINLESS STEEL FRAME WITH FABRICATED SECURED PERFORATED STAINLESS STEEL HINGED STRAINER.	ZURN	ZS199-DC	
FD-1	FLOOR DRAIN	2" DRAIN. PROVIDE WITH ADJUSTABLE CAST IRON BODY, ROUND BRONZE TOP FOR FINISHED FLOORS. PROVIDE WITH 1/2" TRAP PRIMER INLET.	ZURN	Z507	PROVIDE WITH ZURN Z1072 TRAP SEAL.
FD-2	FLOOR DRAIN	4" DRAIN. PROVIDE WITH ADJUSTABLE CAST IRON BODY, ROUND BRONZE TOP FOR FINISHED FLOORS. PROVIDE WITH 1/2" TRAP PRIMER INLET.	ZURN	Z507	PROVIDE WITH ZURN Z1072 TRAP SEAL.
FD-3	FLOOR DRAIN	3" PROVIDE WITH ADJUSTABLE CAST IRON BODY, ROUND BRONZE TOP FOR FINISHED FLOORS. PROVIDE WITH 1/2" TRAP PRIMER INLET.	ZURN	Z507	PROVIDE WITH ZURN Z1072 TRAP SEAL.
FS-1	FLOOR SINK	8" DEEP, CAST IRON BODY WITH WHITE ACID RESISTING PROCELAIN ENAMEL INTERIOR AND TOP, ANTI-SPLASH INTERIOR BOTTOM DOME STRAINER, 1/2 GRATE, 4" OUTLET.	ZURN	Z1901-2	
HB-1	HOSE BIBB	EXTERNAL VACUUM BREAKER, ALL BRONZE INTERIOR COMPONETS, VANDAL-RESISTANT OPERATING STEM, ROUGH BRONZE EXTERIOR, AND 3/4" MALE HOSE CONNECTION.	ZURN	Z1341-LF	
OD-1	OVERFLOW DRAIN	15" DIAMETER, CAST IRON DOME, LOW SILHOUETTE POLY-DOME STRAINER, SIDE OUTLET, 2" INTERNAL WATER DAM.	ZURN	Z100--90-W2	
RD-1	ROOF DRAIN	15" DIAMETER, CAST IRON DOME, LOW SILHOUETTE POLY-DOME STRAINER, SIDE OUTLET.	ZURN	Z100-90	
SB-1	SUPPLY BOX	LEAD-FREE METAL POWDER COATED OUTLET BOX WITH HAMMER ARRESTOR VALVE.	GUY GRAY	MIB1HAAB	
SI2	LINT INTERCEPTOR	IN WALL LINT INTERCEPTOR, PVC HOUSING, TOP INLET. MAX FLOW RATE 23 GPM	STRIEM	SIDEKICK	
SI-1	SOLIDS INTERCEPTOR	ACID RESISTANT COMPOSITE SOLIDS INTERCEPTOR. IN CABINET INSTALLATION WITH REMOVABLE PVC SEDIMENT BUCKET.	ZURN	Z1180	
TD-1	TRENCH DRAIN	NO HUB, BOTTON OUTLET TRENCH DRAIN. PROVIDE WITH CAST IRON SLOTTED GRATE CLASS B	ZURN	Z844-U3-CG	
TP1	TRAP PRIMER	ELECTRONIC TRAP PRIMER AT 120V/20A. 3/4" INLET WITH 1/2" OUTLETS.	PRECISION PLUMIBNG	PTS	
WB-1	WASHER BOX	20 GAUGE WASHER BOX, QTR TURN VALVES WITH WATER HAMMER ARRESTERS, 2" DRAIN.	GUY GRAY	MWB-16	
WH-1	WALL HYDRANT	EXPOSED ANTI-SIPHON WITH VACUUM BREAKER STAINLESS STEEL FACE AND LOOSE KEY.	ZURN	Z1310	

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ARCHITECTURE | PLANNING | INTERIORS

CMTA
A LEGENCE Company

PROFESSIONAL SEAL

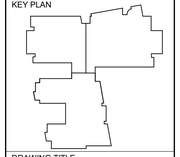


TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

PROJECT STATUS

KEY PLAN



DRAWING TITLE

PLUMBING SCHEDULES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	5/19/2026
DRAWN BY	TS
APPROVED BY	JF

ISSUE DATES

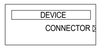
NO.	DATE	PURPOSE
1	10/31/2025	SD
2	12/15/2025	DD PRICING SET
3	3/16/2026	50% CD
4	3/26/2026	PHASE 1
5	5/19/2026	100% CD

P6.01

5/18/2026 11:27:34 AM Autodesk Docs://Trumbull Hillcrest Middle School/250502-Trumbull Hillcrest MS-MEP_BIM360_R26.rvt

Docusign Envelope ID: 7421B099-F7EC-4432-ADA3-BA95722BEB71

AV SYSTEM SYMBOLS LEGEND

	PROJECTOR
	ALS RECEIVER
	OFF SHEET REFERENCE FLAG, REFERENCE DRAWING "AVX.XX", FLAG "X"
	ON SHEET REFERENCE FLAG, REFERENCE FLAG "X"
	FLAT PANEL DISPLAY
	WALL MOUNTED SPEAKERS, CONTINUATION NOT SHOWN
	CEILING SPEAKERS, CONTINUATION NOT SHOWN
	PARTIAL PLATE/ PARTIAL DEVICE
	AV DEVICE
	BODY TRANSMITTER/ LAVALIER MICROPHONE
	HANDHELD MICROPHONE
	CEILING SPEAKER
	CEILING MICROPHONE
	AUDIO AMPLIFIER

SCOPE GUIDANCE AND GENERAL NOTES (APPLIES TO ALL SHEETS):

1. COORDINATE ALL FURNITURE CUTOUTS WITH FURNITURE PROVIDER.
2. FINAL HEIGHT AND MOUNTING LOCATIONS SHALL BE COORDINATED WITH THE ARCHITECTUAL ELEVATIONS.
3. FIELD VERIFY ALL DIMENSIONS PRIOR TO INSTALLATION OF EQUIPMENT.
4. PROVIDE BLANK PLATES FOR BOXES LEFT OR DENOTED AS "BLANK" FOR FUTURE INSTALLATIONS.
5. ALL UTP CABLING SHALL BE PLENUM RATED, UON.
6. CEILING SPEAKERS ARE SHOWN FOR ZONING, CONDUIT SIZING, AND ROUTING ONLY. REFERENCE ARCHITECTURAL RCP FOR EXACT CEILING SPEAKER LOCATIONS.
7. ALL CATEGORY CABLING FOR AV USE SHALL BE TERMINATED BY THE AV CONTRACTOR INTO JACKS. ALL PATCH CABLES PROVIDED BY THE AV CONTRACTOR SHALL BE PREFABRICATED. NO SHIELDED RJ45 PLUGS SHALL BE FIELD TERMINATED ON THIS PROJECT.
8. USE VELCRO STRAPS FOR ALL CABLE MANAGEMENT APPLICATIONS. TIE WRAPS ARE PROHIBITED.
9. CABLES ROUTED ON J-HOOKS SHALL BE PARALLEL OR PERPENDICULAR TO WALLS AND STRUCTURAL ELEMENTS AND SHALL BE KEPT IN A NEAT BUNDLE. RUNNING CABLE DIAGONALLY ACROSS ANY SPACE INCLUDING AREAS CONCEALED ABOVE ACCESSIBLE CEILINGS SHALL NOT BE PERMITTED.
10. AUDIO VISUAL SCOPE:
    THE AUDIO VISUAL PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE AUDIO VISUAL CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
    10.1. DISPLAY DEVICES SUCH AS FLAT PANEL TVS, PROJECTORS, AND SCREENS.
    10.2. AUDIOVISUAL EQUIPMENT, SUCH AS AV RACKS, TRANSMITTERS, RECEIVERS, AND CONTROLLERS.
    10.3. PROPRIETARY AV CABLING, SUCH AS HDbT, HDMI, SPEAKER WIRES, AND CONTROL CABLES.
    10.4. PROPRIETARY AV STORAGE AND MOUNTING DEVICES, SUCH AS PROJECTOR ENCLOSURES AND DISPLAY MOUNTS.

SIGNAL TYPES:

M — M	MICROPHONE LEVEL AUDIO
L — L	LINE LEVEL AUDIO
L/R — L/R	STEREO LINE LEVEL AUDIO
SPK — SPK	SPEAKER LEVEL AUDIO
70V — 70V	70.7V AUDIO SIGNAL
HDMI — HDMI	HDMI HIGH RESOLUTION VIDEO SIGNAL
DM — DM	DIGITIAL MEDIA VIDEO SIGNAL
C — C	CONTROL SIGNAL
RS-232 — RS-232	RS-232 SERIAL SIGNAL
SERIAL — SERIAL	SERIAL ANNOTATION SIGNAL
IRS — IRS	INFARED/SERIAL SIGNAL
REL — REL	CONTACT CLOSURE OR RELAY SIGNAL
LAN — LAN	STANDARD ETHERNET CONTROL
IR	WIRELESS, INFRARED
RF	WIRELESS, RADIO FREQUENCY

ABBREVIATIONS

ABV	ABOVE
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
ARCH	ARCHITECT/ARCHITECTUAL
ARF	ABOVE RAISED FLOOR
BEL	BELOW
BFC	BELOW FINISHED CEILING
C	CONDUIT
CC	CENTER CONTACT
CCA	CEILING CONNECTOR ASSEMBLY
CLG	CEILING
COL	COLUMN
CONN	CONNECT/CONNECTION
CONT	CONTINUATION/CONTINOUS
DN	DOWN
EC	EMPTY CONDUIT
FBO	FINISHED BY OTHER
FCA	FLOOR CONNECTOR ASSEMBLY
FL	FLOOR
LAN	LOCAL AREA NETWORK
N/A	NOT APPLICABLE
N/I	NOT ISSUED
NC	NORMALLY CLOSED CONTACT CLOSURE
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN CONTACT CLOSURE
NTS	NOT TO SCALE
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFE	OWNER FURNISHED EQUIPMENT
SCRN	PROJECTOR SCREEN
SPEC	SPECIFICATIONS
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
WCA	WALL CONNECTOR ASSEMBLY

AV SHEET LIST

Sheet Number	Sheet Name
AV0.01	AUDIO VISUAL LEGEND AND NOTES
AV7.01	AUDIO VISUAL SIGNAL FLOW - CONFERENCE ROOM AND MUSIC CLASSROOMS
AV7.02	AUDIO VISUAL SIGNAL FLOW - CAFETERIA AND GYM
AV7.03	AUDIO VISUAL SIGNAL FLOW - BLACK BOX
AV8.01	AUDIO VISUAL DETAILS

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NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
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TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

AUDIO VISUAL LEGEND AND NOTES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NO SCALE
DATE	05/19.2026
DRAWN BY	JR
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ISSUE DATES

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AV0.01

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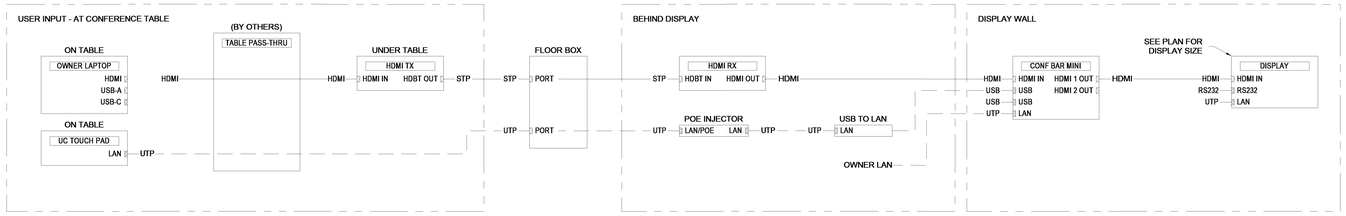


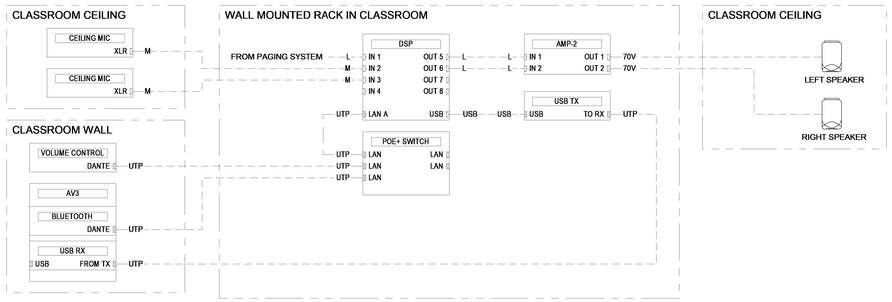
SYSTEM DETAILS (THIS DETAIL ONLY)

1. THE SYSTEM SHALL SUPPORT LOCAL PRESENTATION AND WEB CONFERENCING USING THE CONFERENCING BAR.
2. USERS SHALL BE ABLE TO SHARE VIA WIRED CONNECTION AT THE TABLE OR WIRELESSLY THROUGH THE TEAMS MEETING INTERFACE.
3. A CONFERENCING CAMERA BAR WILL BE USED TO PICK UP THE PARTICIPANTS AT THE TABLE(S).
4. CONFIGURE THE DISPLAY TO AUTOMATICALLY SLEEP AND WAKE BASED ON SYSTEM STATE.
5. COORDINATE IP ADDRESSES WITH OWNER AND PROVIDE AN IP ADDRESS SPREADSHEET DETAILING EACH DEVICE PER SPECIFICATION REQUIREMENTS
6. COORDINATE DEVICE COLOR SELECTIONS WITH ARCHITECT UTILIZING A COLOR SELECTION MATRIX.

1 AV - SIGNAL FLOW - CONFERENCE ROOM
NO SCALE

CONFERENCE ROOM BOD EQUIPMENT LIST

ITEM	MANUFACTURER	MODEL	SUBSTITUTION ACCEPTED UPON...	NOTES
FLAT PANEL DISPLAY	SAMSUNG	QM-C SERIES	YES	SIZE AS NOTED IN DRAWINGS. DISPLAY SHALL INCLUDE AUTO-ON, AUTO-OFF, AND AUTO-SWITCHING WITH PRIORITY UPON SIGNAL SENSE. DISPLAY SHALL BE COMMERCIAL GRADE AND RATED FOR MINIMUM 16/HRS A DAY. DISPLAY MODEL SHALL HAVE A MINIMUM 3 YEAR WARRANTY. LG DISPLAYS WILL NOT BE ALLOWED ON THIS PROJECT.
DISPLAY MOUNT	CHIEF	TS325TU	YES	SUBSTITUTION MUST BE PULLOUT OR SWING ARM MOUNT AND COMPATIBLE WITH BACK BOX.
CONFERENCE BAR	LOGITECH	RALLY BAR	NO	INCLUDE DISPLAY MOUNT AND ANY ACCESSORIES REQUIRED TO MEET DESIGN INTENT.
UC TOUCHPAD	LOGITECH	TAP	NO	SHALL BE COMPATIBLE WITH CONFERENCE BAR. SHALL BE DESIGNED TO DIRECTLY CONNECT TO THE CONFERENCE BAR.
HDMI TX	EXTRON	DTP2 T 211	YES	
HDMI RX	EXTRON	DTP2 R 211	YES	
BULK MATERIALS	MISC	MISC	YES	PROVIDE CABLES, CONNECTORS, IO CARDS, SUMMING AMPLIFIERS, ADAPTERS, AND ALL OTHER EQUIPMENT NOT SPECIFICALLY LISTED HERE TO...



MUSIC CLASSROOM BOD EQUIPMENT LIST

ITEM	MANUFACTURER	MODEL	SUBSTITUTION ACCEPTED UPON APPROVAL	NOTES
EQUIPMENT RACK	MIDDLE ATLANTIC	TOR-2-20SP	YES	
DSP	QSC	CORE 8 FLEX	YES	
VOLUME CONTROL	ATTERO TECH	AXON C1	YES	
HANGING MICROPHONE	RODE	NT5	YES	SMALL DIAPHRAGM CONDENSER MICROPHONE, PROVIDE SHOCK MOUNTS AND SMALL STEREO BAR AS REQUIRED TO FORM AN ORTF ARRAY
BLUETOOTH	RDL	DB-BT1A	YES	
USB TX	LIBERTY	INT-USB2-50C	YES	
USB RX	LIBERTY	INT-USB2-50HWP	YES	
WALL SPEAKERS	JBL	CONTROL 28-1	YES	
AMPLIFIER	EXTRON	XPA U 2002 SB	YES	TWO CHANNEL AMPLIFIER, 200W PER CHANNEL INTO 8 OHM, FANLESS COOLING
BULK MATERIALS	MISC	MISC	YES	PROVIDE CABLES, CONNECTORS, IO CARDS, SUMMING AMPLIFIERS, ADAPTERS, AND ALL OTHER EQUIPMENT NOT SPECIFICALLY LISTED HERE TO ENSURE ADHERENCE TO DESIGN INTENT.

2 AV - SIGNAL FLOW - MUSIC CLASSROOM
NO SCALE

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AUDIO VISUAL SIGNAL FLOW - CONFERENCE ROOM AND MUSIC CLASSROOMS

STATE PROJ. NO.	144-0108N
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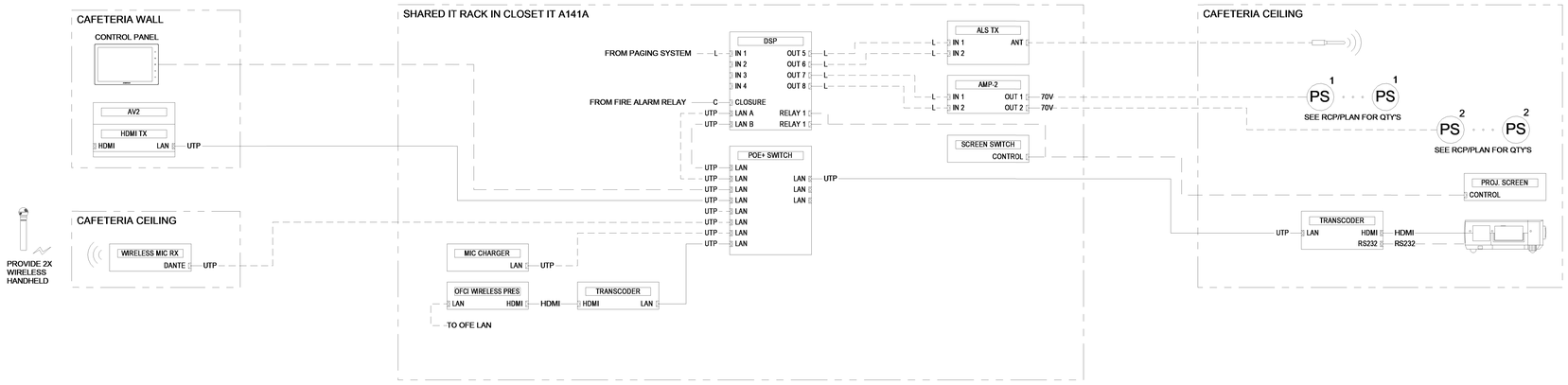
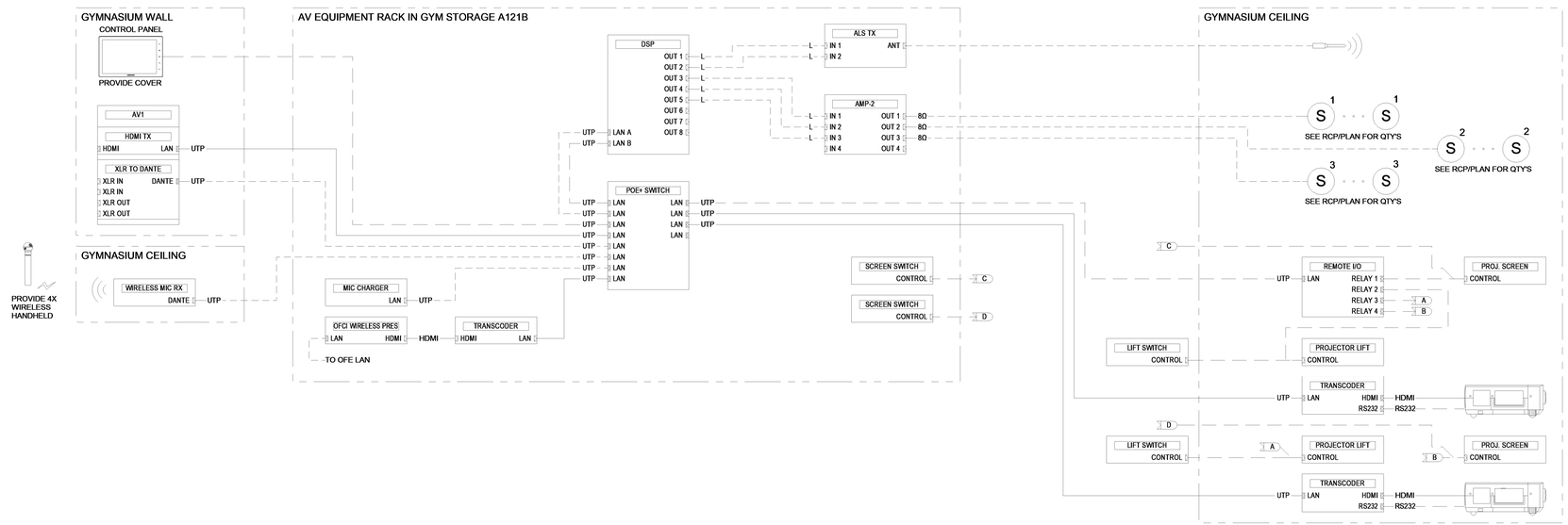


1 AV - SIGNAL FLOW - CAFETERIA
NO SCALE

CAFETERIA BOD EQUIPMENT LIST				
ITEM	MANUFACTURER	MODEL	SUBSTITUTION ACCEPTED UPON APPROVAL	NOTES
DSP	QSC	CORE 8 FLEX	YES	
CONTROL PANEL	QSC	TSC-50-G3	YES	
CONTROL PANEL COVER	FSR	WB-TSC-SM-10	YES	
ALS	LISTEN	LS-53-216	YES	
WIRELESS MIC RX	SHURE	MXWAPX4	YES	
WIRELESS HANDHELD	SHURE	MXW2X/SM58	YES	
MIC CHARGER	SHURE	MXWNDX	YES	
PENDANT SPEAKER	JBL	CONTROL 67 HC/T	YES	MUST HAVE NARROW COVERAGE PATTERN INTENDED FOR HIGH CEILING APPLICATIONS, 75 DEGREE, 70V TRANSFORMER
CEILING SPEAKER	JBL	CONTROL 416C/T	YES	6.5" TWO-WAY CEILING SPEAKER, 70V TRANSFORMER, ZERO BEZEL DESIGN, 120 DEGREE CONICAL COVERAGE
AMPLIFIER	EXTRON	XPA 2001	YES	
HDMI TX	QSC	NV-1-H-WE	YES	
OFCI WIRELESS PRES	OWNER FURNISHED		N/A	
TRANSCODER	QSC	NV-21-HU	YES	
PROJECTOR	EPSON	POWERLITE L890U	YES	
PROJECTION SCREEN	DRAPER		YES	
BULK MATERIALS	MISC	MISC	YES	PROVIDE CABLES, CONNECTORS, IO CARDS, SUMMING AMPLIFIERS, ADAPTERS, AND ALL OTHER EQUIPMENT NOT SPECIFICALLY LISTED HERE TO ENSURE ADHERENCE TO DESIGN INTENT.



2 AV - SIGNAL FLOW - GYM
NO SCALE

GYMNASIUM BOD EQUIPMENT LIST				
ITEM	MANUFACTURER	MODEL	SUBSTITUTION ACCEPTED UPON APPROVAL	NOTES
AV EQUIPMENT RACK	MIDDLE ATLANTIC	BGR-19SA27	YES	INCLUDE FAN, CASTER BASE, BLANK PANELS, VERTICAL POWER STRIP(S), LACING BARS, FRONT AND REAR RACK RAILS, AND FRONT AND REAR DOORS. INCLUDE ACCESSORIES AS REQUIRED TO MEET DESIGN INTENT. SUBSTITUTIONS SHALL PROVIDE 19 MIN. RACK SPACES AT 25" MIN. DEPTH
DSP	QSC	CORE 8 FLEX	YES	
CONTROL PANEL	QSC	TSC-70-G3	YES	
CONTROL PANEL COVER	FSR	WB-TSC-SM-10	YES	
ALS	LISTEN	LS-53-216	YES	
XLR TO DANTE	ATTERO TECH	UNDX210+	YES	
WIRELESS MIC RX	SHURE	MXWAPX4	YES	
WIRELESS HANDHELD	SHURE	MXW2X/SM58	YES	
MIC CHARGER	SHURE	MXWNDX	YES	
SPEAKER	FULCRUM ACOUSTIC	DX12	YES	DUAL 12" COAXIAL LOUDSPEAKER, 400W POWER HANDLING, 50 HZ - 20 KHZ, PROVIDE YOKE MOUNT
AMPLIFIER	FULCRUM ACOUSTIC	DRIVEFLEX 46	YES	600W PER CHANNEL, 4 CHANNELS, POWER SHARING
HDMI TX	QSC	NV-1-H-WE	YES	
OFCI WIRELESS PRES	OWNER FURNISHED		N/A	
TRANSCODER	QSC	NV-21-HU	YES	
REMOTE IO	QSC	QIO-LVR4	YES	
PROJECTOR	EPSON	EB-PU2010W	YES	
PROJECTOR LIFT	DRAPER	SLX21	YES	
PROJECTION SCREEN	DRAPER	140034U	YES	
BULK MATERIALS	MISC	MISC	YES	PROVIDE CABLES, CONNECTORS, IO CARDS, SUMMING AMPLIFIERS, ADAPTERS, AND ALL OTHER EQUIPMENT NOT SPECIFICALLY LISTED HERE TO ENSURE ADHERENCE TO DESIGN INTENT.

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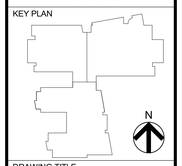

DRAWING TITLE

AUDIO VISUAL SIGNAL FLOW - CAFETERIA AND GYM

STATE PROJ. NO.	144-0108N
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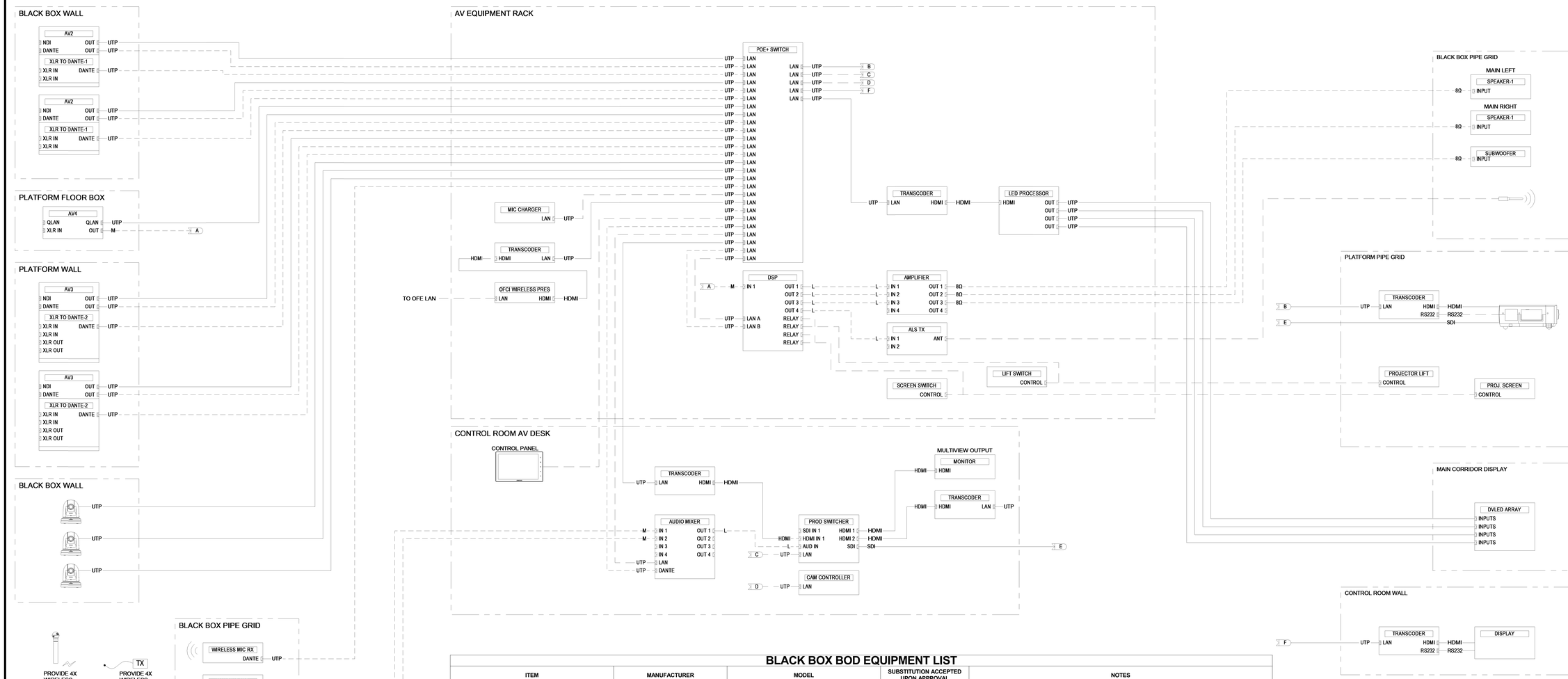

BLACK BOX BOD EQUIPMENT LIST

ITEM	MANUFACTURER	MODEL	SUBSTITUTION ACCEPTED UPON APPROVAL	NOTES
AV EQUIPMENT RACK	MIDDLE ATLANTIC	BGR-19SA27	YES	INCLUDE FAN, CASTER BASE, BLANK PANELS. VERTICAL POWER STRIP(S), LACING BARS, FRONT AND REAR RACK RAILS, AND FRONT AND REAR DOORS. INCLUDE ACCESSORIES AS REQUIRED TO MEET DESIGN INTENT. SUBSTITUTIONS SHALL PROVIDE 19 MIN. RACK SPACES AT 25" MIN. DEPTH
DSP	QSC	CORE 8 FLEX	YES	
CONTROL PANEL	QSC	TSC-70-G3	YES	
ALS	LISTEN	LS-53-216	YES	
XLR TO DANTE-1	ATTERO TECH	AXON D2I	YES	2 XLR IN DANTE INTERFACE
XLR TO DANTE-2	ATTERO TECH	UNDX210+	YES	2 XLR IN, 2 XLR OUT DANTE INTERFACE
TRANSCODER	QSC	NV-21-HU	YES	PROVIDE (2) ADDITIONAL BEYOND THOSE SHOWN IN LINE DIAGRAMS FOR PORTABLE USE
SPEAKER	FULCRUM ACOUSTIC	CCX1277	YES	12 INCH SUBCARDIOD COAXIAL LOUDSPEAKER, EYE BOLT SUSPENSION POINTS
SUBWOOFER	FULCRUM ACOUSTIC	CS218L	YES	DUAL 18 INCH SUBCARDIOID SUBWOOFER, EYE BOLT SUSPENSION POINTS
AMPLIFIER	FULCRUM ACOUSTIC	DRIVEFLEX 412	YES	4 X 1200W AMPLIFIER WITH DSP
PTZ CAMERA	PANASONIC	AW-UE50 SERIES	YES	4K PTZ CAMERA WITH 24X ZOOM, POE POWER, NATIVE NDI HX OUTPUT, 3G-SDI OUTPUT, PROVIDE WALL...
PRODUCTION SWITCHER	OSEE	GOSTREAM DUET 8 ISO	YES	8 INPUT CHANNELS INCLUDING SIMULTANEOUS HDMI, SDI, AND NDI, OUTPUTS FOR PROGRAM, PREVIEW, AN...
CAMERA CONTROLLER	PTZCAM	VIEW NDI MINI	YES	PTZ CAMERA CONTROLLER WITH SUPPORT FOR NDI, MINIMUM 8 NDI CAMERA SUPPORT
AUDIO MIXER	YAMAHA	MD3-D	YES	DIGITAL MIXING CONSOLE WITH 12 XLR INPUTS, NATIVE DANTE SUPPORT, SUPPORT FOR WIRELESS...
STAGE BOX	YAMAHA	TIO1608-D2	YES	PROVIDE WITH RACK CASE
WIRELESS MIC RX	SHURE	MXWAPX8	YES	
WIRELESS HANDHELD	SHURE	MXW2X/SM58	YES	
WIRELESS BODYPACK	SHURE	MXW1X	YES	
MIC CHARGER	SHURE	MXWNDX	YES	
HANGING MICROPHONE	RODE	NT5	YES	SMALL DIAPHRAGM CONDENSER MICROPHONE, PROVIDE SHOCK MOUNTS AND SMALL STEREO BAR AS REQUIRED TO FORM AN ORTF ARRAY
PROJECTOR	EPSON	L1505UHNL	YES	4K LASER PROJECTOR, 10K LUMENS, PROVIDE LENS FOR THROW DISTANCE SHOWN ON DRAWINGS
PROJECTOR LIFT	DRAPER	SLX SERIES	YES	LIFT WITH BOTTOM CLOSURE PANEL, SUPPORTS MIN 200 LB, DROP DISTANCE AS REQUIRED TO REACH 10' ABOVE FLOOR IN SERVICE POSITION, PROVIDE HARDWARE AS REQUIRED TO ATTACH TO PIPE GRID
PROJECTION SCREEN	DRAPER	PERMIER SERIES	YES	SIZE AND BLACK DROP AS SHOWN ON DRAWINGS, WHITE REAR PROJECTION MATERIAL, LOW VOLTAGE CONTROL, PROVIDE HARDWARE AS REQUIRED TO ATTACH TO PIPE GRID
DVLED ARRAY	SQUAREV	VFP1.5 SERIES	YES	1.5MM PIXEL PITCH, INCLUDES LED PROCESSOR, SIZE AS SHOWN ON DRAWINGS
LED PROCESSOR	INCL ABOVE	INCL ABOVE	YES	INCLUDED IN DVLED ARRAY SYSTEM
WIRELESS PRESENTATION	OFCI	OFCI	N/A	OWNER FURNISHED WIRELESS PRESENTATION PLATFORM
FLAT PANEL DISPLAY	SAMSUNG	QM-C SERIES	YES	SIZE AS NOTED IN DRAWINGS. DISPLAY SHALL INCLUDE AUTO-ON, AUTO-OFF, AND AUTO-SWITCHING WITH PRIORITY UPON SIGNAL SENSE. DISPLAY SHALL BE COMMERCIAL GRADE AND RATED FOR MINIMUM 16/HRS A DAY. DISPLAY MODEL SHALL HAVE A MINIMUM 3 YEAR WARRANTY. LG DISPLAYS WILL NOT BE ALLOWED ON THIS PROJECT.
DISPLAY MOUNT	CHIEF	TS325TU	YES	SUBSTITUTION MUST BE PULLOUT OR SWING ARM MOUNT AND COMPATIBLE WITH BACK BOX.
BULK MATERIALS	MISC	MISC	YES	PROVIDE CABLES, CONNECTORS, IO CARDS, SUMMING AMPLIFIERS, ADAPTERS, AND ALL OTHER EQUIPMENT NOT SPECIFICALLY LISTED HERE TO ENSURE ADHERENCE TO DESIGN INTENT.

1 AV - SIGNAL FLOW - BLACK BOX
NO SCALE

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STATE OF CONNECTICUT ROBERT S. LARAIA No. 62 LICENSED TELECOMMUNICATION TECHNOLOGIST
Signed on 05/18/2026
using a Digital Signature.

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KEY PLAN

DRAWING TITLE
AUDIO VISUAL SIGNAL FLOW - BLACK BOX

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ISSUE DATES

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1 AV - RACK PLATE DETAIL
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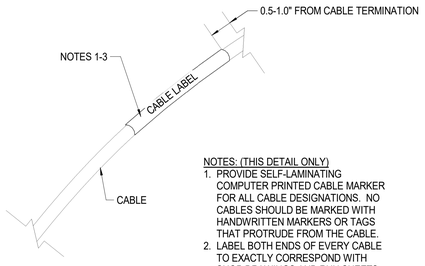

NOTES: (THIS DETAIL ONLY)
1. PROVIDE SELF-LAMINATING COMPUTER PRINTED CABLE MARKER FOR ALL CABLE DESIGNATIONS. NO CABLES SHOULD BE MARKED WITH HANDWRITTEN MARKERS OR TAGS THAT PROTRUDE FROM THE CABLE.
2. LABEL BOTH ENDS OF EVERY CABLE TO EXACTLY CORRESPOND WITH SHOP DRAWINGS AND RUN SHEETS APPROVED DURING THE SUBMITTAL PROCESS.
3. LABELS SHOULD USE A MINIMUM 0.09375" TALL LETTERS.

2 TYPICAL AV CABLE LABELING
NO SCALE

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AUDIO VISUAL DETAILS

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AUDIO VISUAL INFRASTRUCTURE SYMBOLS LEGEND

DRAWING SYMBOL	DESCRIPTION	BACKBOX SIZE	MOUNTING HEIGHT AFF UON	(QTY) CONDUIT SIZE (AV)	AV-SPECIFIC DATA DROPS PROVIDED BY TELECOM	POWER PROVIDED BY EC	DETAIL (DETAIL/ SHEET)	
YY D3	YY = INCH DISPLAY FLAT PANEL DISPLAY BACKBOX	2G	60"	(1) - 1.25"	2	DUPLEX	1 / AVI7.01	PROVIDE POWER AND DATA ADJACENT TO GANG BOX. STUB AV CONDUIT TO ABOVE CEILING IN SAME ROOM AS EQUIPMENT. UON. PROVIDE IN-WALL PLYWOOD OR METAL BLOCKING TO SUPPORT WEIGHT OF DISPLAY AND EQUIPMENT. SEE TYPICAL BLOCKING DETAIL FOR BLOCKING REQUIREMENTS. DISPLAY AND MOUNT TO BE PROVIDED UNDER THE AV CONTRACT. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR
DV	DVLED WALL BOX SEE ELEVATIONS	SEE ELEVATIONS	SEE ELEVATIONS	SEE ELEV.	SEE ELEVATIONS	SEE ELEVATIONS	-	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. PROVIDE POWER AND DATA CONNECTIONS PER ELEVATION. PROVIDE IN-WALL PLYWOOD OR METAL BLOCKING TO SUPPORT WEIGHT OF DISPLAY AND EQUIPMENT. SEE INDIVIDUAL DVLED WALL ELEVATIONS FOR BLOCKING REQUIREMENTS. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR.
W1	WALL JUNCTION BOX TYPE 1	1G	48"	(1) - 1"	-	-	1 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. PROVIDE POWER AND DATA CONNECTIONS WITHIN 1 STUD FRAME OR 6" FROM THE AV WALL PLATE. SEE TYPICAL WALL PLATE DETAIL FOR ADDITIONAL INFORMATION. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR.
W2	WALL JUNCTION BOX TYPE 2	2G	18"	(1) - 1.25"	2	DUPLEX	1 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. PROVIDE POWER AND DATA CONNECTIONS WITHIN 1 STUD FRAME OR 6" FROM THE AV WALL PLATE. SEE TYPICAL WALL PLATE DETAIL FOR ADDITIONAL INFORMATION. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR. AV SHALL NOT SHARE SAME JUNCTION BOX AS POWER OR DATA.
W3	WALL JUNCTION BOX TYPE 3	2G	48"	(1) - 1.25"	-	-	1 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. WALL BOX PROVIDED BY ELECTRICAL CONTRACTOR. AV SHALL NOT SHARE SAME JUNCTION BOX AS POWER OR DATA.
W4	WALL JUNCTION BOX TYPE 4	4G	18"	(1) - 1.25"	-	DUPLEX	1 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. PROVIDE POWER AND DATA CONNECTIONS WITHIN 1 STUD FRAME OR 6" FROM THE AV WALL PLATE. SEE TYPICAL WALL PLATE DETAIL FOR ADDITIONAL INFORMATION. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR. AV SHALL NOT SHARE SAME JUNCTION BOX AS POWER OR DATA.
W5	WALL JUNCTION BOX TYPE 5	2G	48"	(1) - 1"	-	-	1 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. SEE EQUIPMENT TYPE MARK FOR ADDITIONAL INFORMATION. BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR.
J1	CEILING JUNCTION BOX TYPE 1	1G	CEILING	(1) - 1"	-	-	-	CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE. PROVIDE CONDUIT IN INACCESSIBLE CEILINGS ONLY UON. ENSURE COMPLETE PATHWAY BETWEEN BACKBOX POSITION AND CORRESPONDING AV EQUIPMENT.
J2	CEILING JUNCTION BOX TYPE 2	NEMA 8x8	CEILING	SEE RCP	-	-	-	CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE. PROVIDE CONDUIT IN INACCESSIBLE CEILINGS ONLY UON. ENSURE COMPLETE PATHWAY BETWEEN BACKBOX POSITION AND CORRESPONDING AV EQUIPMENT.
SS	CEILING SURFACE MOUNTED SPEAKER	-	CEILING	SEE RCP	-	-	-	CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE. PROVIDE CONDUIT IN INACCESSIBLE CEILINGS ONLY UON. ENSURE COMPLETE PATHWAY BETWEEN SPEAKER POSITION AND CORRESPONDING AV AMPLIFIER.
SW	CEILING SURFACE MOUNTED SUBWOOFER	-	CEILING	(1) - 1"	-	-	-	CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE. PROVIDE CONDUIT IN INACCESSIBLE CEILINGS ONLY UON. ENSURE COMPLETE PATHWAY BETWEEN SPEAKER POSITION AND CORRESPONDING AV AMPLIFIER.
PS	CEILING SUSPENDED PENDANT SPEAKER	-	CEILING	(1) - 1"	-	-	2 / AVI7.02	CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE. PROVIDE CONDUIT IN INACCESSIBLE CEILINGS ONLY UON. ENSURE COMPLETE PATHWAY BETWEEN SPEAKER POSITION AND CORRESPONDING AMPLIFIER.
S	WALL MOUNTED SPEAKER	1G	SEE ELEVATION	(1) - 1"	-	-	-	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. COORDINATE FINAL LOCATION WITH ARCHITECTUAL DRAWINGS.
	FLOORSTANDING AV RACK	SEE PLAN	SEE PLAN	SEE PLAN	SEE PLAN	SEE PLAN	-	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. ENSURE CABLE PATHWAY TO ANY ASSOCIATED AV ENABLED SPACE.
P	AV SHARED FLOOR BOX WITH POWER AND DATA TYPE 1	WIREMOLD 8AT	FLOOR	(1) - 1.25"	2	DUPLEX	6 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. SEE RCP FOR ANY ADDITIONAL REQUIREMENTS. COORDINATE BOX COVER FINISH AND COLOR WITH ARCHITECT. SEE ELECTRICAL DRAWINGS FOR POWER REQUIREMENTS. SEE TELECOM DRAWINGS FOR DATA REQUIREMENTS.
F	AV SHARED FLOOR BOX WITH POWER AND DATA TYPE 2	FSR-600P	FLOOR	(1) - 1.25"	2	DUPLEX	5 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. SEE RCP FOR ANY ADDITIONAL REQUIREMENTS. COORDINATE BOX COVER FINISH AND COLOR WITH ARCHITECT. SEE ELECTRICAL DRAWINGS FOR POWER REQUIREMENTS. SEE TELECOM DRAWINGS FOR DATA REQUIREMENTS.
	PROJECTOR	CHIEF CMS492C	CEILING	(1) - 1.25"	2	QUAD	-	ELECTRICAL CONTRACTOR TO STAGE POWER AND COORDINATE TERMINATION INTO PROJECTOR ENCLOSURE WITH AV CONTRACTOR. CONDUIT SHALL ROUTE TO THE AV RACK ASSOCIATED FOR THIS SPACE. FOR ACCESSIBLE CEILINGS, PROVIDE CONDUIT PATHWAY TO EACH ACCESSIBLE CEILING AREA WITH AV EQUIPMENT. CABLING WITHIN ACCESSIBLE CEILINGS MAY BE ROUTED WITH J-HOOKS.
CO	PROJECTOR LIFT	-	CEILING	(1) - 1.25"	2	DEDICATED 20A	3 / AVI7.02	ELECTRICAL CONTRACTOR TO STAGE POWER AND COORDINATE TERMINATION INTO PROJECTOR ENCLOSURE WITH AV CONTRACTOR. PROVIDE CONDUIT TO ACCESSIBLE CEILING SPACE, IN CEILINGS THAT ARE INACCESSIBLE PROVIDE CONDUIT TO LOCATION SHOWN IN DRAWINGS.CABLING WITHIN ACCESSIBLE CEILINGS MAY BE ROUTED WITH J-HOOKS.
	MOTORIZED PROJECTION SCREEN	-	CEILING	(1) - 1"	-	HARDWIRED	3 & 4 / AVI7.01	PROVIDE CONDUIT TO NEAREST ACCESSIBLE CEILING, UON. ELECTRICAL CONTRACTOR TO STAGE POWER AND COORDINATE TERMINATION INTO SCREEN WITH AV CONTRACTOR. COORDINATE FINAL LOCATION WITH ARCHITECTUAL DRAWINGS.

WALL DEVICES

- ZZ AFF — YY D — DISPLAY BACK BOX
- ZZ AFF — XX W — AV WALL BOX
- ZZ AFF — YY S — AV WALL MOUNTED SPEAKER

FLOOR DEVICES

- XX — XX F — FLOOR BOX
- XX — XX P — FLOOR POKE-THROUGH
- XX — XX J — FLOOR JUNCTION BOX

CEILING DEVICES

- YY D — AV CEILING MOUNTED DISPLAY
- XX J — AV CEILING JUNCTION BOX
- W S — AV CEILING SPEAKER
- W P — AV PENDANT SPEAKER
- M — AV CEILING MICROPHONE
- C — AV CEILING CAMERA

SUB-LABEL LEGEND

VV = SPEAKER ZONE

XX = AV EQUIPMENT OR PLATE TYPE MARK

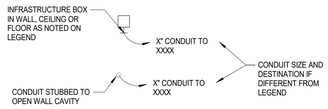
YY = DIAGONAL SCREEN SIZE OF DISPLAY (IN INCHES)

ZZ = HEIGHT OF INFRASTRUCTURE IF DIFFERENT FROM INFRASTRUCTURE LEGEND

AV EQUIPMENT TYPE MARK

ANT	-	ANTENNA
AV#	-	AV CUSTOM PLATE (SEE PLATE DETAILS SHEET)
CAM	-	CAMERA
CP	-	CONTROL PANEL OR CONTROL TOUCH PANEL
IR	-	INFRARED TRANSMITTER
MIC	-	MICROPHONE
PR	-	PARTITION SENSOR
SP	-	SCHEDULING PANEL
SC	-	SCREEN CONTROL SWITCH
OC	-	OCCUPANCY SENSOR
VTC	-	VIDEO CONFERENCE SOUNDBAR

CONDUIT CALLOUT



NOTES:

1. CONDUIT SIZE AND DESTINATION ARE SHOWN ONLY WHEN REQUIREMENTS DIFFER FROM LEGEND.
2. CONDUIT CONNECTED TO BOX PER MANUFACTURES INSTRUCTIONS.
3. CONDUIT STUBBED TO OPEN WALL CAVITY REAM AND BUSH CONDUIT END.

GENERAL NOTES (APPLIES TO ALL SHEETS)

1. COORDINATE ALL POWER REQUIREMENTS WITH ELECTRICAL CONTRACTOR.
2. COORDINATE ALL DATA REQUIREMENTS WITH TELECOM CONTRACTOR. DATA DROP QUANTITIES DEFINED IN THE LEGEND ARE MINIMUM DROPS TO SUPPORT AV SYSTEMS IDENTIFIED FOR COORDINATION PURPOSES ONLY. THEY ARE NOT COMPREHENSIVE OF DATA REQUIRED FOR ALL DISCIPLINES. SEE TELECOM PLANS FOR TOTAL DATA COUNTS PER DEVICE TYPE.
3. COORDINATE ALL FURNITURE CUTOUTS WITH FURNITURE PROVIDER.
4. AV CONDUIT SHOWN IN LEGEND IS FOR AV CABLING ONLY. CONDUITS REQUIRED FOR POWER AND DATA ARE SPECIFIED ON THE ELECTRICAL AND TELECOM DRAWINGS, RESPECTIVELY. NO AV CABLING SHALL SHARE A CONDUIT WITH TELECOM OR POWER.
5. ALL WALL BOX HEIGHTS ARE TO CENTER OF BOX U.O.N
6. FINAL HEIGHT AND MOUNTING LOCATIONS SHALL BE COORDINATED WITH THE ARCHITECTURAL ELEVATIONS.
7. FIELD VERIFY ALL DIMENSIONS PRIOR TO INSTALLATION OF EQUIPMENT.
8. INFRASTRUCTURE FOR AV SHALL ADHERE TO DIVISION 26 AND DIVISION 27 SPECIFICATIONS.
9. PROVIDE SEPARATE RACEWAY PATH FOR MICROPHONE LEVEL AUDIO SIGNALS.
10. ROUTING OF CONDUIT SHOWN FOR DESIGN INTENT ONLY. COORDINATE EXACT ROUTE BASED ON FIELD CONDITIONS.
11. REAM AND BUSH ALL CONDUIT ENDS. PROVIDE PULL STRING IN ALL CONDUIT RUNS.
12. PROVIDE BLANK PLATES FOR BOXES LEFT OR DENOTED AS "BLANK" FOR FUTURE INSTALLATIONS.
13. ALL UTP CABLING SHALL BE PLENUM RATED, UON.
14. CEILING SPEAKERS ARE SHOWN FOR ZONING, CONDUIT SIZING, AND ROUTING ONLY. REFERENCE ARCHITECTURAL RCP FOR EXACT CEILING SPEAKER LOCATIONS.
15. ALL CATEGORY CABLING FOR AV USE SHALL BE TERMINATED BY THE AV CONTRACTOR INTO JACKS. ALL PATCH CABLES PROVIDED BY THE AV CONTRACTOR SHALL BE PREFABRICATED. NO SHIELDED RJ45 PLUGS SHALL BE FIELD TERMINATED ON THIS PROJECT.
16. USE VELCRO STRAPS FOR ALL CABLE MANAGEMENT APPLICATIONS. TIE WRAPS ARE PROHIBITED.
17. ALL CONDUITS TO NEAREST ACCESSIBLE CEILING SHALL BE STUBBED UP INTO THE SAME ROOM UON ON THE PLANS.
18. CABLES ROUTED ON J-HOOKS SHALL BE PARALLEL OR PERPENDICULAR TO WALLS AND STRUCTURAL ELEMENTS AND SHALL BE KEPT IN A NEAT BUNDLE. RUNNING CABLE DIAGONALLY ACROSS ANY SPACE INCLUDING AREAS CONCEALED ABOVE ACCESSIBLE CEILINGS SHALL NOT BE PERMITTED.

SCOPE GUIDANCE NOTES (APPLIES TO ALL SHEETS)

1. ELECTRICAL SCOPE:
   THE INFRASTRUCTURE PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE ELECTRICAL CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   1.1. GROUNDING BUS AND GROUND BARS
   1.2. EMPTY CONDUIT WITH PULL-WIRE
   1.3. SLEEVES THROUGH WALL PARTITIONS
   1.4. JUNCTION BOXES AND BACK BOXES
   1.5 FLOOR BOXES
   1.6 POWER OUTLETS
   1.7 DISPLAY BACK BOXES
   1.8 ACOUSTICS REQUIREMENTS FOR AV BACK BOXES SUCH AS MASS LOADED VINYL, PUTTY PACK, OR INSULATION REQUIREMENTS, ARE DETAILED IN THE ARCHITECTURAL DRAWINGS. ALL AV BACK BOX INSTALLATIONS MUST ADHERE TO THESE REQUIREMENTS. REFERENCE ARCHITECTURAL DRAWINGS FOR MORE INFORMATION
2. STRUCTURED CABLING SCOPE:
   THE DATA/TELECOM CABLING PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE COMMUNICATIONS CABLING CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   2.1. ALL DATA CABLING FROM IDF/MDF NETWORK PATCH PANELS TO FACEPLATES OR TERMINATION BLOCKS
   2.2. TERMINATIONS OF DATA CONNECTORS, JACKS, AND FACEPLATES
3. AUDIO VISUAL SCOPE:
   THE AUDIO VISUAL PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE AUDIO VISUAL CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   3.1. DISPLAY DEVICES SUCH AS FLAT PANEL TVS, PROJECTORS, AND SCREENS.
   3.2. AUDIOVISUAL EQUIPMENT, SUCH AS AV RACKS, TRANSMITTERS, RECEIVERS, AND CONTROLLERS.
   3.3. PROPRIETARY AV CABLING, SUCH AS HDbT, HDMI, SPEAKER WIRES, AND CONTROL CABLES.
   3.4. PROPRIETARY AV STORAGE AND MOUNTING DEVICES, SUCH AS PROJECTOR ENCLOSURES AND DISPLAY MOUNTS.

ABBREVIATIONS

ABV	ABOVE
AFF	ABOVE FINISHED FLOOR
ARF	ABOVE RAISED FLOOR
AFC	ABOVE FINISHED CEILING
BFC	BELOW FINISHED CEILING
ARCH	ARCHITECT/ARCHITECTUAL
BEL	BELOW
C	CONDUIT
CLG	CEILING
CONN	CONNECT/CONNECTION
CONT	CONTINUATION/CONTINOUS
FL	FLOOR
LAN	LOCAL AREA NETWORK
N/A	NOT APPLICABLE
N/I	NOT ISSUED
NTS	NOT TO SCALE
NIC	NOT IN CONTRACT
OFE	OWNER FURNISHED EQUIPMENT
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
SCRN	PROJECTOR SCREEN
SPEC	SPECIFICATIONS
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED

AVI SHEET LIST

Sheet Number	Sheet Name
AVI0.01	AUDIO VISUAL INFRASTRUCTURE LEGEND AND NOTES
AVI1.02A	AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA A
AVI1.02B	AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA B
AVI2.12A	AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA A
AVI2.12B	AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA B
AVI6.01	AUDIO VISUAL INFRASTRUCTURE ELEVATIONS
AVI6.02	AUDIO VISUAL INFRASTRUCTURE ELEVATIONS
AVI7.01	AUDIO VISUAL INFRASTRUCTURE DETAILS
AVI7.02	AUDIO VISUAL INFRASTRUCTURE DETAILS

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530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

AUDIO VISUAL INFRASTRUCTURE LEGEND AND NOTES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NO SCALE
DATE	05/19.2026
DRAWN BY	JR
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
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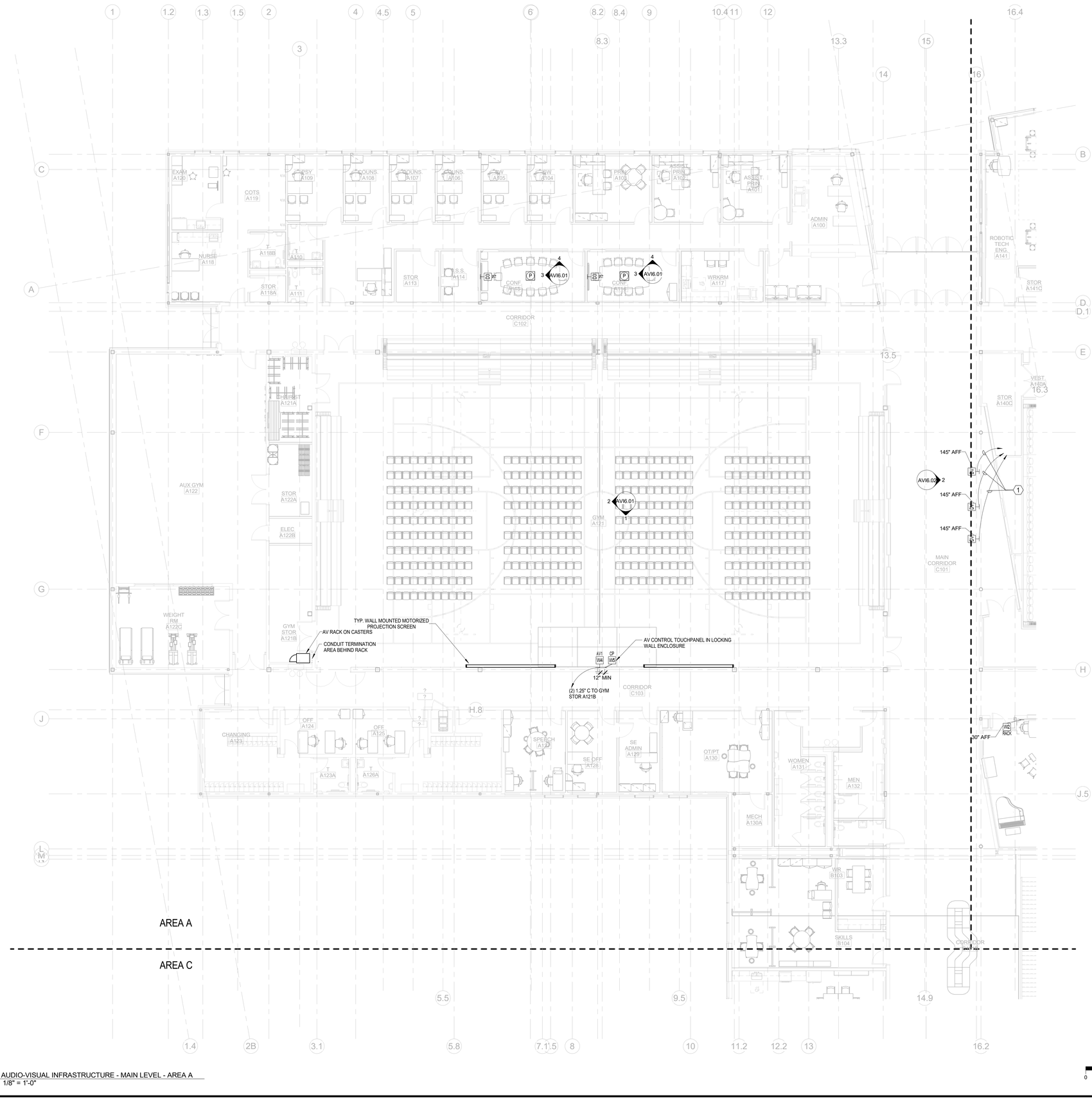

1 AUDIO-VISUAL INFRASTRUCTURE - MAIN LEVEL - AREA A
1/8" = 1'-0"

GENERAL NOTES:

1. REFERENCE ARCHITECTURAL ELEVATIONS PRIOR TO THE INSTALLATION OF ALL FLAT PANEL DISPLAY LOCATIONS.
2. FLOOR BOXES ARE PLACED FOR DIAGRAMMATIC PURPOSES ONLY. REFERENCE ARCHITECTURAL DRAWINGS FOR PRECISE LOCATIONS OF FLOOR BOXES.
3. REFERENCE ARCHITECTURAL DETAILS FOR SCHEDULING PANEL ALIGNMENT WITH ROOM SIGNS. LOCATIONS OF SCHEDULING PANELS SHOWN ARE GENERAL LOCATIONS ONLY AND NOT TO SCALE. FOLLOW GUIDELINES ESTABLISHED BY ARCHITECTURAL DETAILS.
4. RACK POSITION SHOWN FOR DIAGRAMMATIC PURPOSES ONLY. COORDINATE PRECISE RACK PLACEMENT WITH TELECOM CONTRACTOR AND OWNER IT GROUP.

KEYED NOTES:

1. (1) 1.25" C. OR EQUIVALENT PATHWAY TO CONTROL A139A

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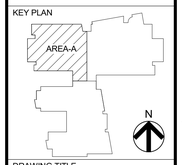

DRAWING TITLE

AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	JR
APPROVED BY	RSL

ISSUE DATES

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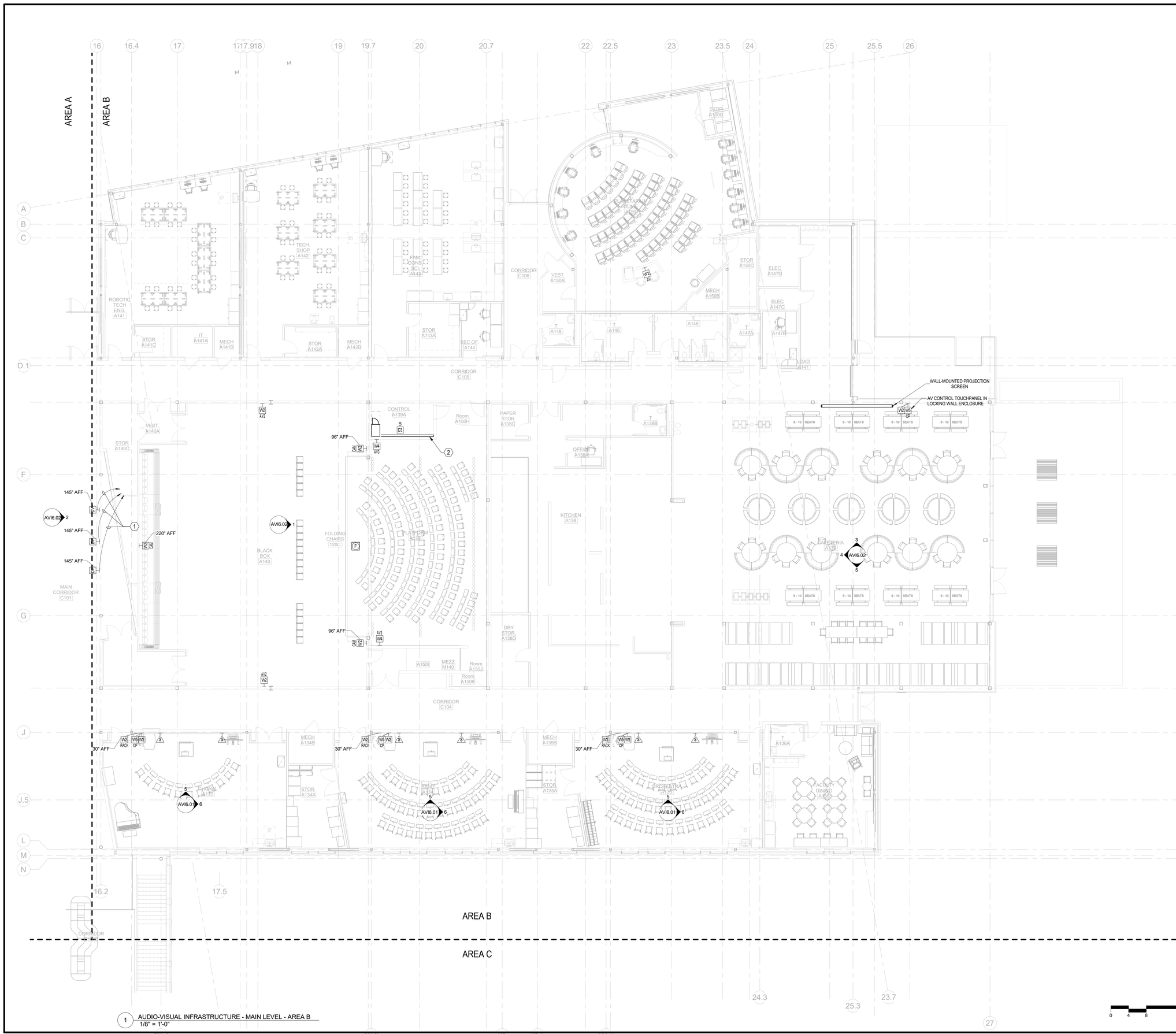

1 AUDIO-VISUAL INFRASTRUCTURE - MAIN LEVEL - AREA B
1/8" = 1'-0"

GENERAL NOTES:

1. REFERENCE ARCHITECTURAL ELEVATIONS PRIOR TO THE INSTALLATION OF ALL FLAT PANEL DISPLAY LOCATIONS.
2. FLOOR BOXES ARE PLACED FOR DIAGRAMMATIC PURPOSES ONLY. REFERENCE ARCHITECTURAL DRAWINGS FOR PRECISE LOCATIONS OF FLOOR BOXES.
3. REFERENCE ARCHITECTURAL DETAILS FOR SCHEDULING PANEL ALIGNMENT WITH ROOM SIGNS. LOCATIONS OF SCHEDULING PANELS SHOWN ARE GENERAL LOCATIONS ONLY AND NOT TO SCALE. FOLLOW GUIDELINES ESTABLISHED BY ARCHITECTURAL DETAILS.
4. RACK POSITION SHOWN FOR DIAGRAMMATIC PURPOSES ONLY. COORDINATE PRECISE RACK PLACEMENT WITH TELECOM CONTRACTOR AND OWNER IT GROUP.

(#) KEYED NOTES:

1. (1) 1.25" C. OR EQUIVALENT PATHWAY TO CONTROL A139A
2. SURFACE-MOUNTED LOW VOLTAGE RACEWAY. PROVIDE SEPARATOR TO MAINTAIN SIGNAL SEPARATION FOR AUDIO AND VIDEO SIGNALS. INSTALL 6" BELOW COUNTERTOP. PROVIDE CABLE ACTIVATIONS EVERY 2'.

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KEY PLAN



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AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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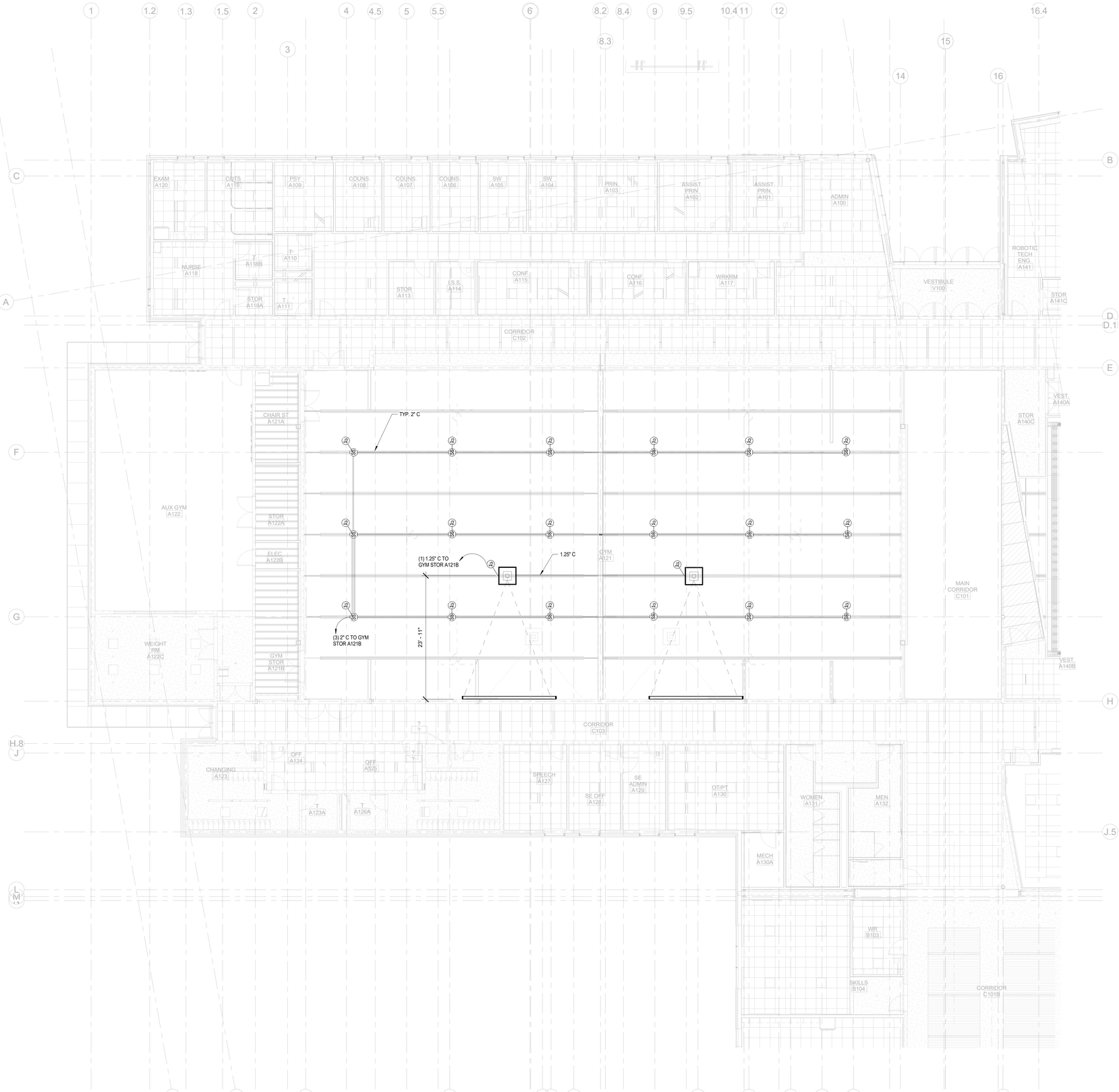

1 AUDIO-VISUAL INFRASTRUCTURE - MAIN LEVEL RCP - AREA A
1/8" = 1'-0"

0 4 8 16

GENERAL NOTES:

1. SPEAKER LAYOUTS ARE DIAGRAMMATIC ONLY. MAINTAIN SYMMETRY WITH LIGHT FIXTURES AND OTHER CEILING ELEMENTS WHILE MAINTAINING UNIFORM COVERAGE PER SPEC REQUIREMENTS. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING PLANS.

KEYED NOTES:

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KEY PLAN



DRAWING TITLE

AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	JR
APPROVED BY	RSL

ISSUE DATES

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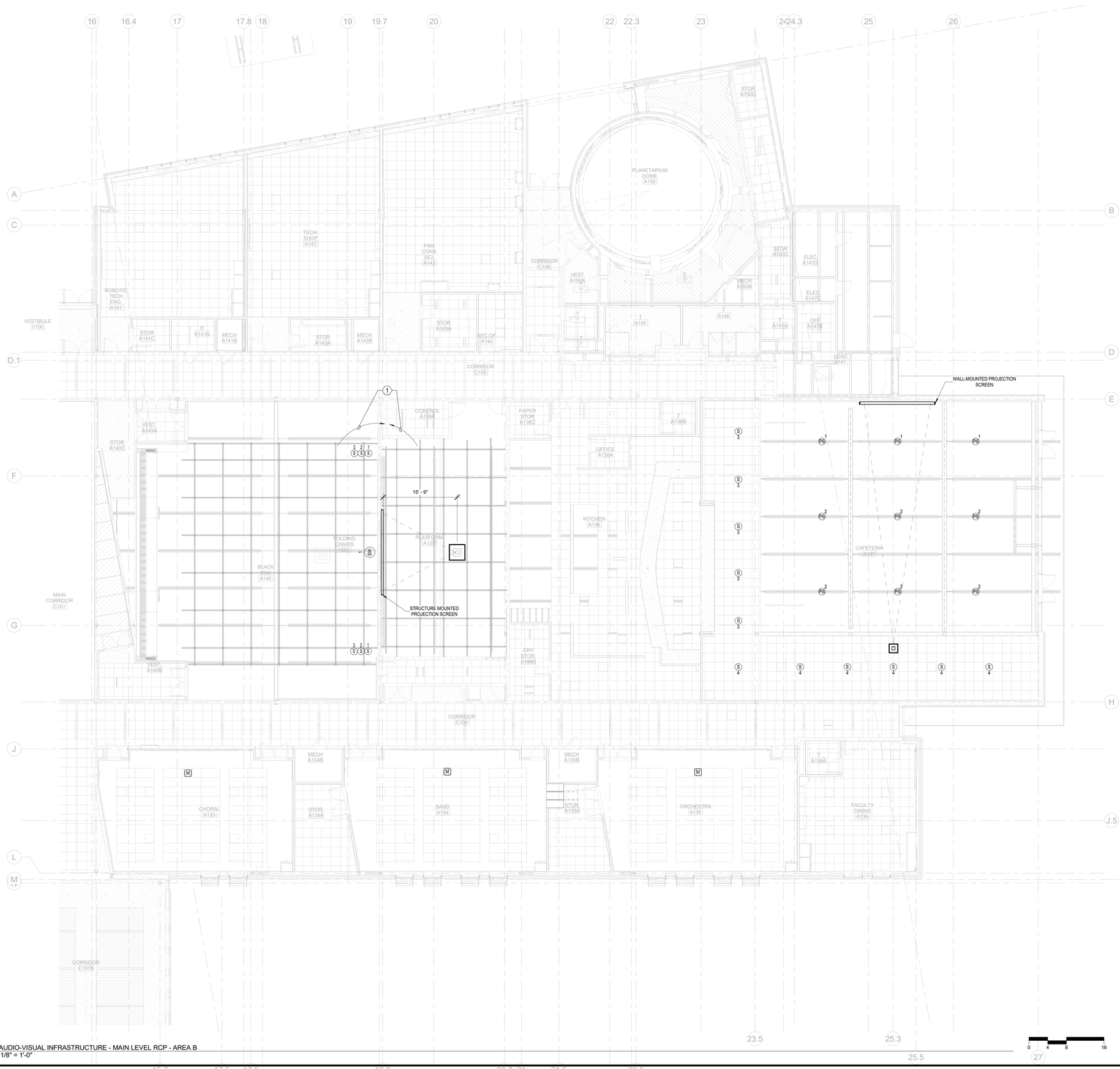

1 AUDIO-VISUAL INFRASTRUCTURE - MAIN LEVEL RCP - AREA B
1/8" = 1'-0"

GENERAL NOTES:

1. SPEAKER LAYOUTS ARE DIAGRAMMATIC ONLY. MAINTAIN SYMMETRY WITH LIGHT FIXTURES AND OTHER CEILING ELEMENTS WHILE MAINTAINING UNIFORM COVERAGE PER SPEC REQUIREMENTS. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING PLANS.

KEYED NOTES:

1. (2) 2" C OR EQUIVALENT PATHWAY FROM ABOVE PIPE GRID TO CONTROL A139A ABOVE ACCESSIBLE CEILING

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STATE OF CONNECTICUT · ROBERT S. LARAIA · TELECOMMUNICATION TECHNICIAN · No. 62 · LICENSED

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

AUDIO VISUAL INFRASTRUCTURE - MAIN LEVEL RCP AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	JR
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

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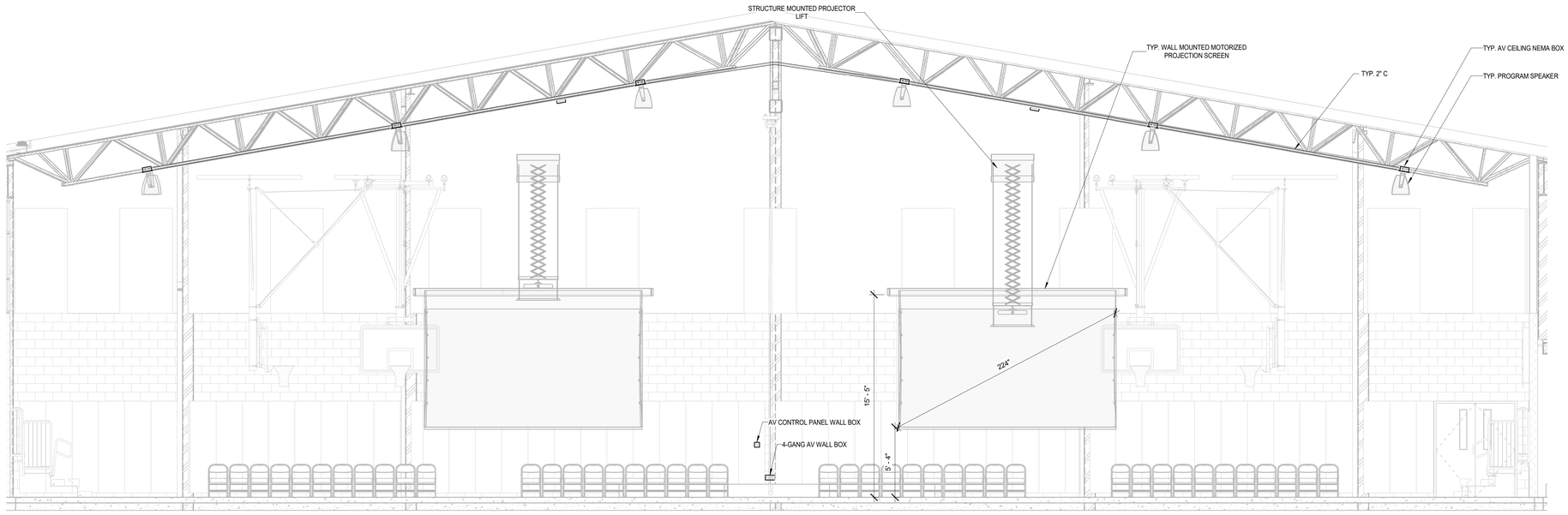
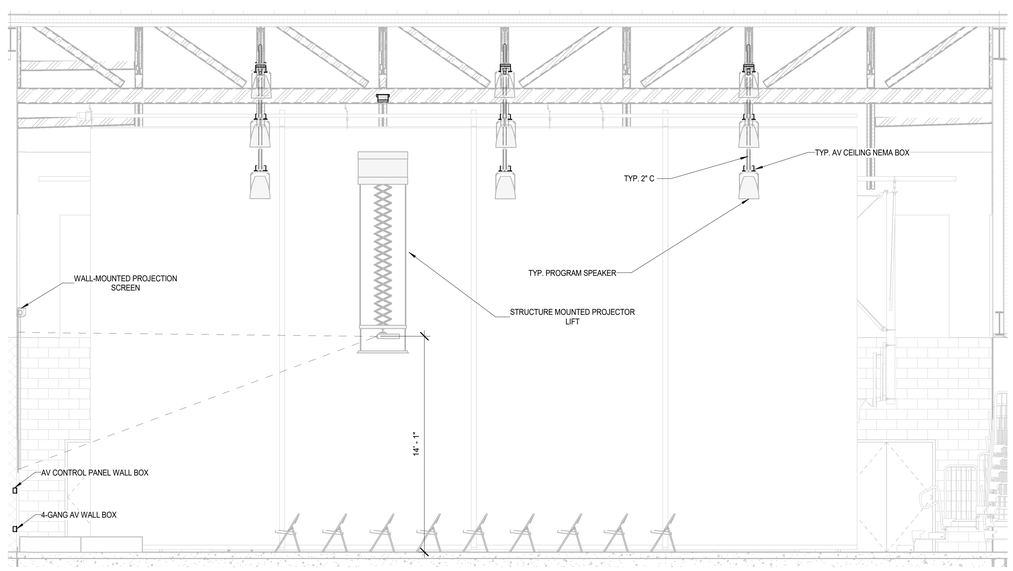
5/19/2026 8:41:48 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-STG_R26.rvt

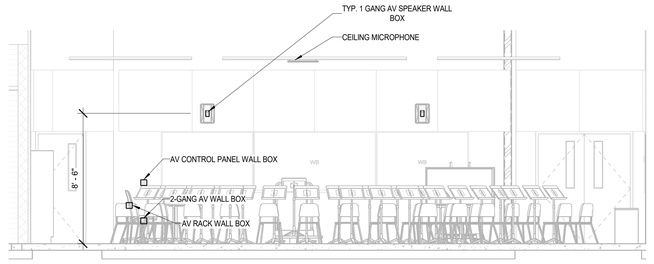
Docusign Envelope ID: 7421B099-F7EC-4432-ADA3-BA95722BEB71



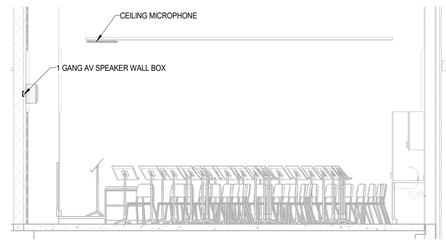
1 GYM A121 PROJECTION LEV.
1/4" = 1'-0"



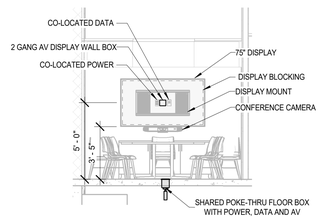
2 GYM A121 SECTION
1/4" = 1'-0"



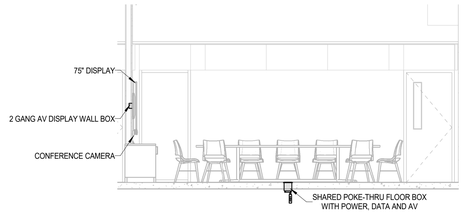
5 TYP. MUSIC CLASSROOM PRESENTATION ELEV.
1/4" = 1'-0"



6 TYP. MUSIC CLASSROOM SECTION
1/4" = 1'-0"



3 TYP. CONF DISPLAY ELEV.
1/4" = 1'-0"



4 TYP. CONF SECTION
1/4" = 1'-0"

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One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

NEWCOMB & BOYD
303 Peachtree Center Avenue, NE
Suite 525
Atlanta, GA 30303-1277
T 404 730-8400
NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT · ROBERT S. LARAIA · No. 62 · LICENSED TELECOMMUNICATION TECHNICIAN

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

AUDIO VISUAL INFRASTRUCTURE ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	05/19.2026
DRAWN BY	JR
APPROVED BY	RSL

ISSUE DATES

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2	12/15/2025	DD Pricing Set
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AVI6.01

5/18/2026 8:42:14 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-STG_R26.rvt

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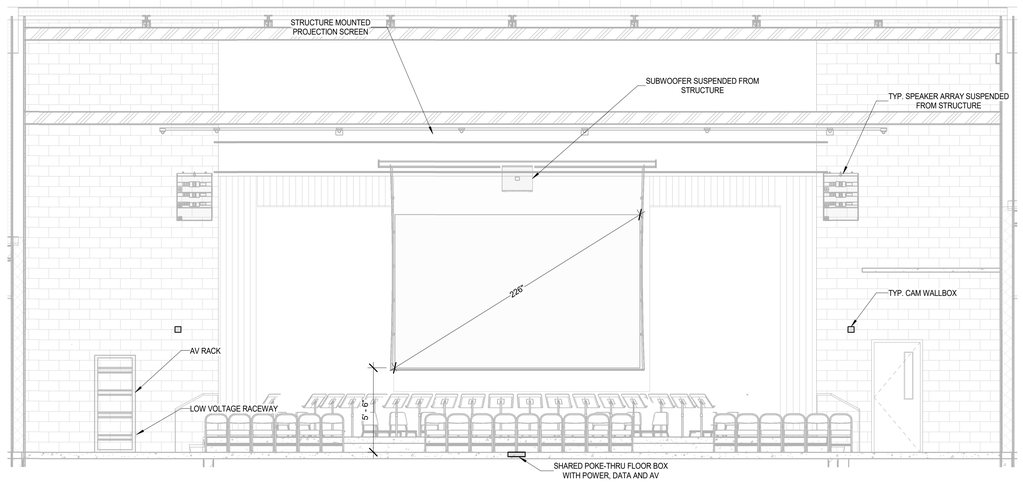
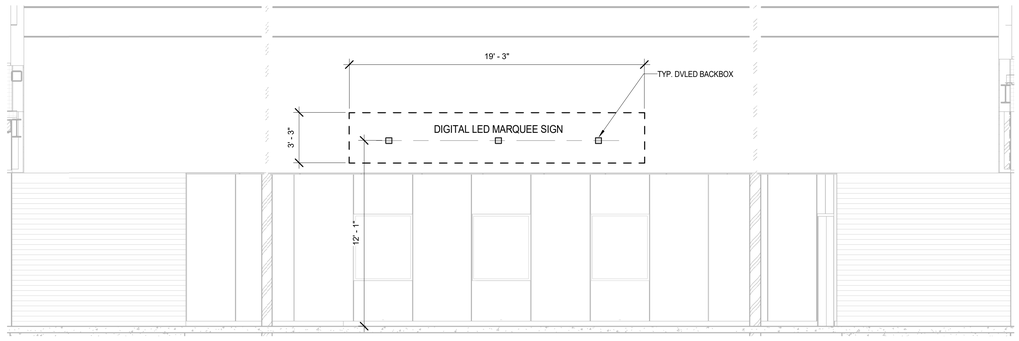
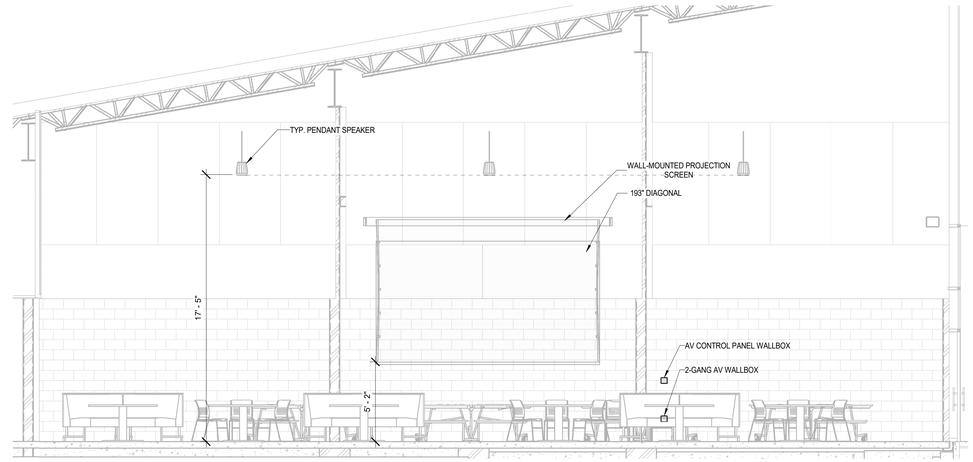


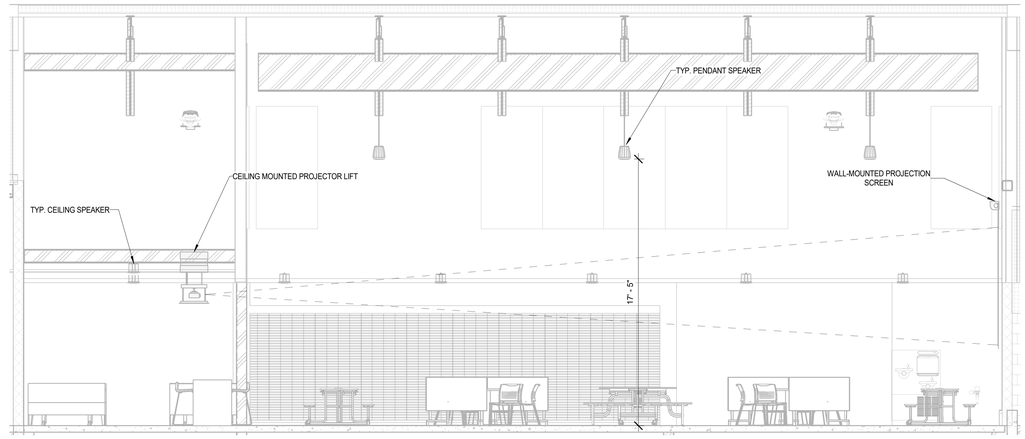
1 PLATFORM A139 BLCK BOX A140 PROJECTION ELEV.
1/4" = 1'-0"



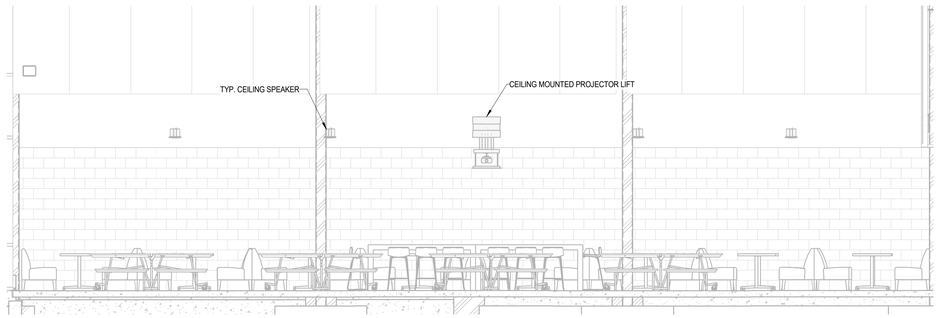
2 MAIN CORRIDOR C101 MARQUEE
1/4" = 1'-0"



3 CAFETERIA A137 - NORTH WALL ELEVATION
1/4" = 1'-0"



4 CAFETERIA A137 - WEST WALL ELEVATION
1/4" = 1'-0"



5 CAFETERIA A137 - SOUTH WALL ELEVATION
1/4" = 1'-0"

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OFFICE PROJ. NO.	250501
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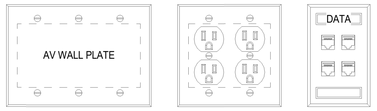
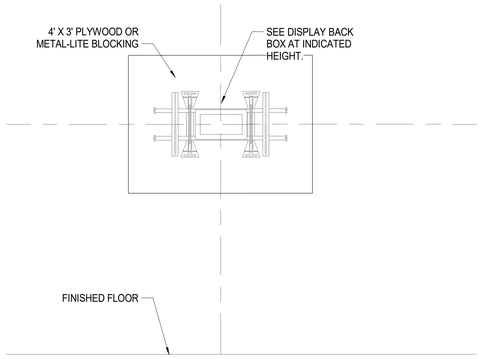


NOTES: (THIS DETAIL ONLY)

1. CUSTOM AV PLATES PROVIDED BY AV CONTRACTOR.
2. DATA PLATE PROVIDED BY DATA CONTRACTOR.
3. POWER PLATE PROVIDED BY ELECTRICAL CONTRACTOR.
4. FOR REFERENCE ONLY. CONFIRM REQUIREMENTS FOR AV, DATA, AND POWER PER SPECIFIC TRADE DRAWINGS.
5. ENSURE AV BACK BOX IS COLLOCATED WITH POWER AND DATA PER THE LEGEND. POWER AND DATA BOXES SHALL BE LOCATED WITHIN 1 STUD FRAME OR 6" OF THE AV BACK BOX.
6. ELECTRICAL, TELCOM, AND AV SHALL NOT SHARE A SINGLE BACK BOX NOR CONDUIT.

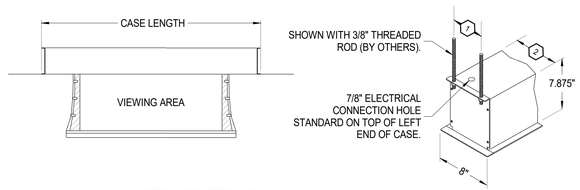
1 AV/POWER/DATA FACEPLATE SPACING
NO SCALE



NOTE:

1. BACK BOX AND DISPLAY MOUNT ARE SHOWN FOR CENTERLINE REFERENCE ONLY. MOUNT AND BACK BOX TO VARY PER DISPLAY TYPE. SEE FLOOR PLANS FOR SPECIFIC BACK BOX PER DISPLAYS.
2. PROVIDE BLOCKING FOR ALL WALL MOUNTED FLAT PANEL DISPLAYS.

2 TYPICAL AV DISPLAY BLOCKING
NO SCALE



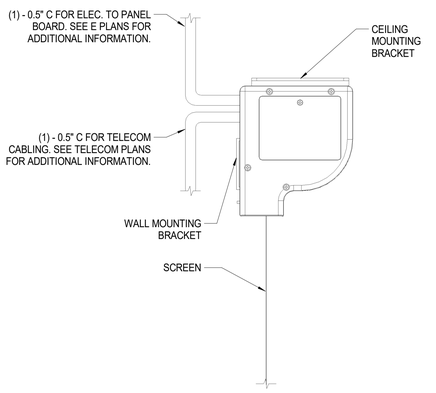
NOTES: (THIS DETAIL ONLY)

1. BASIS OF DESIGN FOR ALL LOW VOLTAGE CONTROLLED FRONT PROJECTION SCREENS IS THE DRAPER ACCESS SERIES V TAB TENSIONED PROJECTION SCREEN.

KEY NOTES: (THIS DETAIL ONLY)

1. 4.875" SEPERATION
2. 6.875" SEPERATION

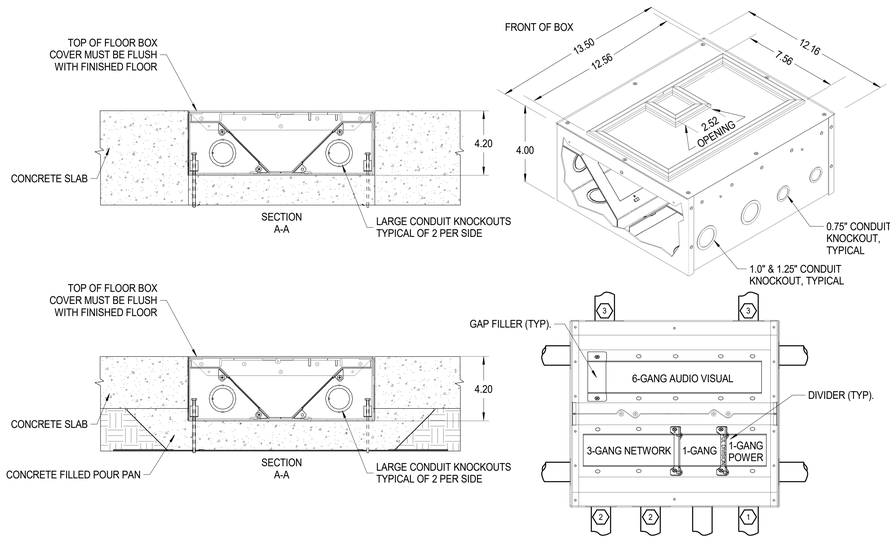
3 AV PROJECTION SCREEN DETAIL
NO SCALE



NOTES: (THIS DETAIL ONLY)

1. BASIS OF DESIGN IS THE DALITE TENSIONED CONTOUR ELECTROL
2. SCREEN. FOLLOW MANUFACTURER'S INSTALLATION INSTRUCTIONS.

4 WALL MOUNTED PROJECTION SCREEN DETAIL
NO SCALE



NOTES (THIS DETAIL ONLY):

1. PROVIDE SIGNAL "DIVIDERS" & "GAP FILLERS" AS REQUIRED.
2. FLOOR BOX DIMENSIONS 13.5" (W) x 12.0" (L) X 8.0" (D).
3. FLOOR BOX HAS (8) CONDUIT KNOCKOUTS ON BOTTOM.
4. ALL KNOCKOUTS ARE FOR 0.75", 1.0", 1.25", 1.50" OR 2.0"CONDUIT.
5. ALL FLOOR BOXES TO HAVE [CARPET FLANGE] [FLAT COVER].

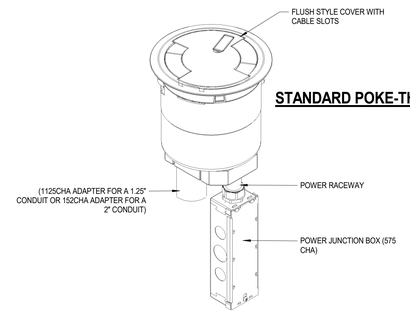
DESIGNER NOTES (THIS DETAIL ONLY):

1. COORDINATE CONDUIT SIZING & CONDUIT RUN DESTINATIONS: (MINIMUM SIGNAL CONDUIT 1.25", POWER 0.75", TELECOM 1.0").

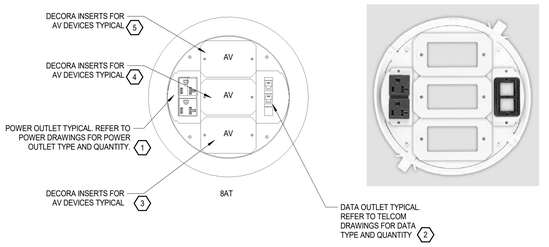
KEY NOTES (THIS DETAIL ONLY):

1. 0.75" CONDUIT FOR ELECTRICAL.
2. 1.0" CONDUIT FOR DATA.
3. 1.25" CONDUIT FOR AUDIO VISUAL.

5 SHARED FLOOR BOX - FSR 600P-4
NO SCALE



STANDARD POKE-THRU COVER



NOTES (THIS DETAIL ONLY):

SELECTED PLATES:

1. COMPARTMENT 1
   68REC - TWO (2) PROPRIETARY 20AMP DUPLEX POWER RECEPTACLES WITH MOUNTING PLATES.
2. COMPARTMENT 2
   682A - 2 PORT COMMUNICATIONS DEVICE PLATE.
3. COMPARTMENT 3
   8DEC - SINGLEGANG DEVICE PLATE THAT WILL ACCEPT DECORATOR STYLE DEVICES SUCH AS 20A RECEPTACLES, GGCIS, 106 ADAPTERS OR A/V DEVICES. FITS IN ANY ONE (1) OF THE THREE (3) GANGS IN THE CENTER COMPARTMENT.
4. COMPARTMENT 4
   8DEC - SINGLEGANG DEVICE PLATE THAT WILL ACCEPT DECORATOR STYLE DEVICES SUCH AS 20A RECEPTACLES, GGCIS, 106 ADAPTERS OR A/V DEVICES. FITS IN ANY ONE (1) OF THE THREE (3) GANGS IN THE CENTER COMPARTMENT.
5. COMPARTMENT 5
   8DEC - SINGLEGANG DEVICE PLATE THAT WILL ACCEPT DECORATOR STYLE DEVICES SUCH AS 20A RECEPTACLES, GGCIS, 106 ADAPTERS OR A/V DEVICES. FITS IN ANY ONE (1) OF THE THREE (3) GANGS IN THE CENTER COMPARTMENT

SELECTED PLATES:

COMPARTMENT 1
5BLH - HALF-GANG BLANK HOUSING ASSEMBLY.

COMPARTMENT 2
5PTHA - HALF-GANG PASS THROUGH HOUSING ASSEMBLY.

COMPARTMENT 3
1125CHA - ONE-GANG 1 1/4" TRADE SIZE CONDUIT HOUSING ASSEMBLY.

COMPARTMENT 4
1125CHA - ONE-GANG 1 1/4" TRADE SIZE CONDUIT HOUSING ASSEMBLY.

COMPARTMENT 5
1125CHA - ONE-GANG 1 1/4" TRADE SIZE CONDUIT HOUSING ASSEMBLY.

6 AV SHARED 8AT POKE THRU FLOOR BOX DETAIL
NO SCALE

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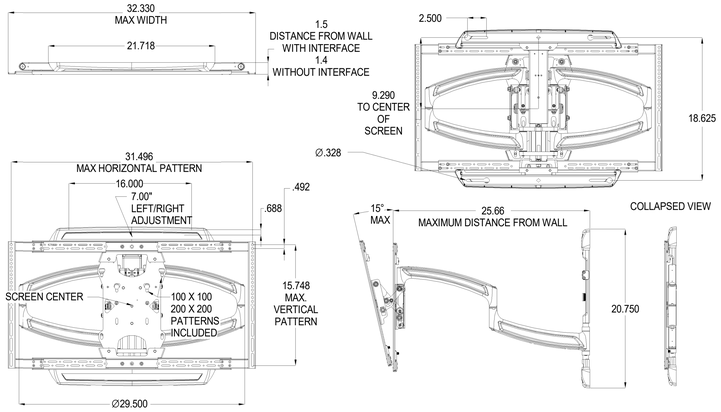
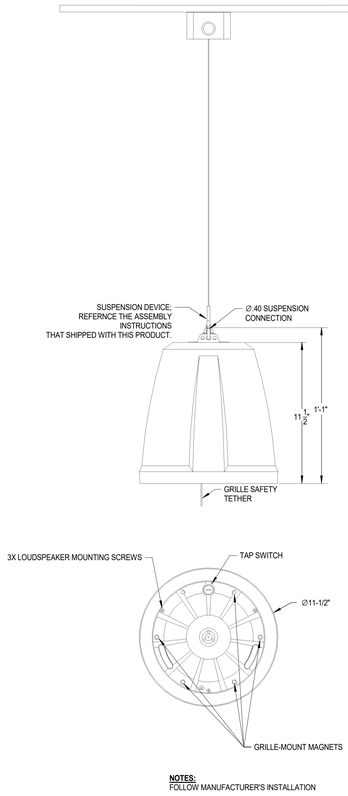


NOTES (THIS DETAIL ONLY):

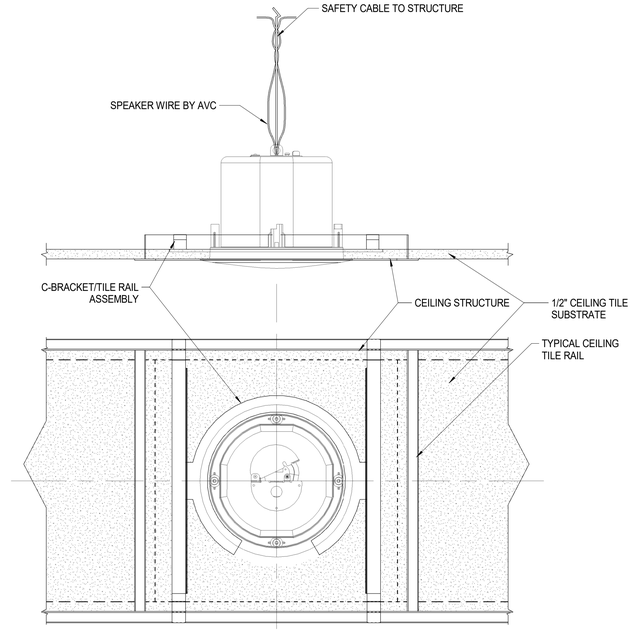
1. BASIS OF DESIGN IS THE CHIEF MANUFACTURING MODEL TS525TU. VERIFY STRUCTURAL BLOCKING.
2. REQUIREMENTS WITH A STRUCTURAL ENGINEER.
3. COORDINATE MEDIUM AND LOW VOLTAGE INFRASTRUCTURE WITH LOCATION OF MOUNT.
4. NEATLY BUNDLE CABLING TO ENSURE CATCHFREE OPERATION AND PROVIDE BLACK LOOMING OVER BUNDLE FOR CLEAN APPEARANCE.
5. REFERENCE WRITTEN SPECIFICATION FOR ADDITIONAL DISPLAY AND MOUNT REQUIREMENTS.

1 CHIEF TS525TU SWING ARM MOUNT DETAIL
NO SCALE



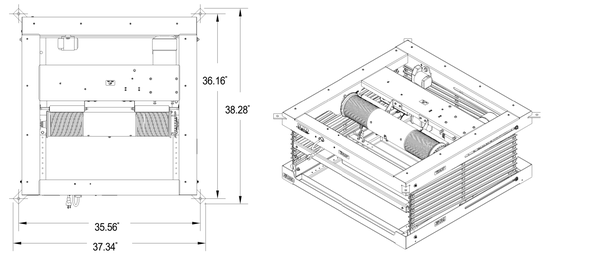
NOTES:
FOLLOW MANUFACTURER'S INSTALLATION

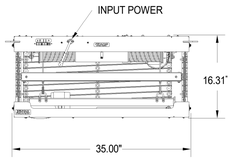
2 PENDANT SPEAKER DETAIL
NO SCALE

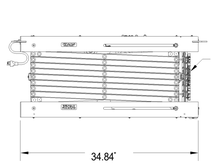


NOTES:
1. SPEAKER, PRE-CONSTRUCTION RING, SPEAKER CABLE, AND SAFETY CABLE TO BE PROVIDED AND INSTALLED BY AVC.
2. SPEAKER CABLES SHALL BE J-HOOKED AS NEEDED IN ACT CEILINGS OR RUN TIGHT TO DECK IN OPEN TO STRUCTURE CEILINGS WITH COLOR MATCHING CABLE.
3. COORDINATE FINAL SPEAKER LAYOUT WITH OTHER TRADES.
4. ATTACH SAFETY CABLE PER MANUFACTURER SPECIFICATIONS.
5. REFER TO MANUFACTURER INSTRUCTIONS FOR MORE DETAILS. PROVIDE SEISMIC ACCESSORIES WHERE REQUIRED BY CODE.
6. PROVIDE SERVICE LOOP AT EACH SPEAKER.

3 DROP TILE CEILING SPEAKER WITH C-BRACKET RING DETAIL
NO SCALE





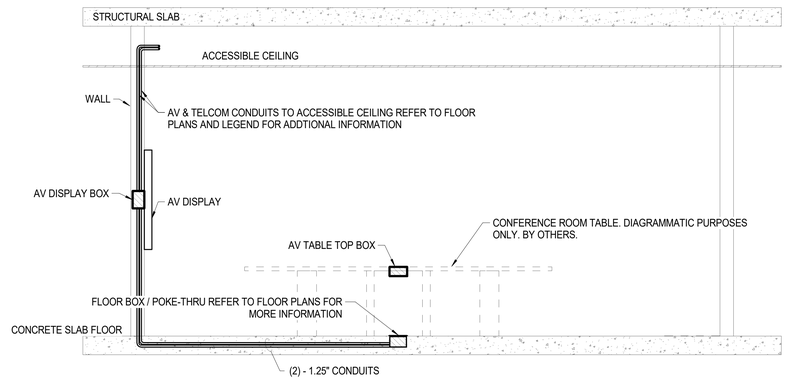


NOTE:
1. BASIS OF DESIGN - DRAPER SCISSORLIFT SLX14.
2. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
3. VERIFY COMPATIBILITY WITH PROJECTOR AND DIMENSIONS PRIOR TO ORDERING.

NOTES:
110 VOLT LIFT PN 300251
220 VOLT LIFT PN 300258

EXTENDED HEIGHT: 15 FT. 4 5/16 IN.

4 SCISSORLIFT SLX14 DETAIL
NO SCALE



5 STANDARD CONFERENCE ROOM DETAIL
NO SCALE

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SECURITY DEVICE TAGS:

GENERAL NOTES:

1. # REPRESENTS A NUMBER AND X REPRESENTS AN ALPHABETICAL CHARACTER.
2. SEE CAMERA DETAILS AND SCHEDULES ON SHEET SC5.02.
3. SEE DOOR DETAILS AND SCHEDULES ON SHEET SC5.01.

ACCESS CONTROL SYSTEM:

```
####      DOOR NUMBER
SEC-#X    SECURITY ENCLOSURE DESIGNATION
X#        DOOR TYPE.
```

VIDEO SURVEILLANCE SYSTEM:

```
C#-####     CAMERA NUMBER
TR-##       TELECOM ROOM DESIGNATION
XX -#X -X#  MOUNT TYPE - CAMERA TYPE - RECORDING PROFILE
```

SECURITY COMMUNICATIONS SYSTEM TAG:

```
IC-####     INTERCOM NUMBER
LAN-##      HEAD END DESIGNATION (NETWORK SWITCH, OR INTERCOM EXCHANGE)
#-SC###     DETAIL-SHEET NUMBER (WHERE APPLICABLE)
```

SECURITY DEVICE TAG:

```
GB-####     SECURITY DEVICE TYPE-NUMBER
            (GB= GLASS BREAK DETECTOR, MD = MOTION DETECTOR,
            DUR = DURESS BUTTON))
SEC-##      SECURITY ENCLOSURE DESIGNATION
#-SC###     DETAIL NUMBER-SHEET NUMBER
```

ABBREVIATIONS:

1G - SINGLE GANG
2G - DOUBLE GANG
3G - TRIPLE GANG (NONGANGABLE
ABA - ARCHITECTURAL BARRIERS ACT OF 1968
ABAAG - ABA ACCESSIBILITY GUIDELINES
ACAMS - ACCESS CONTROL AND ALARM MONITORING SYSTEM
ACS - ACCESS CONTROL SYSTEM
ACU - ACCESS CONTROL UNIT
ADA - AMERICANS WITH DISABILITIES ACT
AFC/AFF/AFG/ARF - ABOVE FINISHED CEILING/FLOOR/GRADE/RAISED FLOOR
ARCH - ARCHITECT/ARCHITECTURAL
BCKBD - BACKBOARD
BFC - BELOW FINISHED CEILING
CDT - CONDUIT
CONN - CONNECTION
CKT - CIRCUIT
CLG - CEILING
EC - ELECTRICAL CONTRACTOR
EMT - ELECTRICAL METALLIC TUBING
EQUIP - EQUIPMENT
EXIST - EXISTING
FOC - FIBER/FIBER OPTIC CABLING
FA - FIRE ALARM
G - GROUND
IDC - INSTALLATION DISPLACEMENT CONNECTOR
IDS - INTRUSION DETECTION SYSTEM
JB - JUNCTION BOX
LAN - LOCAL AREA NETWORK
MM - MULTI-MODE
MP - MEGAPIXEL
MTD - MOUNTED
MTG - MOUNTING
N/A - NOT APPLICABLE
NEC - NATIONAL ELECTRIC CODE
NIC - NOT IN CONTRACT
NTS - NOT TO SCALE
OC - ON CENTER
OFCI - OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI - OWNER FURNISHED, OWNER INSTALLED
OSP - OUTSIDE PLANT
PNL - PANEL
PTZ - PAN/TILT/ZOOM
RR - RISER RATED
RTE - REQUEST-TO-EXIT
SEC - SECURITY ENCLOSURES
SM - SINGLE MODE
SPEC - SPECIFICATION
SW - SWITCH
TGB - TELECOM GROUND BUSBAR
TMGB - TELECOM MAIN GROUND BUSBAR
WP - WEATHERPROOF
UON - UNLESS OTHERWISE NOTED
VMS - VIDEO MANAGEMENT SYSTEM
VSS - VIDEO SURVEILLANCE SYSTEM
XFMR - TRANSFORMER
1G - SINGLE GANG
2G - DOUBLE GANG
3G - TRIPLE GANG (NON-GANGABLE)

SECURITY GENERAL NOTES

1. WHERE ROUTED THROUGH ACCESSIBLE CEILINGS SECURITY CABLES MAY BE SUPPORTED BY J-HOOKS SPACED NO MORE THAN 5' APART OR BY CABLE TRAY. WHERE CABLES PASS THROUGH SPACES WITH EXPOSED CEILING OR ABOVE INACCESSIBLE CEILING, INSTALL CABLES IN CONDUIT. PROVIDE CONDUIT SLEEVES THROUGH ALL WALL PENETRATIONS AND FIRESTOP AS REQUIRED FOR PARTITION TYPE.
2. CABLING INSTALLED ON J-HOOKS AND CONDUIT RUNS SHALL BE ROUTED PARALLEL OR PERPENDICULAR TO WALLS AND STRUCTURAL ELEMENTS. RUNNING CABLING OR CONDUIT DIAGONALLY ACROSS ANY SPACE, INCLUDING AREAS CONCEALED ABOVE FINISHED CEILING, SHALL NOT BE PERMITTED. ROUTE CABLING ON J-HOOKS OR IN TELECOM CABLE RUNWAY IN A NEAT BUNDLE HELD TOGETHER WITH PLENUM RATED VELCRO FASTENERS.
3. ALL CONDUIT, WIRING, AND ASSOCIATED JUNCTION BOXES SHALL BE CONCEALED WITHIN WALLS, FLOORS, OR CEILINGS UNLESS OTHERWISE NOTED. PROVIDE PULL STRING SECURED ON BOTH SIDES IN ALL CONDUIT DURING ROUGH-IN.
4. ALL CONDUIT PENETRATIONS THRU FIRE RATED OR SMOKE PARTITIONS SHALL BE SEALED AND FIRESTOPPED PER THE SPECIFICATIONS.
5. HOMERUNS FOR MULTIPLE LIKE DEVICES CAN BE COMBINED INTO A SINGLE CONDUIT AS LONG AS THE OVERALL CAPACITY OF THE HOMERUN IS EQUAL TO OR LARGER THAN THE CAPACITY (AREA) OF THE INDIVIDUAL CONDUITS IT INCORPORATES. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CALCULATE THE CONDUIT CAPACITY REQUIRED TO INCLUDE CABLING FROM MULTIPLE DOORS, CAMERAS, OR INTERCOMS TO ENSURE THAT THE NEC REQUIRED FILL IS NOT EXCEEDED.
6. EXACT LOCATION, MOUNTING HEIGHT, AND TYPE OF TERMINATION FROM JUNCTION BOX, STUB-UPS, ETC. SHALL BE DETERMINED FROM ARCHITECTURAL DRAWINGS, SHOP DRAWINGS, EQUIPMENT CUTSHEETS, OR DETAILS BEFORE CONDUIT ROUGH-IN. COORDINATE ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
7. BACK BOXES SHALL BE FLUSH MOUNTED UNLESS OTHERWISE NOTED. WHERE REQUIRED, COMPLY WITH THE ABAAG HEIGHT SPECIFICATIONS. VERIFY ALL MOUNTING HEIGHTS WITH ARCHITECTURAL ELEVATIONS.
8. JUNCTION BOXES SHALL BE INSTALLED AT LOGICAL, ACCESSIBLE LOCATIONS. TOTAL BEND BETWEEN PULL BOXES IR HAND HOLES SHALL NOT EXCEED 180 DEGREES. DISTANCE BETWEEN PULL BOXES AND HAND HOLES SHALL NOT EXCEED 200 FEET.
9. CUTTING AND PATCHING SHALL BE PERFORMED IN A WORKMAN LIKE MANNER ACCEPTABLE TO THE ARCHITECT AND OWNER.
10. ALL CONDUIT PENETRATING A WALL SHALL BE CAULKED ON BOTH SIDES WITH RESILIENT NON-HARDENING SEALANT.
11. WALL MOUNTED SECURITY EQUIPMENT SHALL BE MOUNTED IN SUCH A MANNER THAT THEY DO NOT CROSS JOINTS OR SPAN AREAS WHERE THERE IS A MATERIAL TRANSITION.
12. SECURITY EQUIPMENT MOUNTED TO THE EXTERIOR OF THE BUILDING SHALL BE PROVIDED WITH DRIP LOOPS, SEALS, ETC. AS REQUIRED TO PREVENT SEEPAGE OF WATER OR MOISTURE INTO THE BUILDING.
13. DETAILS ARE DIAGRAMMATIC AND SHALL NOT BE USED TO DETERMINE EQUIPMENT LOCATIONS. FLOOR PLANS INDICATE EQUIPMENT LOCATIONS. COORDINATE WITH ARCHITECTURAL AND INTERIOR DRAWINGS PRIOR TO FINAL EQUIPMENT ROUGH-IN AND INSTALLATION.
14. REFERENCE EQUIPMENT DETAILS AND SYSTEM FUNCTIONAL DIAGRAM FOR ADDITIONAL INFORMATION. NEITHER DETAILS NOR DIAGRAMS SHALL BE USED TO DETERMINE DEVICE QUANTITIES. DEVICE LOCATIONS AND QUANTITIES ARE INDICATED ON THE FLOOR PLANS.
15. REFERENCE FLOOR PLANS FOR SECURITY NETWORK SWITCH LOCATIONS AND SECURITY ENCLOSURE LOCATIONS. REFERENCE SECURITY DEVICE TAGS FOR DEVICE DESIGNATION.
16. ALL DEVICES AND EQUIPMENT SHOWN SHALL BE NEW EXCEPT WHERE SPECIFICALLY NOTED OTHERWISE.

SECURITY LOCKDOWN NOTES

GENERAL:
PROCEDURES FOR INITIATING, MANAGING, AND RELEASING A LOCKDOWN IN A K–12 SCHOOL ENVIRONMENT. LOCKDOWN IS USED TO PROTECT STUDENTS, STAFF, AND VISITORS DURING A SERIOUS SECURITY THREAT BY RESTRICTING ACCESS AND MOVEMENT WHILE MAINTAINING REQUIRED LIFE-SAFETY EGRESS.

SITUATIONS REQUIRING LOCKDOWN:
LOCKDOWN MAY BE INITIATED WHEN THERE IS AN IMMEDIATE THREAT TO STUDENT OR STAFF SAFETY, INCLUDING BUT NOT LIMITED TO:
- ACTIVE THREAT OR WEAPON-RELATED INCIDENT
- INTRUDER OR UNAUTHORIZED PERSON ON CAMPUS
- VIOLENCE OR CREDIBLE THREAT OF VIOLENCE
- LAW ENFORCEMENT DIRECTIVE
- ANY INCIDENT REQUIRING RESTRICTED ACCESS TO THE SCHOOL OR CAMPUS

AUTHORIZED INITIATORS:
LOCKDOWN MAY BE INITIATED BY:
- PRINCIPAL OR ASSISTANT PRINCIPAL
- DESIGNATED SCHOOL ADMINISTRATOR
- DISTRICT SECURITY OPERATIONS
- LAW ENFORCEMENT

LOCKDOWN ACTIVATION:
LOCKDOWN MAY BE ACTIVATED USING:
ACCESS CONTROL MANAGEMENT SOFTWARE
PHYSICAL LOCKDOWN (DURESS) BUTTON (LOCATIONS SHOWN ON DRAWINGS)
AUTHORIZED WEB OR MOBILE INTERFACE

ACCESS CONTROL SYSTEM BEHAVIOR DURING LOCKDOWN:
WHEN LOCKDOWN IS ACTIVE, THE SYSTEM WILL:
- LOCK DESIGNATED PERIMETER AND INTERNAL INGRESS DOORS.
- DISABLE NORMAL BADGE OR CARD ACCESS IN AFFECTED AREAS.
- APPLY DOOR-SPECIFIC LOGIC FOR FAIL-SAFE AND FAIL-SECURE HARDWARE
- ALLOW ACCESS ONLY FOR:
  1. LAW ENFORCEMENT
  2. DESIGNATED EMERGENCY OVERRIDE CREDENTIALS
- PERMIT FREE EXIT FROM ROOMS AND BUILDINGS.
- RECORD ALL DOOR EVENTS AND ACCESS ATTEMPTS.
- ILLUMINATE RED EXTERIOR STATUS LIGHT TO INDICATE BUILDING IS IN LOCKDOWN.
- IMMEDIATE API PUSH NOTIFICATIONS AND EMAIL/SMS ALERTS ARE SENT TO DESIGNATED EMERGENCY CONTACTS (LOCAL LAW ENFORCEMENT) AND TO THE SINGLEWIRE INFORMACAST SYSTEM.

OPERATIONAL LOGIC:
SYSTEM OVERRIDE: THE LOCKDOWN COMMAND ASSUMES THE HIGHEST SOFTWARE PRIORITY (LEVEL 0), OVERRIDING SCHEDULES, HOLIDAYS, AND STANDARD CLEARANCE LEVELS.
INPUT/OUTPUT (I/O) SWITCHING:
- INPUT RELAYS TRIGGER ASSOCIATED OUTPUT RELAYS (E.G., MAGNETIC LOCKS DROP POWER, ELECTRIFIED MORTISE LOCKS ENGAGE).
- AUXILIARY OUTPUTS TRIGGER EXTERIOR STROBE LIGHTS.

CREDENTIAL EXCLUSION: ALL STANDARD PROXIMITY, SMART CARD, AND BIOMETRIC CREDENTIALS ARE ADDED TO AN EXCLUSION LIST UNTIL THE SEQUENCE IS MANUALLY RESET.

EMERGENCY OVERRIDES:
OVERRIDES ARE PERMITTED ONLY FOR LAW ENFORCEMENT OR AUTHORIZED PERSONNEL.
OVERRIDES SHALL BE LIMITED TO ONLY THE DOORS NECESSARY.
ALL OVERRIDE ACTIONS ARE LOGGED AND REVIEWED POST-INCIDENT.

POST LOCKDOWN RECOVERY:
RESTORE DOORS TO PRE-LOCKDOWN STATE
RESUME NORMAL ACCESS LEVEL ENFORCEMENT
GENERATE LOCKDOWN INCIDENT REPORT (AUTOMATIC OR ON DEMAND)

PROJECT SPECIFIC NOTES

1. THE EXISTING ACCESS CONTROL SYSTEM IS LENEL S2 WITH THE MAIN SERVER LOCATED IN THE LONGHILL SCHOOL. PROVIDE ADDITIONAL DOOR CONTROLLER PANELS & ASSOCIATED EQUIPMENT AS REQUIRED AND LICENSES TO SUPPORT THE NEW SECURITY DEVICES BEING ADDED. PROVIDE ALL PROGRAMMING AND NETWORK CONFIGURATION TO INTEGRATE THE NEW ACCESS CONTROL DEVICES WITH THE EXISTING LENEL S2 SYSTEM.
2. THE EXISTING VIDEO MANAGEMENT SOFTWARE (VMS) IS MILESTONE. PROVIDE A NEW SERVER AND ASSOCIATED EQUIPMENT FOR THE MIDDLE SCHOOL, AND ADDITIONAL LICENSES AND STORAGE AS REQUIRED TO SUPPORT THE NEW SECURITY DEVICES. COORDINATE WITH THE OWNERS IT & FACILITIES DEPARTMENT FOR ADDITIONAL INFORMATION. THE NEW VMS IN THE MIDDLE SCHOOL WILL BE INDEPENDENT FROM OTHER VMS SYSTEMS IN THE DISTRICT.
3. ALL NETWORK SWITCHES WILL BE PROCURED BY THE PROJECT PRIOR TO SUBSTANTIAL CONSTRUCTION COMPLETION. THE SECURITY CONTRACTOR IS NOT RESPONSIBLE FOR PROVIDING THE NETWORK SWITCHES, BUT IS RESPONSIBLE FOR CONFIGURING SECURITY DEVICES WITH PROPER NETWORK CONFIGURATION THAT WILL BE PROVIDED BY THE OWNER. NOTE THAT FINAL CONNECTION OF SECURITY DEVICES TO THE NETWORK WILL BE DONE ONCE THE NETWORK SWITCHES ARE INSTALLED AND OPERATIONAL.
4. THE TELECOMMUNICATIONS CONTRACTOR WILL FURNISH AND INSTALL ALL CATEGORY-6 CABLING TO SECURITY DEVICES (CAMERAS, DOOR CONTROLLER PANELS, INTERCOM STATIONS, ETC.). ALL OTHER SECURITY WIRING IS THE RESPONSIBILITY OF THE SECURITY CONTRACTOR. TELECOMMUNICATIONS CONTRACTOR WILL ALSO PROVIDE FIBER OPTIC CABLING TO THE NEMA ENCLOSURES ON THE LIGHT POLES FOR POLE-MOUNTED CAMERAS. SECURITY CONTRACTOR TO COORDINATE FINAL LOCATION AND TERMINATION REQUIREMENTS OF CATEGORY-6 AND FIBER OPTIC CABLES WITH THE TELECOMMUNICATIONS CONTRACTOR. REFER TO TELECOMMUNICATIONS DRAWINGS FOR ADDITIONAL INFORMATION.
5. REFER TO THE TELECOMMUNICATIONS DRAWINGS FOR LOCATIONS OF DOOR CONTROLLER PANELS ON THE PLYWOOD BACKBOARDS IN THE TELECOM ROOMS, AND LOCATION OF RACK-MOUNTED SECURITY HARDWARE (I.E. VMS SERVER) ON THE RACK ELEVATION DRAWINGS.
6. ELECTRICAL RECEPTACLES AND CONNECTIONS IN EACH TELECOM ROOM ARE ON EMERGENCY POWER (GENERATOR BACKUP). FOR WALL-MOUNTED EQUIPMENT, PROVIDE BATTERY BACKUP TO CARRY THE LOAD UNTIL THE GENERATOR IS RUNNING. FOR RACK MOUNTED EQUIPMENT, A RACK-MOUNT UPS AND VERTICAL POWER STRIPS WILL BE PROVIDED BY OTHERS. SECURITY CONTRACTOR IS NOT REQUIRED TO PROVIDE ANY UPS'S.

SECURITY SYMBOL LEGEND

DEVICE	SYMBOL	SPEC	BACKBOX SIZE	MTG. HEIGHT	NOTES
ACCESS CONTROL SYSTEM					
CARD READER		281000	4" BOX WITH 1GANG PLASTER RING	42" A.F.F.	MOUNT WITHIN 12" OF DOOR FRAME
CARD READER WITH INTEGRATED KEYPAD		281000	4" BOX WITH 1GANG PLASTER RING	42" A.F.F.	MOUNT WITHIN 12" OF DOOR FRAME
EMERGENCY DOOR RELEASE PUSH BUTTON		281000	4" BOX WITH 1GANG PLASTER RING	42" A.F.F.	
REQUEST-TO-EXIT PUSH BUTTON		281000	4" BOX WITH 1GANG PLASTER RING	42" A.F.F.	MOUNT WITHIN 12" OF DOOR FRAME
REQUEST-TO-EXIT MOTION DETECTOR	RX	281000	4" BOX WITH 1GANG PLASTER RING	12" B.F.C.	MOUNT BOX HORIZONTALLY
DOOR JUNCTION BOX	DJB	281000	8"x8"x4"	SEE NOTES	SURFACE MOUNT ABOVE CEILING ON SECURE SIDE OF DOOR. PROVIDE TAMPER RESISTANT SCREWS FOR COVER
SECURITY ENCLOSURES	SEC	281000	N/A	N/A	ENCLOSURES FOR ACS PANELS, POWER SUPPLIES, ETC.
LOCAL DOOR ALARM MANAGEMENT SYSTEM	LA	281000	4" BOX WITH 1GANG PLASTER RING	42" A.F.F.	
LOCAL DOOR ALARM SOUNDER		281000	SINGLE GANG	96" A.F.F OR 6" B.F.C	FOR OPEN AREAS WITH CEILINGS HIGHER THAN 10' USE ROUGH IN DIMENSION FOR A.F.F.
ACCESS CONTROL SYSTEM WORKSTATION	AWS	281000	N/A	18" AFF	
REMOTE DOOR RELEASE PUSH BUTTON	DR	281000	N/A	6" BELOW COUNTER	REFERENCE FLOOR PLANS
DOOR HARDWARE					
ELECTRIC MORTISE LOCK WITH INTEGRATED REQUEST-TO-EXIT RTE SWITCH	EL	087100	N/A	N/A	
ELECTRIFIED EXIT DEVICE WITH INTEGRATED REQUEST-TO-EXIT SWITCH	EE	087100	N/A	N/A	
MECHANICAL EXIT DEVICE WITH INTEGRATED REQUEST-TO-EXIT SWITCH	CX	087100	N/A	N/A	
ELECTRIFIED EXIT DEVICE WITH INTEGRATED AUDIBLE ALARM	EA	087100	N/A	N/A	
MECHANICAL EXIT DEVICE WITH INTEGRATED AUDIBLE ALARM	CA	087100	N/A	N/A	
DELAYED EGRESS EXIT DEVICE	DE	087100	N/A	N/A	
ELECTRIC POWER TRANSFER HINGE OR POWER TRANSFER ACCESSORY	PT	087100	N/A	N/A	
LOCAL DOOR POWER SUPPLIES	PS	087100	N/A	N/A	
SLIDING DOOR OPERATOR	SDO	087100	N/A	N/A	
ELECTRIC STRIKE	ES	087100	N/A	N/A	
MAGNETIC LOCK WITH INTEGRAL DOOR POSITION SENSOR	ML	087100	N/A	N/A	
WIRELESS CARD READER LOCK	WL	087100	N/A	N/A	
AUTOMATIC DOOR ACTUATOR PUSH BUTTON	DA	087100	4" BOX WITH 1 GANG PLASTER RING	42" A.F.F.	MOUNT ADJACENT TO CARD READER.
ADA DOOR OPERATOR	DO	087100	N/A	N/A	COORDINATE WITH DIVISION 08.
DELAYED EGRESS CONTROLLER WITH LOCAL ALARM AND KEYSWITCH	DEC	087100	4" BOX WITH 2 GANG PLASTER RING	48" A.F.F.	COORDINATE WITH DIVISION 08.
SECURITY COMMUNICATIONS SYSTEM					
INTERCOM SUBSTATION (AUDIO ONLY)		281353	PER MANUFACTURER'S REQUIREMENTS	48" A.F.F.	SEE SECURITY DETAIL SHEETS
INTERCOM SUBSTATION (AUDIO AND VIDEO)		281353	PER MANUFACTURER'S REQUIREMENTS	48" A.F.F.	SEE SECURITY DETAIL SHEETS
INTERCOM MASTER STATION	ICM	281353	N/A	N/A	SEE SECURITY DETAIL SHEETS
VIDEO INTERCOM MASTER STATION	VIM	281353	N/A	N/A	SEE SECURITY DETAIL SHEETS
WALL MOUNTED EMERGENCY CALL STATION		281353	PER MANUFACTURER'S REQUIREMENTS	48" A.F.F.	SEE SECURITY DETAIL SHEETS
FREE STANDING EMERGENCY CALL STATION		281353	PER MANUFACTURER'S REQUIREMENTS	N/A	SEE SECURITY DETAIL SHEETS
CEILING MOUNTED PAGING SPEAKER	S	281353	SEE NOTES	FLUSH CEILING	SEE SECURITY DETAIL SHEETS
VIDEO SURVEILLANCE SYSTEM					
SINGLE SENSOR IP CAMERA		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
MULTI-SENSOR IP CAMERA - 2 HEADS		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
MULTI-SENSOR IP CAMERA - 3 HEADS		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
MULTI-SENSOR IP CAMERA - 4 HEADS		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
SINGLE SENSOR PANORAMIC IP CAMERA		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
SINGLE SENSOR PTZ IP CAMERA		282000	SEE CAMERA DETAILS	AS SHOWN ON DETAILS AND/OR PLANS	
VSS NETWORK VIDEO RECORDER / SERVER	NVR	282000	N/A	AS SHOWN ON DETAILS AND/OR PLANS	
VIDEO SURVEILLANCE SYSTEM WORKSTATION	VWS	282000	N/A	AS SHOWN ON DETAILS AND/OR PLANS	
COMMON SECURITY EQUIPMENT					
SECURITY SYSTEM WORKSTATION	DWS		1G	18" AFF	
CEILING MOUNTED 360 DEGREE MOTION DETECTOR	MD		OCTAGONAL	FLUSH CEILING	
WALL MOUNTED MOTION DETECTOR	MD		1G	96" AFF	
DURESS PUSH-FOR-HELP BUTTON	D		1G	6" BELOW COUNTER	
LOCK DOWN PUSH BUTTON	LD		1G	42" AFF	
UNINTERRUPTIBLE POWER SUPPLY	UPS	280500	--	--	
TAMPER SWITCH	T		--	--	CONNECT TO TAMPER INPUT ON ACCESS CONTROL PANEL. FOR MULTIPLE ENCLOSURES WIRE SWITCHES IN SERIES.
JUNCTION BOX WITH TAMPER RESISTANT SCREWS	J		2G	--	SURFACE MOUNT ABOVE CEILING ON SECURE SIDE OF DOOR. PROVIDE TAMPER RESISTANT SCREWS FOR COVER.
MONITORED AUTOMATIC EXTERNAL DEFIBRILLATOR	AED		2G WITH 1G MUD RING	42" AFF	
DOOR CHIME	CH		2G WITH 1G MUD RING	6" BFC	
DOOR BELL PUSH BUTTON	DB		2G WITH 1G MUD RING	42" AFF	
INTERFACE MODULE FOR WIRELESS DOOR LOCK	PIM	281000	2G WITH 1G MUD RING	6" BFC	
MIDSPAN POE INJECTOR	POE				
FIBER OPTIC MEDIA CONVERTER	FTX				
NETWORK SWITCH	LAN				
MAGNETIC DOOR POSITION SWITCH	M	087100	N/A	N/A	
CEILING MOUNTED GLASS BREAK MONITOR	GB		2G	--	SURFACE MOUNT TO CEILING, UNLESS OTHERWISE NOTED. PROVIDE TAMPER RESISTANT SCREWS FOR COVER.
ARM / DISARM KEYPAD	KP		2G	42" AFF	
LED LIGHT INDICATOR			2G	11' 6" AFG	

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N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT — PROFESSIONAL ENGINEER — No. 22 — LICENSED TELECOMMUNICATION TECHNICIAN

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

SECURITY LEGEND, NOTES AND ABBREVIATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NTS
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

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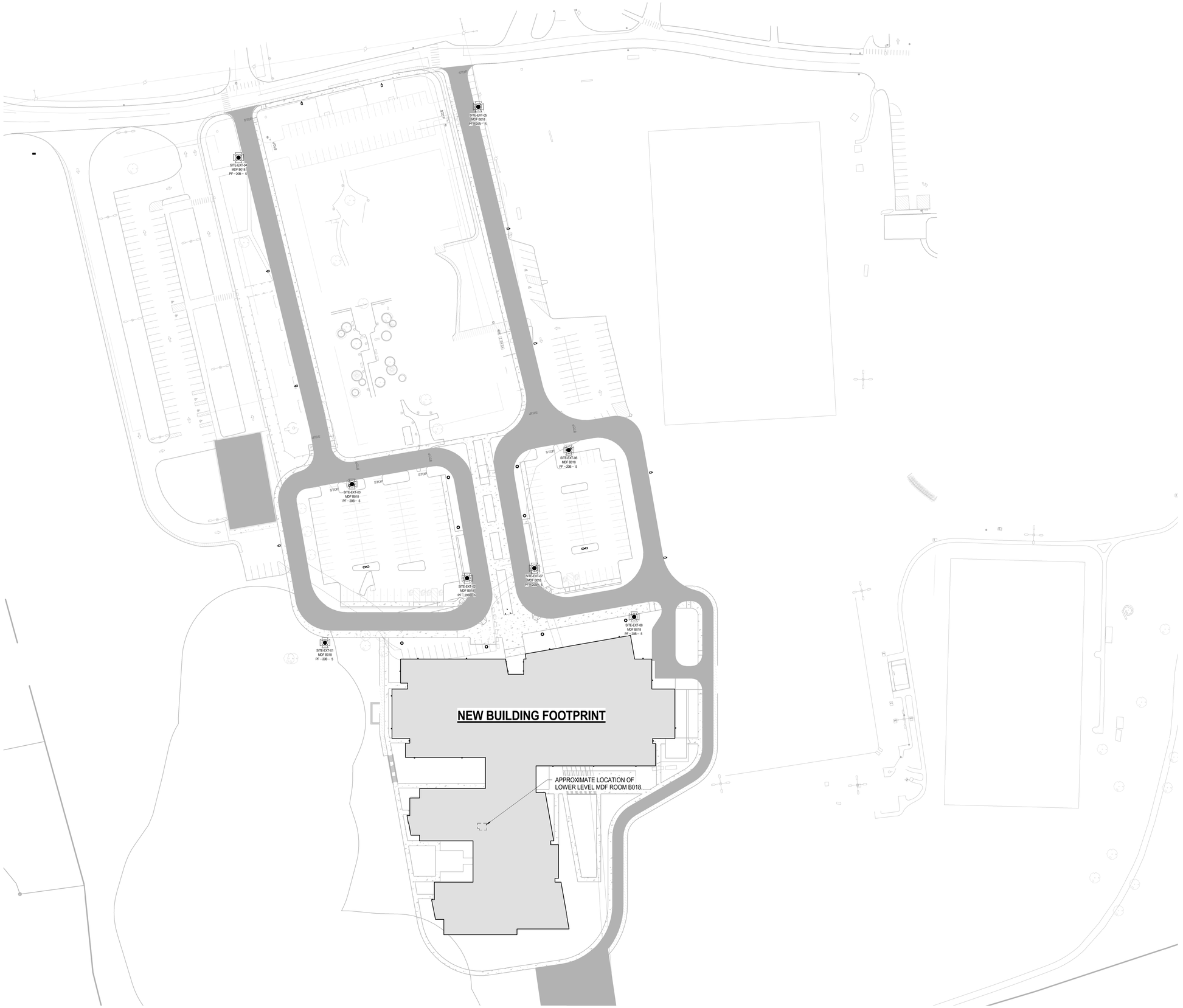

1 **SECURITY - SITE PLAN**
1" = 50'-0"

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ROBERT SCOTT LARAIA
No. 22
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using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN

DRAWING TITLE

SECURITY SITE PLAN

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1" = 50'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
3	03/16/2026	50% CD
5	05/19/2026	100% CD

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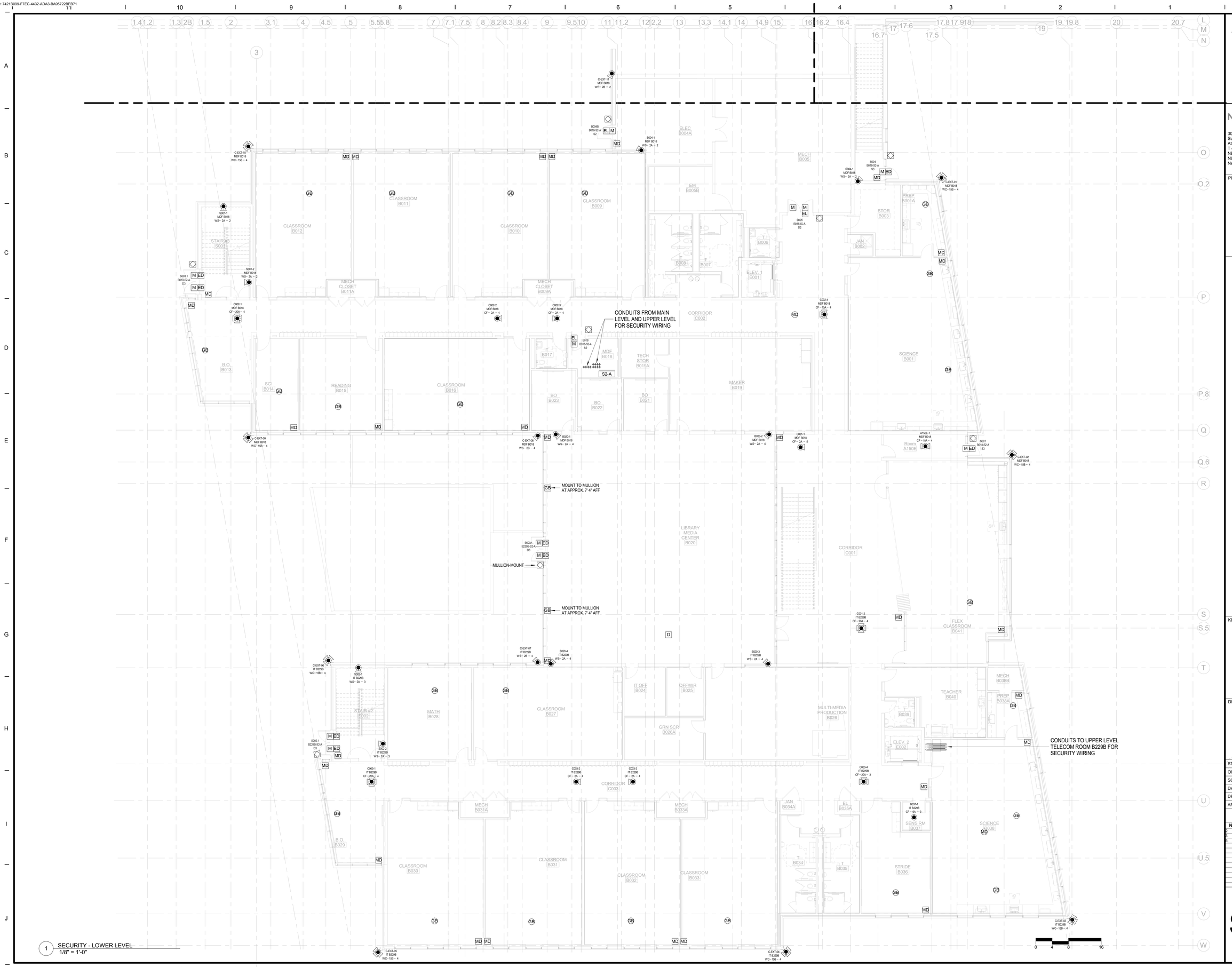

1 SECURITY - LOWER LEVEL
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

SECURITY - LOWER LEVEL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

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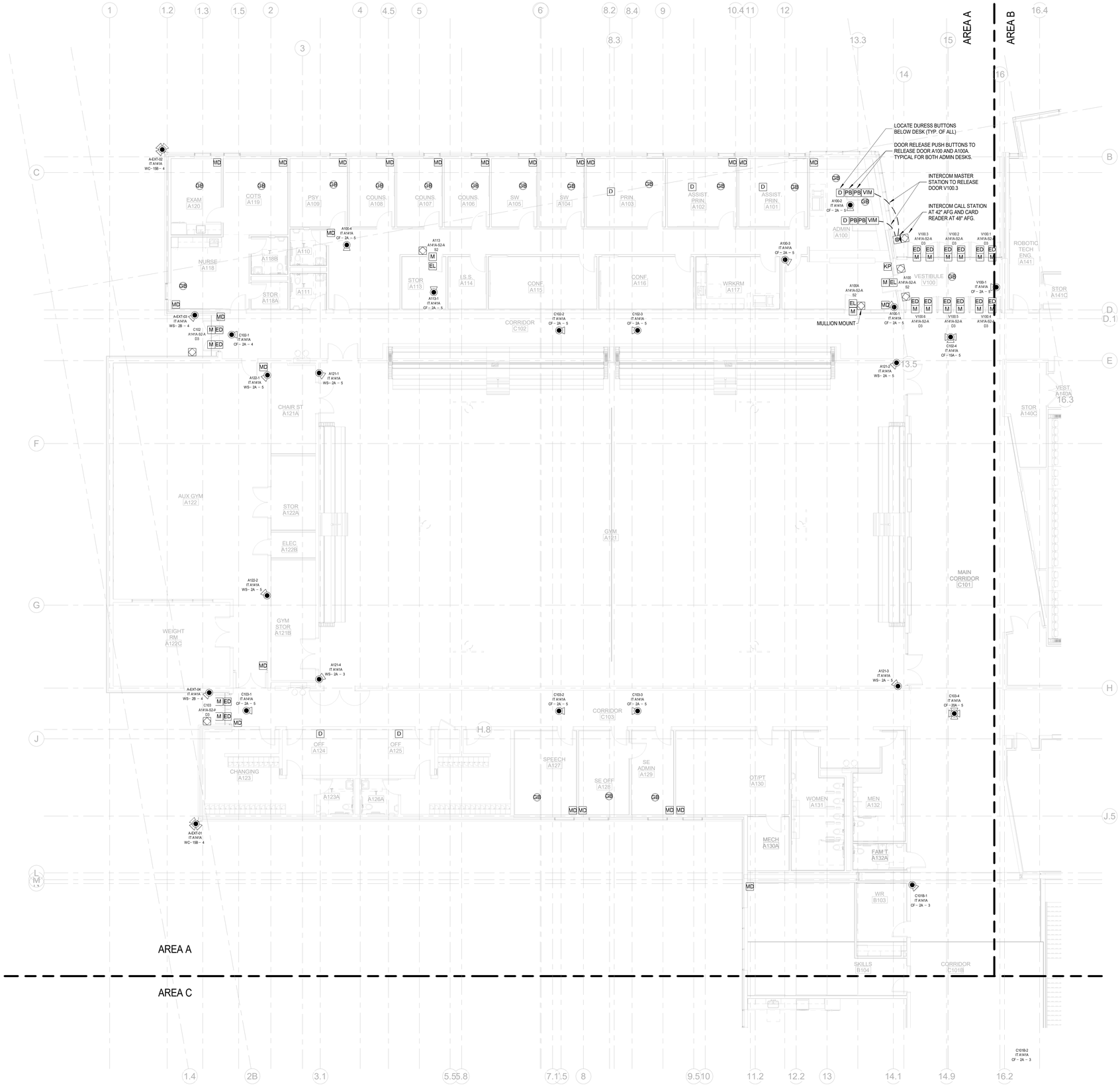

1 SECURITY - MAIN LEVEL - AREA A
1/8" = 1'-0"

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Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT ROBERT SCOTT LARAIA No. 22 LICENSED TELECOMMUNICATION TECHNICIAN

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

SECURITY - MAIN LEVEL
AREA A

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

SC1.02A

5/19/2026 9:24:17 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-STG_R26.rvt

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AREA A

AREA B

AREA C

PROVIDE THREE OUTDOOR LIGHTS (RED, YELLOW, GREEN) TO INDICATE BUILDING LOCKDOWN STATUS

INTERCOM MASTER STATION TO RELEASE DOOR A147.1

PROVIDE THREE OUTDOOR LIGHTS (RED, YELLOW, GREEN) TO INDICATE BUILDING LOCKDOWN STATUS

OVERHEAD DOOR CONTACT

MULLION-MOUNT

MULLION-MOUNT

OVERHEAD CAMERAS ABOVE CASHIERS

42" AFG

42" AFG

ROBOTIC TECH ENG. A141

TECH. SHOP A142

FAM. CONS. SCI. A143

PLANETARIUM DOME A150

STOR A150D

STOR A150C

ELEC A147D

ELEC A147G

OFF A147B

CORRIDOR C106

VEST A150A

MECH A150B

CORR A147

STOR A141C

IT A141A

MECH A141B

STOR A142A

MECH A142B

STOR A143A

SEC OF A144

T A148

T A145

T A146

T A147A

JAN A149

CORRIDOR C105

CONTROL A139A

Room A150H

PAPER STOR A138C

T A138B

OFFICE A138A

CAFETERIA A137

VEST A140A

STOR A140C

KITCHEN A138

PLATFORM A139

FOLDING CHAIRS 120C

BLACK BOX A140

Room A150G

MAIN CORRIDOR C101

VEST A140B

DRY STOR A138D

A150I

Room A150J

Room A150K

CORRIDOR C104

MECH A134B

MECH A135B

T A136A

CHORAL A133

STOR A134A

BAND A134

STOR A135A

ORCHESTRA A135

FACULTY DINING A136

CORRIDOR C101B

16.4 17 17.918 19 20 20.7 22 22.5 23 23.5 24 25 25.5 26

16.2 16.7 17.5 17.8 119.8 21 21.5 22.3 24.3 25.3 23.7 27

1 SECURITY - MAIN LEVEL - AREA B
1/8" = 1'-0"

0 4 8 16

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Hartford, CT 06106
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T 404 730-8400
NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

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KEY PLAN

AREA-B

N

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AREA B

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AREA A

AREA B

AREA C

AREA C

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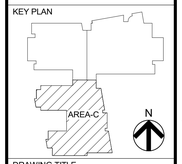

DRAWING TITLE

SECURITY - MAIN LEVEL
AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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1 SECURITY - MAIN LEVEL - AREA C
1/8" = 1'-0"

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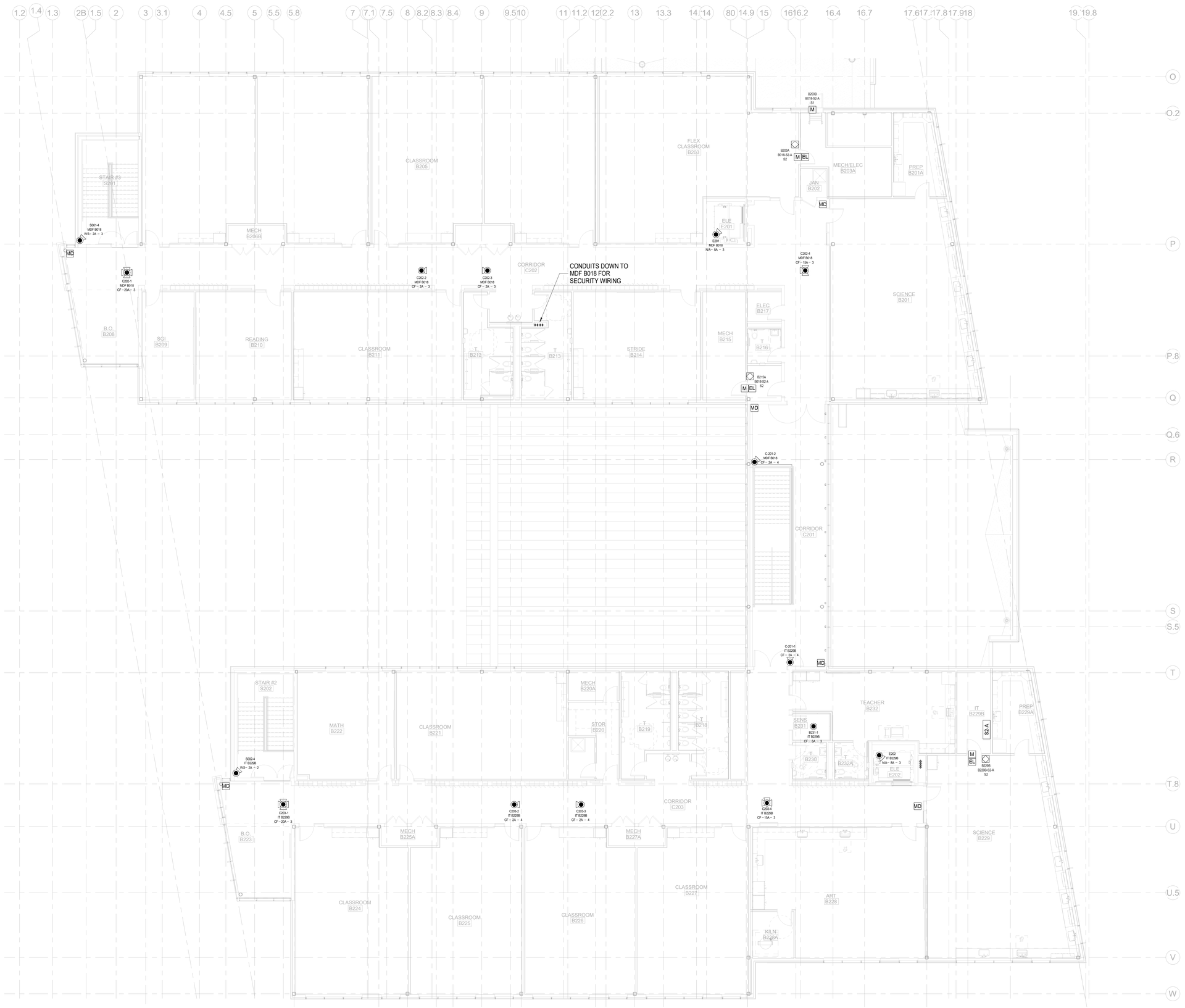

1 SECURITY - UPPER LEVEL
1/8" = 1'-0"

0 4 8 16

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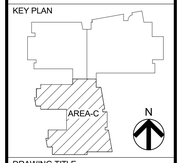

DRAWING TITLE

SECURITY - UPPER LEVEL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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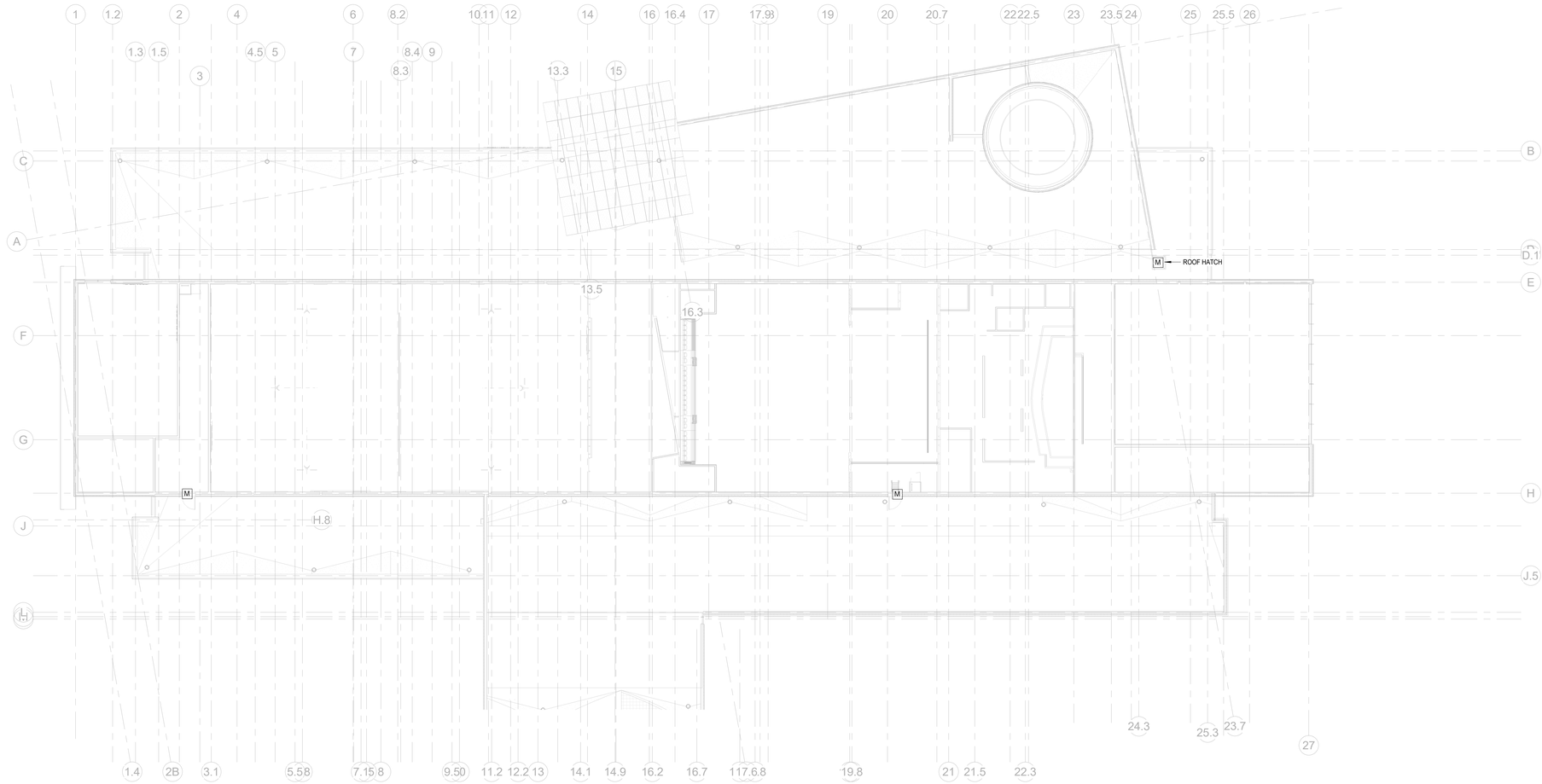

2 SECURITY ROOF PLAN - AREA A & B

1/16" = 1'-0"

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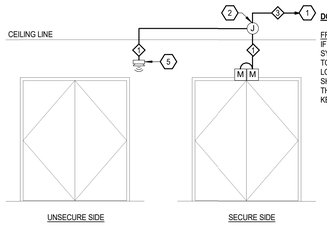
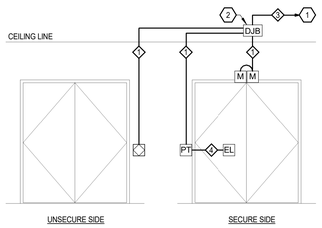


DOOR SEQUENCE OF OPERATION:

FROM BOTH SIDES:
IF THE DOOR IS OPENED, THE ACCESS CONTROL SYSTEM SHALL TRANSMIT AN ALARM CONDITION TO THE CONTROL ROOM. AT LOCATIONS WHERE LOCAL ALARM IS PROVIDED, THE LOCAL ALARM SHALL SOUND AND REMAIN ON UNTIL RESET FROM THE CONTROL ROOM OR FROM THE LOCAL KEYSWITCH.

4 DOOR TYPE D1
NTS



DOOR SEQUENCE OF OPERATION:

FROM THE UNSECURE SIDE:
WHEN AN AUTHORIZED CARD IS PRESENTED TO THE CARD READER, THE ACCESS CONTROL SYSTEM SHALL UNLOCK THE DOOR AND SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO PASS. UPON OPENING THE DOOR THE LOCK SHALL IMMEDIATELY RELOCK. IF THE DOOR IS OPENED WITHOUT THE USE OF A VALID CREDENTIAL, THE ACCESS CONTROL SYSTEM SHALL TRANSMIT AN ALARM CONDITION TO THE CONTROL ROOM.

FROM THE SECURE SIDE:
UPON TURNING THE DOOR HANDLE, THE INTEGRAL REQUEST-TO-EXIT SWITCH SHALL SEND A SIGNAL TO THE ACCESS CONTROL SYSTEM TO SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO EXIT THE DOOR WITHOUT CAUSING AN ALARM CONDITION.

HOLDING THE DOOR OPEN LONGER THAN 30 SECONDS AFTER EITHER ENTRY OR EXIT SHALL GENERATE AN ALARM CONDITION.

5 DOOR TYPE D2
NTS

DOOR SEQUENCE OF OPERATION:

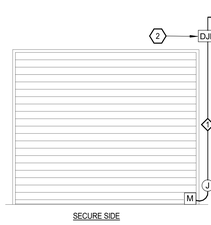
FROM THE UNSECURE SIDE:
WHEN AN AUTHORIZED CARD IS PRESENTED TO THE CARD READER, THE ACCESS CONTROL SYSTEM SHALL UNLOCK THE DOOR AND SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO PASS. UPON OPENING THE DOOR THE LOCK SHALL IMMEDIATELY RELOCK. IF THE DOOR IS OPENED WITHOUT THE USE OF A VALID CREDENTIAL, THE ACCESS CONTROL SYSTEM SHALL TRANSMIT AN ALARM CONDITION TO THE CONTROL ROOM.

FROM THE SECURE SIDE:
UPON DEPRESSING THE EXIT DEVICE, THE INTEGRAL REQUEST-TO-EXIT SWITCH SHALL SEND A SIGNAL TO THE ACCESS CONTROL SYSTEM TO SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO EXIT THE DOOR WITHOUT CAUSING AN ALARM CONDITION.

HOLDING THE DOOR OPEN LONGER THAN 30 SECONDS AFTER EITHER ENTRY OR EXIT SHALL GENERATE AN ALARM CONDITION.

NOTE: NO CARD READER ON 5 OF 6 MAIN ENTRY DOORS. SEE FLOOR PLAN. ALL DOORS TO BE SECURED IN LOCKDOWN EVENT.

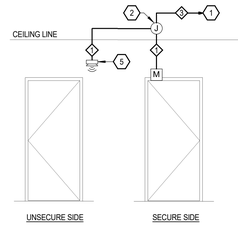
6 DOOR TYPE D3
NTS



DOOR SEQUENCE OF OPERATION:

FROM BOTH SIDES:
IF THE DOOR IS OPENED, THE ACCESS CONTROL SYSTEM SHALL TRANSMIT AN ALARM CONDITION TO THE CONTROL ROOM.

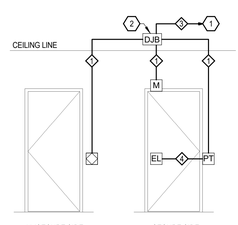
7 DOOR TYPE OH1
NTS



DOOR SEQUENCE OF OPERATION:

FROM THE UNSECURE SIDE:
IF THE DOOR IS OPENED, THE ACS SHALL GENERATE AN ALARM CONDITION. AT LOCATIONS WHERE LOCAL ALARM IS PROVIDED, THE LOCAL ALARM SHALL SOUND AND REMAIN ON UNTIL RESET FROM THE ACS OPERATOR SCREEN OR FROM THE LOCAL KEYSWITCH.

1 DOOR TYPE S1
NTS



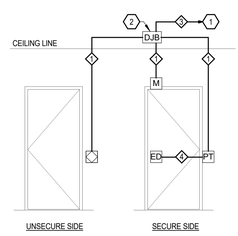
DOOR SEQUENCE OF OPERATION:

FROM THE UNSECURE SIDE:
WHEN AN AUTHORIZED CARD IS PRESENTED TO THE CARD READER, THE ACS SHALL UNLOCK THE DOOR AND SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO PASS. UPON OPENING THE DOOR THE LOCK SHALL IMMEDIATELY RELOCK. IF THE DOOR IS OPENED WITHOUT THE USE OF A VALID CREDENTIAL, THE ACS SHALL GENERATE AN ALARM CONDITION.

FROM THE SECURE SIDE:
UPON TURNING THE DOOR HANDLE, THE INTEGRAL REQUEST-TO-EXIT SWITCH SHALL SEND A SIGNAL TO THE ACS TO SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO EXIT THE DOOR WITHOUT CAUSING AN ALARM CONDITION.

HOLDING THE DOOR OPEN LONGER THAN 30 SECONDS AFTER EITHER ENTRY OR EXIT SHALL GENERATE AN ALARM CONDITION.

2 DOOR TYPE S2
NTS



DOOR SEQUENCE OF OPERATION:

FROM THE UNSECURE SIDE:
WHEN AN AUTHORIZED CARD IS PRESENTED TO THE CARD READER, THE ACCESS CONTROL SYSTEM SHALL UNLOCK THE DOOR AND SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO PASS. UPON OPENING THE DOOR THE LOCK SHALL IMMEDIATELY RELOCK. IF THE DOOR IS OPENED WITHOUT THE USE OF A VALID CREDENTIAL, THE ACCESS CONTROL SYSTEM SHALL GENERATE AN ALARM CONDITION.

FROM THE SECURE SIDE:
UPON DEPRESSING THE EXIT DEVICE, THE INTEGRAL REQUEST-TO-EXIT SWITCH SHALL SEND A SIGNAL TO THE ACCESS CONTROL SYSTEM TO SHUNT THE DOOR CONTACT, ALLOWING THE PERSON TO EXIT THE DOOR WITHOUT CAUSING AN ALARM CONDITION.

HOLDING THE DOOR OPEN LONGER THAN 30 SECONDS AFTER EITHER ENTRY OR EXIT SHALL GENERATE AN ALARM CONDITION.

3 DOOR TYPE S3
NTS

TYPICAL DEVICE ROUGH-IN REQUIREMENTS

DEVICE	BACKBOX TYPE	SYMBOL	MOUNTING HEIGHT	NOTES
CARD READER	SINGLE GANG		42" AFF	4" BOX + SINGLE GANG PLASTER RING
KEY PAD	SINGLE GANG		42" AFF	4" BOX + SINGLE GANG PLASTER RING
EMERGENCY DOOR RELEASE	SINGLE GANG		42" AFF	4" BOX + SINGLE GANG PLASTER RING
REQUEST-TO-EXIT PUSHBUTTON	SINGLE GANG		42" AFF	4" BOX + SINGLE GANG PLASTER RING
GENERIC PUSH-BUTTON	SINGLE GANG	PB	42" AFF	UNLESS OTHERWISE NOTED ON PLANS
MAGNETIC DOOR POSITION SWITCH	N/A	M	N/A	STUB CONDUIT INTO DOOR HEADER
ELECTRIC LOCK	N/A	EL	N/A	STUB CONDUIT INTO DOOR FRAME (HINGE SIDE)
ELECTRIC STRIKE	N/A	ES	N/A	STUB CONDUIT INTO DOOR FRAME (STRIKE SIDE)
MAGNETIC LOCK	N/A	ML	N/A	STUB CONDUIT INTO DOOR HEADER
EXIT DEVICE (ELEC. OR MECH.)	N/A	CB	N/A	STUB CONDUIT INTO DOOR FRAME (HINGE SIDE)
DELAYED EGRESS EXIT DEVICE	N/A	DE	N/A	STUB CONDUIT INTO DOOR FRAME (HINGE SIDE)
ELECTRIC EXIT DEVICE	N/A	ED	N/A	ROUTE CABLING THROUGH DOOR
AUTOMATIC DOOR ACTUATOR	SINGLE GANG	DA	42" AFF	ADJACENT TO CARD READER
LOCAL DOOR ALARM	SINGLE GANG		BFC	ADJACENT TO CARD READER
RTE MOTION DETECTOR	SINGLE GANG	RX	BFC	ADJACENT TO CARD READER
ELECTRIC POWER TRANSFER	N/A	PT	N/A	STUB CONDUIT INTO DOOR FRAME (HINGE SIDE)
DOOR POWER SUPPLIES	N/A	PS	N/A	COORDINATE WITH DOOR HARDWARE CONTRACTOR

GENERAL NOTES (THIS SHEET ONLY):

1. REFERENCE FLOOR PLANS FOR SECURITY ENCLOSURE DESIGNATION FOR EACH DOOR.
2. COORDINATE DOOR ROUGH-IN AND WIRING REQUIREMENTS WITH THE FINAL DOOR SCHEDULE AND DOOR HARDWARE SPECIFICATIONS.
3. UNLESS OTHERWISE NOTED, DOOR LOCKS SHALL BE POWERED BY THE LOCKING HARDWARE POWER SUPPLIES LOCATED WITH THE SECURITY ENCLOSURES. EACH DOOR LOCK SHALL BE CONNECTED TO AN INDIVIDUALLY FUSED CLASS 2 RATED POWER CONNECTION AT THE SOURCE. DO NOT DOUBLE LUG.
4. SIZE POWER CONDUCTORS BETWEEN THE DOOR LOCKING HARDWARE POWER SUPPLIES AND THE LOCK SUCH THAT THE VOLTAGE LOSS DOES NOT EXCEED 10%.
5. CONFIGURE LOCK POWER SUPPLIES TO RELEASE DOORS THAT ARE LOCKED IN THE DIRECTION OF EGRESS UPON FIRE ALARM OR POWER FAILURE. COORDINATE WITH FIRE ALARM DRAWINGS.

CONDUIT TAG LEGEND (THIS SHEET ONLY):

1 0.5" CONDUIT

2 0.75" CONDUIT

3 1" CONDUIT

4 WIRING THROUGH DOOR

KEY NOTES (DOOR DETAILS ONLY):

1 CABLING TO DESIGNATED SECURITY ENCLOSURES AS INDICATED ON FLOOR PLANS. SEE SECURITY GENERAL NOTES FOR CONDUIT AND CABLING REQUIREMENTS.

2 MOUNT DOOR JUNCTION BOX ABOVE ACCESSIBLE CEILING ON SECURE SIDE OF DOOR. FOR DOORS WITH FINISHED CEILINGS ON SECURE SIDE MOUNT IN NEAREST ACCESSIBLE CEILING SPACE.

3 120VAC BY ELECTRICAL CONTRACTOR. REFERENCE ELECTRICAL DRAWINGS.

4 EXIT DEVICE POWER SUPPLY PROVIDED UNDER DIVISION 8 SPECIFICATIONS. COORDINATE WITH THE FINAL DOOR HARDWARE SCHEDULE FOR LOCATIONS WHERE REQUIRED.

5 REFERENCE FLOOR PLANS FOR LOCATIONS WHERE LOCAL DOOR ALARM MANAGEMENT SYSTEM OR SOUNDER IS REQUIRED.

6 COORDINATE EXIT DEVICE TYPE WITH FINAL DOOR HARDWARE SCHEDULE AND DOOR HARDWARE CONTRACTOR. DOORS EQUIPPED WITH ELECTRIC LATCH RETRACTION TYPE LOCKING HARDWARE SHALL BE POWERED BY STANDALONE POWER SUPPLIES LOCATED AT EACH DOOR PROVIDED UNDER DIVISION 8 SPECIFICATIONS. EXIT DEVICES WITH LOW CURRENT DRAW MOTOR DRIVEN RETRACTION OR ELECTRIC TRIM SHALL BE POWERED FROM THE DOOR LOCKING HARDWARE POWER SUPPLY AT THE SECURITY ENCLOSURES.

7 MECHANICAL EXIT DEVICE WITH RTE SWITCH. CONFIGURE ACCESS CONTROL SYSTEM TO BYPASS DELAYED EGRESS SYSTEM ON VALID CARD READ AND ALLOW ACCESS BY RELEASING EXIT DEVICE.

8 CONFIGURE DOOR EXTERIOR ADA DOOR ACTUATORS TO BE ACTIVE WHEN THE DOOR IS UNLOCKED BY THE ACCESS CONTROL SYSTEM. CONNECT INTERIOR DOOR ACTUATOR IN ADDITION TO DOOR OPERATOR TO THE ACCESS CONTROL SYSTEM REQUEST TO EXIT INPUT TO BYPASS DOOR ALARM ON OPERATOR ASSISTED EXIT.

9 WIRELESS LOCK - DOOR SHALL BE PREPPED BY DOOR MANUFACTURER.

10 SEE SECURITY GENERAL NOTES FOR CONDUIT AND CABLING REQUIREMENTS. ROUTE CABLES TO DESIGNATED NETWORK SWITCH.

DOOR EQUIPMENT AND OPERATIONAL MATRIX

SEQUENCE OF OPERATIONS

Door Type	Door Style	Alarm Upon Forced Entry	Alarm Upon Held Open	Unlock On Valid Card Read	Shunt Alarm On Valid Card	Unlock On RTE	Shunt Alarm On RTE	Exterior Door Actuator Activated on Valid Card Read	Interior Door Actuator Tied to RTE	Interior Door Actuator Unlocks and Opens Door	NOTES
S1	Single Door	X									DPS WITH OR WITHOUT LA.
S2	Single Door	X	X	X	X		X				DPS, EL, AND CR.
S3	Single Door	X	X	X	X		X				DPS, ED, AND CR.
S4	Single Door	X	X								
D1	Double Door	X									
D2	Double Door	X	X	X	X		X				CARD READER ACTIVATES DOOR CONTROL BUTTONS
D3	Double Door	X	X								
D4	Double Door	X	X								CARD READER ACTIVATES DOOR CONTROL BUTTONS
SL1	Sliding Door	X	X	X	X	X	X	X	X	X	
OH1	Overhead Door	X	X	X	X	X	X	X	X	X	CARD READER ACTIVATES PUSH BUTTON USED TO RAISE DOOR FOR PREDEFINED TIME.
G1	Exterior Gate	X									

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530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

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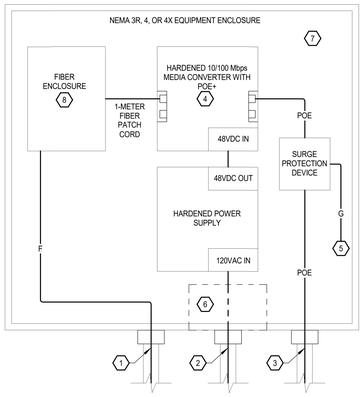


9 POLE-MOUNTED MEDIA ENCLOSURE DETAIL
NTS

GENERAL NOTES (THIS DETAIL ONLY):

1. SEAL ALL PENETRATIONS AND KNOCKOUTS TO MAINTAIN ENCLOSURE RATING.
2. COORDINATE ALL ADDITIONAL TRADE REQUIREMENTS WITH THE APPROPRIATE SUBCONTRACTORS TO ENSURE THE SYSTEM IS OPERATING PER MANUFACTURERS RECOMMENDATIONS.

KEYED NOTES (THIS DETAIL ONLY):

1. ONE 2-STRAND OUTSIDE PLANT OS2 SINGLEMODE FIBER OPTIC CABLE IN 1-INCH FLEX CONDUIT. SEAL PENETRATIONS ONCE CABLE AND FLEX CONDUIT IS INSTALLED.
2. 120V POWER CABLE IN 1-INCH FLEX CONDUIT. SEE ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
3. CATEGORY 6 POE CABLE TO CAMERA IN 3/4-INCH FLEX CONDUIT. SEAL PENETRATIONS ONCE CABLE AND FLEX CONDUITS ARE INSTALLED.
4. HARDENED 10/100 MBPS MEDIA CONVERTER AND POWER SUPPLY WITH COMPATIBLE SFP MODULE.
5. CONNECT GROUND WIRE FROM SURGE PROTECTION DEVICE TO EQUIPMENT GROUND PROVIDED UNDER DIVISION 26.
6. 120 VAC DUPLEX RECEPTACLE.
7. PROVIDE MOUNTING HARDWARE/BRACKETS TO ATTACH ELECTRONICS CABINET
8. WALL-MOUNT FIBER ENCLOSURE (BASIS OF DESIGN: CORNING SPH-01P)

CABLING TYPE LEGEND (THIS DETAIL ONLY):

F - FIBER
G - GROUNDING CONDUCTOR
POE - CAT 6 POE

CAMERA RECORDING TYPE SCHEDULE

RECORDING PROFILE	FPS	QUALITY	COMPRESSION	RETENTION (DAYS)	HOURS	MOTION OR CONTINUOUS	MOTION %
1	15	HIGH	H.264	30	24	MOTION	10
2	15	HIGH	H.264	30	24	MOTION	20
3	15	HIGH	H.264	30	24	MOTION	30
4	15	HIGH	H.264	30	24	MOTION	40
5	15	HIGH	H.264	30	24	MOTION	50

GENERAL NOTES (THIS DETAIL ONLY):

1. NOT ALL RECORDING TYPES ARE USED. COORDINATE FINAL PROGRAMMING REQUIREMENTS WITH OWNER.

GENERAL NOTES (THIS DETAIL ONLY):

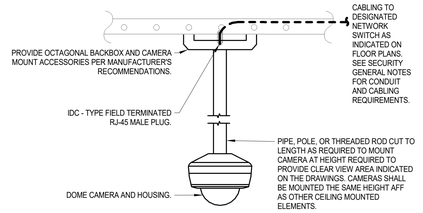
1. THE VIDEO ARCHIVAL SYSTEM SHALL INCLUDE SUFFICIENT NETWORK VIDEO RECORDERS (NVRS) OR SERVERS AND VIDEO STORAGE MEDIA TO RECORD OR ARCHIVE VIDEO FROM EACH CAMERA UNDER THE FOLLOWING PARAMETERS:
   A. HIGHEST SUPPORTED CAMERA RESOLUTION.
   B. HIGHEST QUALITY LEVEL.
   C. FOR 30 DAYS.
   D. ON MOTION.
   E. PROVIDE 25% SPARE CAPACITY.
2. SERVERS SHALL BE CONFIGURED FOR NO MORE THAN 75% UTILIZATION OF TOTAL RECORDING AND PLAYBACK BANDWIDTH OR PROCESSING CAPACITY SUPPORTED

CAMERA TYPE SCHEDULE

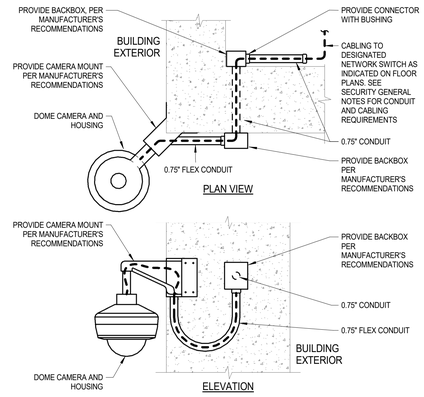
CAMERA TYPE	HOUSING STYLE	FIXED / PTZ / PANORAMIC	ENCLOSURE RATING	SENSOR TYPE	RESOLUTION PIXELS (MP)	HORIZONTAL FIELD OF VIEW	POWER TYPE		POWER CONSUMPTION (W)	
							W/O IR	W IR	W/O IR	W IR
2A	MINI-DOME	FIXED	INDOOR	SINGLE	2.0	--	POE	POE	11	12.95
2B	MINI-DOME	FIXED	OUTDOOR	SINGLE	2.0	--	POE	POE	11	12.95
6A	MINI-DOME	PANORAMIC	INDOOR	SINGLE	6.0	360°	POE	--	12.95	--
8A	MINI-DOME CORNER	FIXED	INDOOR	SINGLE	6.0	176°	POE	--	12.95	--
10A	DOME	FIXED	INDOOR	DUAL-SENSOR	2 X 5.0	180°	POE+	POE++	25.5	51
10B	DOME	FIXED	OUTDOOR	DUAL-SENSOR	2 X 5.0	180°	POE+	POE++	25.5	51
15A	DOME	FIXED	INDOOR	MULTI-SENSOR	3 X 5.0	270°	POE+	POE++	25.5	51
15B	DOME	FIXED	OUTDOOR	MULTI-SENSOR	3 X 5.0	270°	POE+	POE++	25.5	51
20A	DOME	FIXED	INDOOR	MULTI-SENSOR	4 X 5.0	360°	POE+	POE++	25.5	51
20B	DOME	FIXED	OUTDOOR	MULTI-SENSOR	4 X 5.0	360°	POE+	POE++	25.5	51

GENERAL NOTES (THIS DETAIL ONLY):

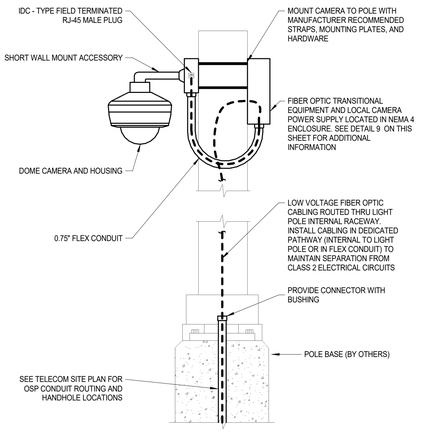
1. NOT ALL CAMERA TYPES ARE USED. REFERENCE CAMERA IDENTIFICATION TAGS ON THE FLOOR PLANS FOR REQUIREMENTS FOR EACH CAMERA.
2. CAMERA TYPE INCLUDES CAMERA TYPE SPECIFIED AS THE NUMERICAL PART OF THE TWO LETTER CODE, AND THE ENCLOSURE RATING TYPE SPECIFIED AS THE ALPHABETICAL PART OF THE TWO LETTER CODE. "A" REPRESENTS INDOOR TYPE CAMERA, "B" REPRESENTS OUTDOOR TYPE CAMERA. REFERENCE SPECIFICATIONS FOR REQUIREMENTS.



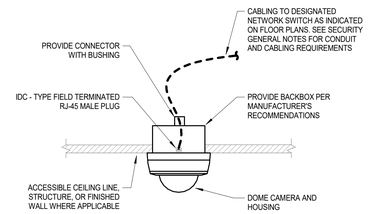
6 CAMERA MOUNT TYPE CT
NTS



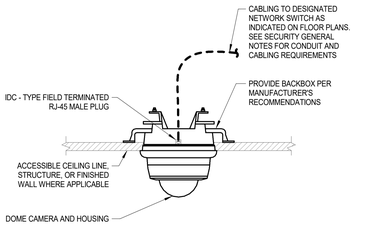
7 CAMERA MOUNT TYPE WC
NTS



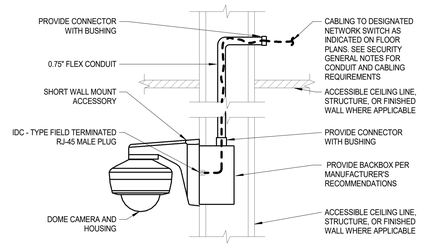
8 CAMERA MOUNT TYPE PH
NTS



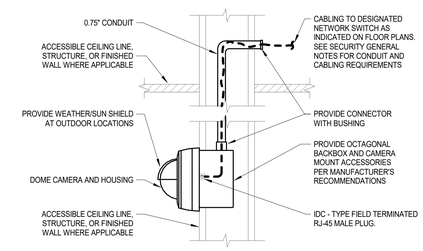
1 CAMERA MOUNT TYPE CS
NTS



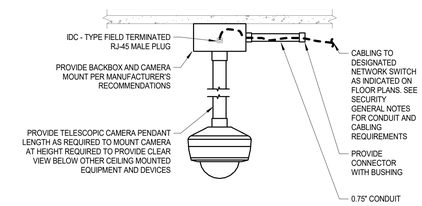
2 CAMERA MOUNT TYPE CF
NTS



3 CAMERA MOUNT TYPE WP
NTS



4 CAMERA MOUNT TYPE WS
NTS



5 CAMERA MOUNT TYPE CP
NTS

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N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT — ROBERT SCOTT LARAIA — No. 22 — LICENSED TELECOMMUNICATION TECHNICIAN

Signed on 05/18/2026 using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

SECURITY DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NTS
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

SC5.02

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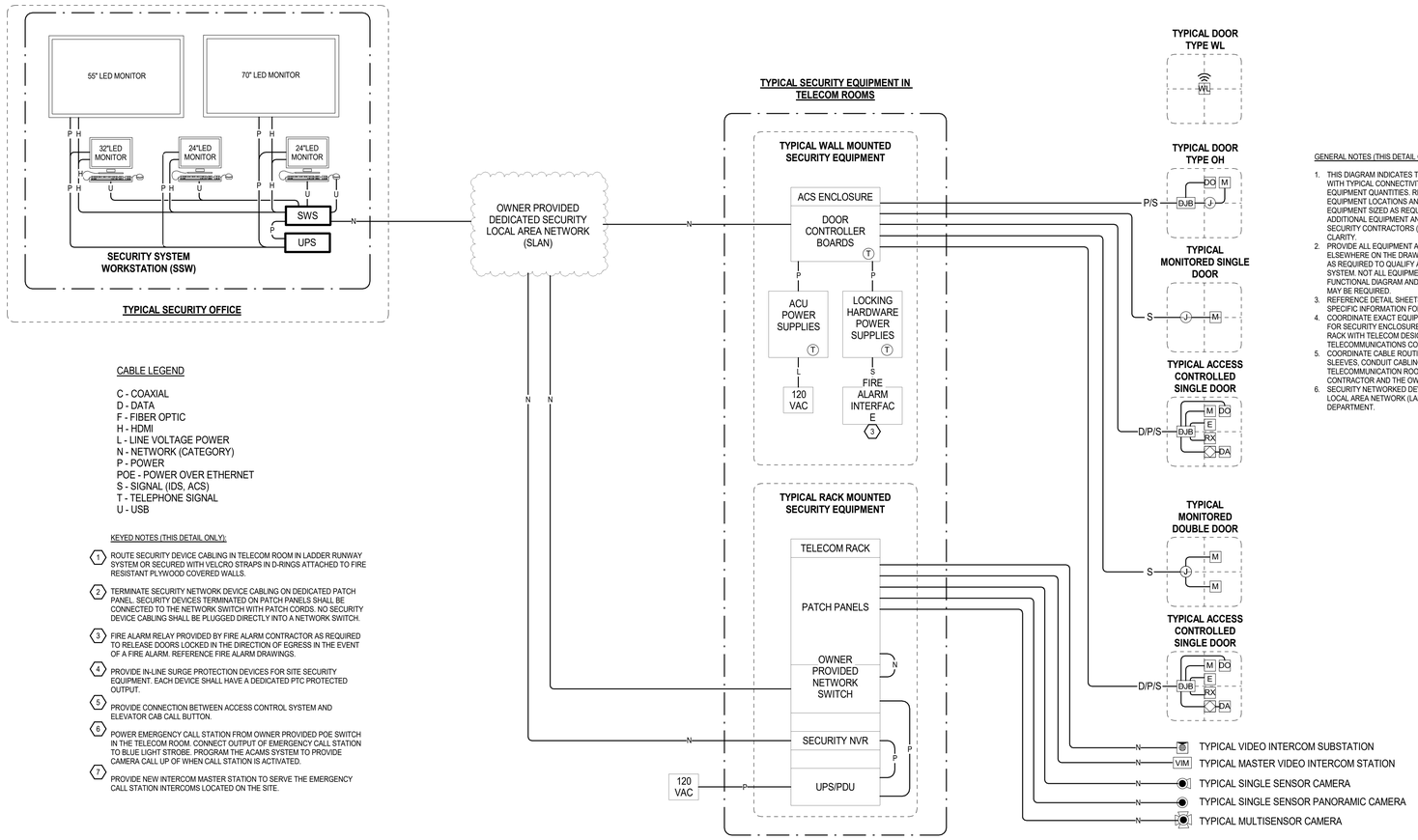

CABLE LEGEND

C - COAXIAL
D - DATA
F - FIBER OPTIC
H - HDMI
L - LINE VOLTAGE POWER
N - NETWORK (CATEGORY)
P - POWER
POE - POWER OVER ETHERNET
S - SIGNAL (IDS, ACS)
T - TELEPHONE SIGNAL
U - USB

KEYED NOTES (THIS DETAIL ONLY):

1. ROUTE SECURITY DEVICE CABLING IN TELECOM ROOM IN LADDER RUNWAY SYSTEM OR SECURED WITH VELCRO STRAPS IN D-RINGS ATTACHED TO FIRE RESISTANT PLYWOOD COVERED WALLS.
2. TERMINATE SECURITY NETWORK DEVICE CABLING ON DEDICATED PATCH PANEL. SECURITY DEVICES TERMINATED ON PATCH PANELS SHALL BE CONNECTED TO THE NETWORK SWITCH WITH PATCH CORDS. NO SECURITY DEVICE CABLING SHALL BE PLUGGED DIRECTLY INTO A NETWORK SWITCH.
3. FIRE ALARM RELAY PROVIDED BY FIRE ALARM CONTRACTOR AS REQUIRED TO RELEASE DOORS LOCKED IN THE DIRECTION OF EGRESS IN THE EVENT OF A FIRE ALARM. REFERENCE FIRE ALARM DRAWINGS.
4. PROVIDE IN-LINE SURGE PROTECTION DEVICES FOR SITE SECURITY EQUIPMENT. EACH DEVICE SHALL HAVE A DEDICATED PTC PROTECTED OUTPUT.
5. PROVIDE CONNECTION BETWEEN ACCESS CONTROL SYSTEM AND ELEVATOR CAB CALL BUTTON.
6. POWER EMERGENCY CALL STATION FROM OWNER PROVIDED POE SWITCH IN THE TELECOM ROOM. CONNECT OUTPUT OF EMERGENCY CALL STATION TO BLUE LIGHT STROBE. PROGRAM THE ACAMS SYSTEM TO PROVIDE CAMERA CALL UP OF WHEN CALL STATION IS ACTIVATED.
7. PROVIDE NEW INTERCOM MASTER STATION TO SERVE THE EMERGENCY CALL STATION INTERCOMS LOCATED ON THE SITE.

GENERAL NOTES (THIS DETAIL ONLY):

1. THIS DIAGRAM INDICATES TYPICAL SECURITY SYSTEM ARCHITECTURE WITH TYPICAL CONNECTIVITY REQUIREMENTS AND NOT ACTUAL EQUIPMENT QUANTITIES. REFERENCE FLOOR PLANS FOR FIELD EQUIPMENT LOCATIONS AND QUANTITIES. PROVIDE HEAD END EQUIPMENT SIZED AS REQUIRED BY NUMBER OF FIELD DEVICES. ADDITIONAL EQUIPMENT AND CONNECTIONS NOT COVERED UNDER THE SECURITY CONTRACTORS (DIVISION 28) SCOPE MAY BE SHOWN FOR CLARITY.
2. PROVIDE ALL EQUIPMENT AND CONNECTIONS AS SPECIFIED, SHOWN ELSEWHERE ON THE DRAWINGS, OR REQUIRED BY THE MANUFACTURER AS REQUIRED TO QUALIFY AS A FULLY FUNCTIONAL AND OPERATIONAL SYSTEM. NOT ALL EQUIPMENT AND CONNECTIONS ARE SHOWN ON THIS FUNCTIONAL DIAGRAM AND ADDITIONAL EQUIPMENT AND CONNECTIONS MAY BE REQUIRED.
3. REFERENCE DETAIL SHEETS FOR ADDITIONAL MOUNTING, CABLING AND SPECIFIC INFORMATION FOR EACH DEVICE TYPE.
4. COORDINATE EXACT EQUIPMENT LAYOUT AND SPACE REQUIREMENTS FOR SECURITY ENCLOSURES AND SECURITY EQUIPMENT IN TELECOM RACK WITH TELECOM DESIGN DOCUMENTS AND THE TELECOMMUNICATIONS CONTRACTOR (DIVISION 27).
5. COORDINATE CABLE ROUTING IN TELECOMMUNICATIONS CABLE TRAYS, SLEEVES, CONDUIT CABLING PATHWAYS, AND CABLING WITHIN TELECOMMUNICATION ROOMS WITH TELECOMMUNICATIONS CONTRACTOR AND THE OWNER'S IT DEPARTMENT.
6. SECURITY NETWORKED DEVICES SHALL BE ON A SEPARATE DEDICATED LOCAL AREA NETWORK (LAN) PROVIDED BY THE OWNER IT DEPARTMENT.

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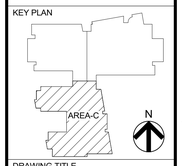

DRAWING TITLE

SECURITY RISER DIAGRAMS

STATE PROJ. NO.	144-0108N
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TELECOM OUTLET / DEVICE ROUGH-IN AND CABLING REQUIREMENT MATRIX

DRAWING SYMBOL	NAME	BACKBOX SIZE	MOUNTING HEIGHT AFF	CONDUIT SIZE	FACEPLATE TYPE	TERMINATION	QTY DATA CABLES	CABLING TYPE	CABLING COLOR	JACK COLOR	ADDITIONAL OUTLET / DEVICE NOTES
#D	DATA OUTLET	2G	18"	1"	SINGLE GANG 2-PORT	RJ-45	#	CAT 6	BLUE	BLUE	# INDICATED ON FLOOR PLANS REPRESENTS QUANTITY OF DATA CABLE DROPS REQUIRED.
#D	DATA OUTLET - ABOVE COUNTER	2G	SEE ADDITIONAL NOTES	1"	SINGLE GANG 2-PORT	RJ-45	#	CAT 6	BLUE	BLUE	MOUNT AT 8"-12" ABOVE COUNTER TOP. COORDINATE WITH ELECTRICAL. # INDICATED ON FLOOR PLANS REPRESENTS QUANTITY OF DATA CABLE DROPS REQUIRED.
W	STANDARD WALL PHONE OUTLET	1G	48"	1"	SINGLE GANG 1-PORT	RJ-45	1	CAT 6	BLUE	BLUE	PROVIDE FACEPLATE WITH PHONE MOUNTING STUDS.
BAS	BUILDING AUTOMATION DATA OUTLET (BMS, LTG CONTROL, INVERTER)	2G	NA	1"	2-PORT BISCUIT BOX	RJ-45	1	CAT 6	BLUE	BLUE	TERMINATE DATA CABLE INSIDE BUILDING CONTROLS ENCLOSURE WITH 2-PORT BISCUIT HOUSING. COORDINATE INSTALLATION LOCATION AND MOUNTING HEIGHT WITH CONTROLS CONTRACTOR.
FA	FIRE ALARM DATA OUTLET	2G	NA	1"	1-PORT BISCUIT BOX	RJ-45	2	CAT 6	BLUE	BLUE	TERMINATE CABLE INSIDE FIRE ALARM CONTROL PANEL WITH 1-PORT BISCUIT HOUSING. COORDINATE INSTALLATION LOCATION AND MOUNTING HEIGHT WITH FA CONTRACTOR.
EC	ELEVATOR CONTROLS DATA OUTLET	NA	NA	1"	MPTL	RJ-45	3	CAT 6	BLUE	BLUE	COORDINATE TERMINATION LOCATION AND FINAL CONNECTION WITH ELEVATOR CONTRACTOR. ONE OF THREE CABLES FOR VIDEO SURVEILLANCE CAMERA INSIDE ELEVATOR CAB.
ES	E-SPORTS SIMPLEX DATA OUTLET	2G	18"	1"	SINGLE GANG 2-PORT	RJ-45	1	CAT 6A	GREEN	GREEN	DATA FOR E-SPORTS COMPUTER. TERMINATE DATA CABLES ON A DEDICATED PATCH PANEL WITHIN THE SERVING TELECOM ROOM.
AP	ACCESS POINT OUTLET	2G	120" AFF (UON)	1"	MPTL	RJ-45	2	CAT 6A	BLUE	BLUE	PROVIDE ADDITIONAL 20' OF SERVICE LOOP FOR FIELD ADJUSTMENTS. SEE WIRELESS DETAILS FOR ADDITIONAL INFORMATION AND MOUNTING DETAIL. COORDINATE EXACT LOCATION WITH VENDOR/OWNER PRIOR TO INSTALLATION.
AP	CEILING-MOUNTED ACCESS POINT OUTLET	2G	CEILING	1"	MPTL	RJ-45	2	CAT 6A	BLUE	BLUE	PROVIDE ADDITIONAL 20' OF SERVICE LOOP FOR FIELD ADJUSTMENTS. SEE WIRELESS DETAILS FOR ADDITIONAL INFORMATION AND MOUNTING DETAIL. COORDINATE EXACT LOCATION WITH VENDOR/OWNER PRIOR TO INSTALLATION.
APX	WALL MOUNTED OUTDOOR WIRELESS ACCESS POINT	2G	NA	1"	MPTL	RJ-45	2	CAT 6A	BLUE	BLUE	PROVIDE ADDITIONAL 20' OF SERVICE LOOP FOR FIELD ADJUSTMENTS. SEE WIRELESS DETAILS FOR ADDITIONAL INFORMATION AND MOUNTING DETAIL. COORDINATE EXACT LOCATION WITH VENDOR/OWNER PRIOR TO INSTALLATION. SUBSCRIPT "X" INDICATES OUTDOOR WIRELESS ACCESS POINT.
VD	CEILING-MOUNTED VAPE DETECTION OUTLET	2G	CEILING	1"	MPTL	RJ-45	1	CAT 6	BLUE	BLUE	PROVIDE ADDITIONAL 20' OF SERVICE LOOP FOR FIELD ADJUSTMENTS. COORDINATE EXACT LOCATION WITH VENDOR/OWNER PRIOR TO INSTALLATION.
CL	CLOCK DATA OUTLET	2G	78"	1"	RJ-45 MOD PLUG	RJ-45	1	CAT 6	BLUE	BLUE	COIL TERMINATED CAT-6 CABLE FOR FUTURE USE IN 2-GANG BACKBOX BEHIND CLOCK. FURNISH AND INSTALL WIRELESS CLOCK PER SPECIFICATIONS. 120V POWER FOR CLOCK BY ELECTRICAL CONTRACTOR.
SP	INFORMACAST OUTDOOR SPEAKER	1G	PER ARCH. ELEVATIONS	1"	RJ-45 MOD PLUG	RJ-45	1	CAT 6	BLUE	BLUE	COORDINATE WITH SPEAKER INSTALLATION.
J	MODULAR FURNITURE DATA WALL CONNECTION	2G	SEE NOTE	1.25"	-	-	-	-	-	-	PROVIDE A 1.25" FLEX CONDUIT BETWEEN FURNITURE AND WALL J-BOX.
#D P	COMBO AV/POWER/DATA POKE-THRU	NA	FLOOR	1.25"	4-PORT INSERT	RJ-45	#	CAT 6	BLUE	BLUE	#D INDICATED ON FLOOR PLANS REPRESENT QUANTITY OF DATA CABLE DROPS REQUIRED. SEE "AV" AND "E" DRAWINGS FOR ADDITIONAL REQUIREMENTS.
#D F	COMBO AV/POWER/DATA FLOOR BOX	NA	FLOOR	1.25"	4-PORT INSERT	RJ-45	#	CAT 6	BLUE	BLUE	
	DATA OUTLET FOR SECURITY CAMERA	SEE NOTE	NA	NA	MPTL	RJ-45	1	CAT 6	BLUE	BLUE	REFER TO SECURITY DRAWINGS FOR ROUGH-IN REQUIREMENTS.
	DATA OUTLET FOR VIDEO INTERCOM	NA	NA	NA	MPTL	RJ-45	1	CAT 6	BLUE	BLUE	DATA OUTLET FOR VIDEO INTERCOM. REFER TO SECURITY DRAWINGS FOR ROUGH-IN REQUIREMNETS.
SR	DATA OUTLET FOR SPEECH REINFORCEMENT SYSTEM	NA	CEILING	NA	1-PORT BISCUIT HOUSING	RJ-45	1	CAT 6	BLUE	BLUE	PROVIDE DATA OUTLET FOR SOUND REINFORCEMENT SYSTEM. TERMINATE TO 1-PORT BISCUIT INSIDE 2X2 CEILING ENCLOSURE AND PROVIDE 3' GRAY PATCH CORD FROM BISCUIT TO ROOM CONTROLLER. SEE DETAILS ON T5.05 AND T5.06.
CP	CLASSROOM A/V CONTROL PANEL	2G W/ 1G REDUCING RING	48"	1"	NA	NA	NA	NA	NA	NA	SEE DETAILS ON SHEETS T5.07 THRU T5.09
AV	CLASSROOM A/V INPUT PLATE	2G W/ 1G REDUCING RING	18"	1.25"	NA	NA	NA	NA	NA	NA	SEE DETAILS ON SHEETS T5.07 THRU T5.09
TS	TEACHER STATION (2 DATA + 3.5MM JACK)	2G W/ 1G REDUCING RING	18"	1"	SINGLE GANG 4-PORT	RJ-45	2	CAT 6	BLUE	BLUE	SEE DETAILS ON SHEETS T5.07 THRU T5.09
						3.5MM JACK	NA	18/2	NA	NA	
BR	FIBER OPTIC DATA OUTLET FOR BROADCAST SYSTEM	2G	18"	1"	3-PORT FACEPLATE	LC/APC	6F	OS2 SINGLE MODE	YELLOW	GREEN LC/APC	TERMINATE ALL BROADCAST FIBER OPTIC CABLES IN THE CONTROL ROOM IN FLOOR STANDING CABINET. AT EACH LOCATION, PROVIDE LC DUPLEX KEYSTONE MODULES WITH DUST COVERS.
DP DS	WALL MOUNT DISPLAY	CHIEF PAC525 OR EQUAL	66"	1.25"	2-PORT BISCUIT	RJ-45	1	CAT 6	BLUE	BLUE	FURNISH AND INSTALL IN-WALL A/V BOX (CHIEF PAC525 OR EQUAL). COORDINATE ELECTRICAL RECEPTACLE LOCATED INSIDE BOX (ELECTRICAL BACKBOX ON TOP OF BOX)
J P J S	PLANETARIUM EQUIPMENT BACKBOXES	SEE NOTE	SEE NOTE	SEE NOTE	NA	NA	NA	NA	NA	NA	BACKBOX LOCATIONS ON DRAWINGS ARE APPROXIMATE. COORDINATE ALL BACKBOX SIZES, CONDUIT DIAMETER, CUNDIT ROUTING, AND LOCATIONS FOR PROJECTORS, SPEAKERS, AND OTHER PLANETARIUM EQUIPMENT WITH VENDOR. 'P' SUBSCRIPT INDICATES PROJECTOR AND 'S' SUBSCRIPT INDICATES SPEAKER.
V	PAGING SPEAKER VOLUME CONTROLLER	1G	48"	0.75"	NA	NA	NA	NA	NA	NA	SEE FLOOR PLAN FOR LOCATIONS. PLATE AND VOLUME CONTROL KNOB TO BE WHITE. BASIS OF DESIGN: ATLAS AT100D.

GENERAL NOTES / DEVICE NOTES

1. ALL INFORMATION IS TYPICAL AS INDICATED IN THIS MATRIX UNLESS OTHERWISE NOTED ELSEWHERE.
2. ALL OUTLETS SHALL BE LOCATED ADJACENT TO POWER RECEPTACLES WHERE APPLICABLE.
3. FINAL HEIGHT AND MOUNTING LOCATIONS SHALL BE COORDINATED WITH THE ARCHITECTURAL ELEVATIONS.
4. ALL OUTLET CONDUITS SHALL BE ROUTED TO THE NEAREST ACCESSIBLE CEILING SPACE IN THE CORRIDOR, UON.
5. PROVIDE BLANK MODULES FOR ALL UNUSED PORTS.
6. REAM AND BUSH ALL CONDUIT ENDS.
7. PROVIDE SINGLE GANG PLASTER RING FOR DOUBLE GANG BOXES WITH SINGLE GANG FACEPLATES.
8. PROVIDE DOUBLE GANG PLASTER RING FOR DOUBLE GANG BOXES WITH DOUBLE GANG FACEPLATES.
9. REFER TO FACEPLATE DETAILS FOR OUTLET PORT CONFIGURATION.

SCOPE GUIDANCE

1. THE WORK DESCRIBED IN THESE T-SERIES DRAWINGS APPLY TO DIVISION 27 SPECIFICATIONS.
2. ELECTRICAL SCOPE: THE INFRASTRUCTURE PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE ELECTRICAL CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   A. TELECOM SPACES
      1. BACKBOARDS
      2. CONDUIT PULL BOXES
      3. RISER SLEEVES
      4. SLEEVES FROM TELECOM SPACES TO CABLE TRAY
      5. SLEEVES THROUGH WALL PARTITIONS ALONG CABLE TRAY ROUTE INCLUDING AIR ZONE/SPACE PARTITIONS
      6. JUNCTION BOXES
      7. FLOOR BOXES, AS SPECIFIED BY ELECTRICAL OR AUDIOVISUAL
      8. SITE WORK, DUCTBANK AND INNERDUCT FOR CAMPUS DISTRIBUTION
      9. INTERIOR INNERDUCT
      10. BONDING AND GROUNDING CONDUIT AND RACEWAY TO GROUND BUS
3. CABLING SCOPE: THE CABLING PORTION OF THESE DOCUMENTS SHALL BE PROVIDED AND INSTALLED BY THE COMMUNICATIONS CABLING CONTRACTOR AND SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   A. TELECOM SPACES
      1. TELECOM RELAY RACKS AND EQUIPMENT CABINETS
      2. CABLE RUNWAY AND ALL ACCESSORIES IN TELECOM ROOMS
      3. PATCH PANELS AND FIBER ENCLOSURES
      4. RACK-MOUNT UNINTERRUPTIBLE POWER SUPPLIES AND VERTICAL POWER STRIPS.
      5. VERTICAL AND HORIZONTAL CABLING MANAGEMENT
      6. BONDING AND GROUNDING OF EQUIPMENT TO GROUND BUS (AS PROVIDED BY ELECTRICAL PORTION)
   B. CABLING AND CONNECTIVITY
      1. ALL COPPER AND FIBER CABLING PATCH CORDS - SEE SHEET T4.02 FOR TYPES, QUANTITIES, COLORS AND LENGTHS.
      2. ALL COPPER AND FIBER CONNECTORS AND JACKS
      3. ALL COPPER AND FIBER TERMINATIONS
      4. ALL DATA CABLING REQUIRED TO SUPPORT SECURITY AND ACCESS CONTROL INFRASTRUCTURE. (CAMERAS, CARD READERS, MEDIA CONVERTERS, ETC.)
      5. FACEPLATES AND/OR BISCUITS
      6. EXTERIOR/OUTSIDE PLANT CABLING, INCLUDING SPLICING, TERMINATIONS AND TESTING.
   C. INTERIOR & EXTERIOR PATHWAYS
      1. SEALING OF TELECOM CONDUITS AND SLEEVES. PROPERLY SEAL AND FIRESTOP ALL PENETRATIONS. CONTRACTOR SHALL INSTALL THE APPROPRIATE FIRESTOP ASSEMBLY IN ORDER TO MAINTAIN THE FIRE BARRIERS AND PARTITION RATINGS.
   D. WIRELESS ACCESS POINTS
      1. WIRELESS ACCESS POINTS SHALL BE OWNER FURNISHED
4. THE CONTRACTOR RESPONSIBLE FOR THE ELECTRICAL PORTION SHALL PROVIDE AND INSTALL ALL INCIDENTAL EQUIPMENT AND MATERIALS RELATED TO THEIR WORK AND REQUIRED BY THE COMMUNICATIONS CABLING DOCUMENTS. FOR EXAMPLE, INSULATING BUSHINGS FOR CONDUIT ENDS SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
5. THE CONTRACTOR RESPONSIBLE FOR THE CABLING PORTION SHALL PROVIDE AND INSTALL ALL INCIDENTAL EQUIPMENT AND MATERIALS RELATED TO THEIR WORK AND REQUIRED BY THE COMMUNICATION CABLING DOCUMENTS. FOR EXAMPLE, VELCRO CABLE TIES NECESSARY FOR CABLE MANAGEMENT SHALL BE PROVIDED BY THE CABLING CONTRACTOR.
6. FOR THE INFRASTRUCTURE PORTION, ANY AND ALL DEVIATIONS FROM THE CONTRACT DOCUMENTS REQUIRED BY FIELD CONDITIONS SHALL BE RESOLVED THROUGH THE RFI PROCESS TO AVOID INADEQUATE OR INCORRECT INFRASTRUCTURE FOR USE BY THE CABLING CONTRACTOR.
7. THE CABLING CONTRACTOR SHALL NOTE THAT SECURITY DRAWINGS REQUIRE CAT-6 CABLING TO BE RUN BY THE STRUCTURED CABLING CONTRACTOR.
8. CONDUITS AND OTHER RACEWAYS USED FOR ANY PURPOSE, INCLUDING WIRING AND CABLING FOR BUILDING WITHIN ARCHITECTURAL SHAFTS AND ENCLOSURES INDICATED ON THE DRAWING OR CONCEALED WITHIN THE CONCRETE STRUCTURE, EXCEPT WHERE ROUTING IS SPECIFICALLY SHOWN OR DETAILED TO BE EXPOSED ON THE DRAWINGS. THE CONTRACTOR SHALL COORDINATE ROUTING OF RACEWAY WITHIN CONCRETE SLABS, BEAMS, AND COLUMNS WITH THE SUBCONTRACTORS. RACEWAY CONCEALED IN STRUCTURE SHALL NOT EXCEED 1" DIAMETER AND ROUTING OF SUCH RACEWAY SHALL BE MODIFIED TO COMPLY WITH THE CONCEALMENT AND SPACING REQUIREMENTS INDICATED ON THE STRUCTURAL DRAWINGS. RACEWAY SHALL NOT BE VISIBLE FROM THE FINISHED SPACE. CONDUITS SHALL BE ROUTED TIGHT TO STRUCTURE ABOVE, UON.
9. PROVIDE A PROPERLY SIZED PULLBOX PER ANSI/TIA-569 IN CONDUIT PATHWAYS WHERE CONDUIT WOULD EXCEED 100' OF CONTINUOUS PATHWAY OR 180 DEGREES OF BEND BETWEEN PULLBOXES OR THE ENDS OF THE CONDUIT PATHWAY.
10. DRAWINGS ARE GENERALLY DIAGRAMMATIC IN NATURE AND SHALL BE USED AS SUCH. EXACT LOCATIONS AND CONDITIONS OF TELECOM DEVICES AND ASSOCIATED INFRASTRUCTURE SHALL BE FIELD COORDINATED WITH OTHER TRADES PRIOR TO INSTALLATION.
11. PROVIDE CONDUIT PATHWAYS FOR LOW VOLTAGE CABLES ROUTED ACROSS INACCESSIBLE, OPEN AND HARD CEILINGS.
12. CONTRACTOR SHALL NOT PROVIDE AND INSTALL INFRASTRUCTURE AND NETWORK CABLING FOR SECURITY AND AV DEVICES NOT SHOWN ON THE TELECOM PLANS. SEE SECURITY AND AUDIO-VISUAL SHEETS FOR ADDITIONAL INFORMATION.
13. CONTRACTOR SHALL TERMINATE AND TEST ALL NETWORK DATA CABLING (REGARDLESS OF THE SYSTEM TYPE) IN ACCORDANCE WITH THE DIVISION 27 STRUCTURED CABLING AND PERFORMANCE VERIFICATION SPECIFICATIONS TO ENSURE THE PROPER FIBER AND DATA CHANNEL WARRANTY IS PROVIDED.
14. FIRE ALARM - THE FIRE ALARM CONTRACTOR WILL DETERMINE THE FINAL QUANTITY OF FATC PANELS IN THE FIELD. COORDINATE WITH THE FIRE ALARM CONTRACTOR FOR FINAL LOCATIONS OF FACT AND FACP PANELS FOR ANY ADDITIONAL DATA DROPS THAT MAY BE REQUIRED.

STANDARD TELECOM ABBREVIATIONS

AFC - ABOVE FINISHED CEILING
AFF - ABOVE FINISHED FLOOR
AFG - ABOVE FINISHED GRADE
ARF - ABOVE RAISED FLOOR
AP - ACCESS POINT
AV - AUDIO VISUAL
BFC - BELOW FINISHED CEILING
BOD - BASIS OF DESIGN
CCA - CEILING CONNECTOR ASSEMBLY
CDT/C - CONDUIT
CONT - CONTINUATION/CONTINUOUS
CLG - CEILING
CMP - COMMUNICATIONS MULTIPURPOSE CABLE, PLENUM
CMR - COMMUNICATIONS MULTIPURPOSE CABLE, RISER
EC - ELECTRICAL CONTRACTOR
EMT - ELECTRICAL METALLIC TUBING
ETR - EXISTING TO REMAIN
FAC - FLOOR ASSEMBLY CONNECTOR
FA - FIRE ALARM
FL - FLOOR
F - FIBER
FE - FIBER ENCLOSURE
GND - GROUND
GRC - GALVANIZED RIGID CONDUIT
HC - HORIZONTAL CROSS-CONNECT
IDC - INSTALLATION DISPLACEMENT CONNECTOR
IDF - INTERMEDIATE DISTRIBUTION FRAME
JB - JUNCTION BOX
MDF - MAIN DISTRIBUTION FRAME
MM - MULTI-MODE
MPOE - MINIMUM POINT OF ENTRY
MPTL - MALE PLUG - FILLED TERMINATED LINK
NIC - NOT IN CONTRACT
NSW - NETWORK SWITCH
NTS - NOT TO SCALE
OC - ON CENTER
OFCI - OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI - OWNER FURNISHED, OWNER INSTALLED
OSP - OUTSIDE PLANT
PBB - PRIMARY BONDING BUSBAR or TMGB
PDS - PROTECTED DISTRIBUTION SYSTEM
POE - POWER OVER ETHERNET
RAE - REFER TO ARCHITECTURAL ELEVATIONS.
RBB - RACK BONDING BUSBAR
RFI - REQUEST FOR INFORMATION
SBB - SECONDARY BONDING BUS BAR or TGB
SM - SINGLE MODE
SPEC - SPECIFICATION
TBB - TELECOM BONDING BACKBONE
TBC - TELECOM BONDING CONDUCTOR
TEBC - TELECOM EQUIPMENT BONDING CONDUCTOR
TGB - TELECOM GROUNDING BUSBAR or SBB
TMGB - TELECOM MAIN GROUNDING BUSBAR or PBB
TR - TELECOM ROOM
TS - TELECOM SPACE
UON - UNLESS OTHERWISE NOTED
VOIP - VOICE OVER INTERNET PROTOCOL
WP - WEATHERPROOF
XFMR - TRANSFORMER

LOW VOLTAGE COMMONLY USED SYMBOLS LEGEND

- LADDER TYPE TELECOMMUNICATIONS RUNWAY (SIZE AS NOTED ON ENLARGED PLANS)
- BASKET-TYPE CABLE TRAY (SIZE AS SPECIFIED OR NOTED ON FLOOR PLANS)
- 2-POST TELECOMMUNICATIONS RACK WITH REQUIRED CLEARANCES
- 4-POST TELECOMMUNICATIONS RACK
- TELECOMMUNICATIONS SERVER RACK
- DOUBLE SIDED VERTICAL CABLE MANAGER (SIZE AS NOTED ON ENLARGED PLANS)
- TELECOMMUNICATIONS GROUND BUS BAR (SIZE PER GROUNDING DETAIL)
- FLOOR OUTLET (REFER TO ROUGH IN MATRIX FOR ADDITIONAL INFORMATION)
- WALL OUTLET (REFER TO ROUGH IN MATRIX FOR ADDITIONAL INFORMATION)
- CEILING OUTLET (REFER TO ROUGH IN MATRIX FOR ADDITIONAL INFORMATION)

PAGING SPEAKER LEGEND & NOTES

- S1 70V CEILING SPEAKER WITH TILE BRIDGE
- S2 70V INTERIOR 15W WALL-MOUNT HORN SPEAKER
- S3 CLASSROOM SOUND REINFORCEMENT 2x2 LAY-IN SPEAKER
- SP EXTERIOR INFORMACAST HORN SPEAKER

NOTES:
1. ALL EXTERIOR HORN SPEAKERS SHALL BE INFORMACAST COMPLIANT AND REQUIRE A CAT-6 CABLE TO EACH. COORDINATE FINAL TERMINATION WITH SPEAKERS.
2. FOR INTERIOR PAGING, CONTRACTOR SHALL FURNISH AND INSTALL ALL MATERIALS, INCLUDING BUT NOT LIMITED TO CEILING SPEAKERS, HORN SPEAKERS, TILE BRIDGE. INFORMACAST PAGING ADAPTERS, LINE MATCHING TRANSFORMERS, AMPLIFIERS, AND ALL OTHER MATERIALS FOR A FULLY FUNCTIONING SYSTEM.
3. THE SCHOOL DISTRICT OWNS THE SINGLEWIRE INFORMACAST SYSTEM, COORDINATE WITH OWNER TO CONFIGURE NEW DEVICES (OUTDOOR SPEAKERS AND INFORMACAST PAGING ADAPTERS) TO THE EXISTING SYSTEM. CONTRACTOR TO PROVIDE ALL ADDITIONAL LICENSES.
4. THE BELL SCHEDULE IS CONTROLLED BY THE INFORMACAST SOFTWARE. COORDINATE PROGRAMMING OF BELL SCHEDULE FOR THE NEW SCHOOL WITH THE OWNER IT AND/OR FACILITIES DEPARTMENT.
5. FOR THE GYMNASIUM, BLACK BOX THEATER, AND CAFETERIA, PAGING ANNOUNCEMENTS WILL BE BROADCAST OVER THE SPEAKERS INCORPORATED WITH THE AUDIO-VISUAL SYSTEM. PROVIDE 70V SPEAKER SIGNAL WITH LINE MATCHING TRANSFORMER TO EACH A/V CABINET. COORDINATE WITH A/V INTEGRATOR.
6. REFER TO CLASSROOM A/V DETAIL DRAWINGS FOR INTEGRATION OF PAGING SYSTEM WITH CLASSROOM SOUND REINFORCEMENT SPEAKERS.

CLOCK SYSTEM NOTES

1. CONTRACTOR TO FURNISH AND INSTALL CLOCKS AS INDICATED ON THE PROJECT DRAWINGS.
2. COORDINATE INSTALLATION WITH ELECTRICAL (CLOCKS ARE 120V HARDWIRED).
3. CLOCKS WILL UTILIZE THE WIRELESS NETWORK FOR TIME SYNCHRONIZATION. OBTAIN DHCP AND OTHER NETWORK CONFIGURATION INFORMATION FROM OWNER'S IT DEPARTMENT PRIOR TO INSTALLATION. OWNER WILL PROVIDE NTP SERVER INFORMATION.
4. FINAL SETUP AND CONFIGURATION OF CLOCKS MAY NOT BE ABLE TO BE PERFORMED UNTIL ALL WIRELESS ACCESS POINTS ARE INSTALLED AND CONFIGURED JUST PRIOR TO OCCUPANCY.
5. PROVIDE WIRE CAGES AROUND CLOCKS WHERE THEY WILL BE SUBJECT TO DAMAGE (I.E. GYM, AUXILIARY GYM, ETC.)

WIRELESS ACCESS POINT NOTES

1. WIRELESS ACCESS POINTS WILL BE FURNISHED BY OTHERS.
2. AT 'AP' DATA LOCATIONS ABOVE ACT CEILING, TERMINATE THE CAT-6A CABLES ABOVE CEILING TO A 2-PORT PLENUM RATED BISCUIT. PROVIDE A 20' SERVICE LOOP TO ALLOW WIRELESS ACCESS POINT TO BE REPOSITIONED AS NEEDED.
3. AT EXTERIOR WIRELESS ACCESS POINT LOCATIONS, FURNISH AND INSTALL OBERON (CHATSWORTH) WIRELESS ENCLOSURE (MODEL 1022-00) MOUNTED TO FACADE OF BUILDING AT ELEVATION AS INDICATED. FROM REAR OF ENCLOSURE, FURNISH AND INSTALL (1) 1" CONDUIT PER ELECTRICAL SPECIFICATIONS TO STUB ABOVE FINISHED CEILING INSIDE THE BUILDING. PROVIDE PLASTIC BUSHINGS ON BOTH CONDUIT ENDS. SEAL AROUND CONDUIT PENETRATIONS TO PREVENT WATER AND INSECT INGRESS. TERMINATE CAT-6A CABLES INSIDE THE ENCLOSURE USING A 2-PORT BISCUIT WITH A 12" SERVICE LOOP.

CLASSROOM A/V NOTES

1. CLASSROOM AUDIO-VISUAL AND SOUND REINFORCEMENT SYSTEM IS BOXLIGHT FRONTROW UNITY (NO SUBSTITUTIONS).
2. THERE ARE THREE VARIATIONS OF CLASSROOM A/V INCLUDING STANDARD CLASSROOMS WITH A MOBILE INTERACTIVE DISPLAY, LARGE CLASSROOMS WITH A MOBILE INTERACTIVE DISPLAY, AND CLASSROOMS WITH FIXED WALL-MOUNT DISPLAYS. REFER TO FLOOR PLAN KEYNOTES AND CLASSROOM A/V DETAIL SHEETS.
3. OTHER INSTRUCTIONAL SPACES WILL UTILIZE THE SPEAKERS INTEGRATED WITH THE INTERACTIVE DISPLAY FOR LOCAL AUDIO.
4. INTERACTIVE DISPLAYS, MOBILE CARTS, AND WALL-MOUNT BRACKETS WILL BE PROVIDED BY OTHERS. CONTRACTOR IS RESPONSIBLE FOR ALL OTHER EQUIPMENT AND MATERIALS UNLESS NOTED AS NOT IN CONTRACT (NIC).
5. ANY WIRING SHOWN AS 'SUPPLIED' ON THE DETAIL DRAWINGS INDICATES THAT THIS WIRE IS PROVIDED WITH THE BOXLIGHT FRONTROW UNITY SYSTEM.
6. IN CLASSROOMS WITH THE BOXLIGHT FRONTROW UNITY SYSTEM AND A FIXED WALL-MOUNT DISPLAY, CONTRACTOR TO FURNISH AND INSTALL THE HDBASE-T WALL-PLATE TRANSMITTER AND THE RECEIVER. SECURE THE RECEIVER INSIDE THE IN-WALL A/V BOX.

PATHWAY NOTES

1. ALL CABLING TO BE SUPPORTED ON J-HOOKS AND/OR CABLE SLINGS (ADJUSTABLE CABLE SUPPORTS).
2. SUGGESTED CABLE ROUTES ARE INDICATED ON THE FLOOR PLAN DRAWINGS, BUT MAY BE ADJUSTED BASED ON FIELD CONDITIONS AND COORDINATION WITH OTHER TRADES.
3. FURNISH AND INSTALL (1) 2" SLEEVE INTO EACH CLASSROOM AND OTHER SPACES FOR ROUTING OF CABLES FROM MAIN CABLING ROUTE INTO EACH ROOM.
4. FIBER OPTIC BACKBONE CABLING SHALL BE ON INDEPENDENT J-HOOKS AND SEPARATE FROM HORIZONTAL CAT-6/6A COPPER CABLING.

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530 Daniels Farm Road, Trumbull, CT 06611

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KEY PLAN



DRAWING TITLE

TELECOM LEGEND, NOTES AND ABBREVIATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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DANIELS FARM ROAD

ELECTRICAL CABINET

HH-3

HH-5

HH-4

HH-6

HH-7

HH-2

HH-1

PROVIDE (4) 2" UNDERGROUND CONDUITS BETWEEN NEW HAND HOLES "HH-2" AND "HH-3" FOR SERVICE PROVIDER CABLING. REFER TO CIVIL SITE UTILITY DRAWINGS FOR CONDUIT ROUTING INFORMATION.

NOTE: TELECOM DUCTBANK MAY SHARE THE TRENCH WITH THE ELECTRICAL DUCTBANK. PROVIDE 24" BETWEEN TELECOM AND ELECTRICAL CONDUITS IN THE TRENCH. COORDINATE EXACT TELECOM DUCTBANK ROUTING WITH ELECTRICAL.

NEW BUILDING FOOTPRINT

PROVIDE (8) 2" UNDERGROUND TELECOM CONDUITS

APPROXIMATE LOCATION OF LOWER LEVEL MDF ROOM B018. SEE SHEET T4.01 FOR CONDUIT TERMINATION LOCATION WITHIN MDF ROOM. PVC CONDUITS TO TRANSITION TO RIGID CONDUIT BEFORE TURNING UP INTO MDF ROOM.

PROVIDE (8) 2" UNDERGROUND CONDUITS FROM NEW HAND HOLE "HH-1" TO LOWER LEVEL MDF ROOM B018. (4) CONDUITS RESERVED FOR SERVICE PROVIDER CABLING, (2) CONDUITS RESERVED FOR SECURITY & (2) 2" UNDERGROUND CONDUIT FUTURE USE.

1 TELECOM - SITE PLAN
1" = 50'-0"

KEYNOTES (THIS SHEET ONLY)

1. 36"x36" POLY-CONCRETE PRECAST HANDHOLE WITH TIER 15 COVER.
2. TWO (2) 2" SCHEDULE 40 CONDUITS BETWEEN HANDHOLES.
3. 1.25" SCHEDULE 40 CONDUIT FROM HANDHOLE TO MEDIA ENCLOSURE ON LIGHT POLE FOR SECURITY CAMERA FIBER OPTIC WIRING. SEE DETAIL 8 ON SHEET SC5.02 FOR ADDITIONAL INFORMATION.
4. POLE-MOUNTED, 360-DEGREE, OUTDOOR-RATED, VIDEO SURVEILLANCE CAMERA BY SECURITY INTEGRATOR. TELECOM CONTRACTOR TO FURNISH AND INSTALL POLE-MOUNTED NEMA ENCLOSURE, FIBER ENCLOSURE AND ALL TERMINATIONS, MEDIA CONVERTER AND POWER SUPPLY, AND SURGE PROTECTION EQUIPMENT. SEE DETAIL 9 ON SHEET SC5.02 FOR ADDITIONAL INFORMATION.
5. FURNISH, INSTALL,TERMINATE AND TEST (1) 48-STRAND OS2 SINGLEMODE, OUTDOOR RATED FIBER OPTIC CABLE FROM MDF ROOM TO HANDHOLE. TERMINATE TO SPLICE CASE LOCATED INSIDE HANDHOLE (BASIS OF DESIGN: CORNING SCF-4C18-01). FURNISH, INSTALL, TERMINATE AND TEST (1) 6-STRAND, OS2 SINGLEMODE, OUTDOOR RATED FIBER OPTIC CABLE FROM SPLICE CASE TO POLE-MOUNTED MEDIA ENCLOSURE VIA 1.25" CONDUIT.

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KEY PLAN

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TELECOM - SITE PLAN

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SHEET KEYNOTES

1. STANDARD CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.05
2. LARGE CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 2/T5.05
3. SUGGESTED J-HOOK AND/OR CABLE SLING PATHWAY. SEE PATHWAY NOTES ON T0.01.
4. PROVIDE (1) 1.25" CONDUIT FROM FLOOR BOX TO A/V BACKBOX BEHIND DISPLAY.
5. PROVIDE (4) 4" CONDUITS ACROSS HARD CEILING AREA.
6. COORDINATE TERMINATION AND LOCATION OF DATA DROPS WITH SECURITY DOOR CONTROLLER PANELS.
7. ROUTE DATA CABLES THROUGH SOUND BOOTH CABLE ENTRY PORTS. CONFIRM FINAL LOCATION INSIDE SOUND BOOTH BEFORE INSTALLATION. FOLLOW ALL SOUND BOOTH MANUFACTURER RECOMMENDATIONS FOR CABLE ROUTING.
8. A/V RACK (MIDDLE ATLANTIC #BGR-1927 OR EQUAL). BROADCAST FIBER CABLES TERMINATE IN RACK IN RACK-MOUNT FIBER ENCLOSURE.
9. WALL-RECESSED PAGING SPEAKER.
10. FURNISH AND INSTALL (1) EZ-PATH ACOUSTICAL SLEEVE (STI #NEZ33-W) LOCATED 6" AFF.
11. FURNISH AND INSTALL (1) 4"H X 2"D SURFACE MOUNT RACEWAY AT 24" AFF FOR ROUTING OF A/V CABLES BETWEEN SOUND BOOTH, PRODUCTION DESKS, A/V RACK, AND GREEN SCREEN ROOM.

1 TELECOM - LOWER LEVEL
1/8" = 1'-0"

0 4 8 16

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KEY PLAN

AREA-C

N

DRAWING TITLE

TELECOM - LOWER LEVEL

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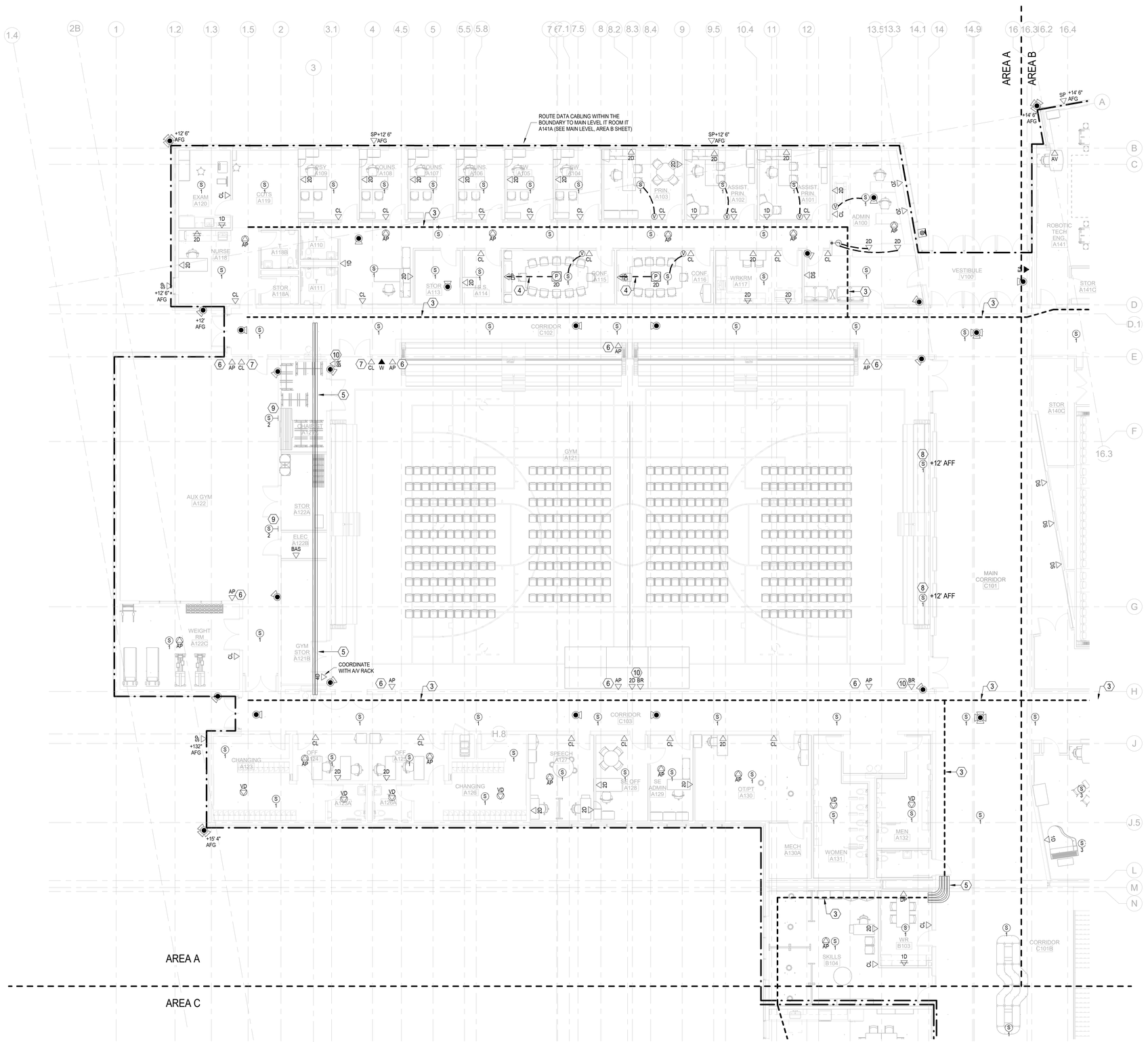
SHEET KEYNOTES

1. STANDARD CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.05
2. LARGE CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 2/T5.05
3. SUGGESTED J-HOOK AND/OR CABLE SLING PATHWAY. SEE PATHWAY NOTES ON T0.01.
4. PROVIDE (1) 1.25" CONDUIT FROM FLOOR BOX TO A/V BACKBOX BEHIND DISPLAY.
5. PROVIDE (2) 4" CONDUITS ACROSS HARD CEILING AREA.
6. PROVIDE WIRELESS ACCESS POINT ENCLOSURES FOR WALL MOUNTED AP. PROVIDE BASIS OF DESIGN PRODUCT OBERON HI-BAR SURFACE MOUNT ENCLOSURE 1014 PN# 1014-IND-C OR APPROVED EQUAL.
7. 16" DIAMETER CLOCK. PROVIDE PROTECTIVE CAGE AROUND CLOCK.
8. WALL-RECESSED PAGING SPEAKER.
9. PROVIDE WIRE GUARD FOR HORN SPEAKER (VALCOM #V-WGHORN-2 OR EQUAL).
10. PROVIDE PLEXIGLASS COVER OVER DATA DROP.



1 TELECOM - MAIN LEVEL - AREA A
1/8" = 1'-0"

0 4 8 16

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KEY PLAN



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TELECOM - MAIN LEVEL AREA A

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SHEET KEYNOTES

1. STANDARD CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.05
2. LARGE CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 2/T5.05
3. SUGGESTED J-HOOK AND/OR CABLE SLING PATHWAY. SEE PATHWAY NOTES ON T0.01.
4. PROVIDE (1) 1.25" CONDUIT FROM FLOOR BOX TO A/V BACKBOX BEHIND DISPLAY.
5. PROVIDE (4) 4" CONDUITS ACROSS HARD CEILING AREA.
6. 16" DIAMETER CLOCK. PROVIDE PROTECTIVE CAGE AROUND CLOCK.
7. SPECIALTY CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.06
8. COORDINATE TERMINATION AND LOCATION OF DATA DROPS WITH SECURITY DOOR CONTROLLER PANELS.
9. CAT-6A DATA DROP ('ES') FOR E-SPORTS GAMING STATION TO BE FED VIA CONDUIT FROM BELOW SLAB TO BACKBOX AT 18" AFF.

PLANETARIUM NOTES

1. BACKBOX LOCATIONS ON DRAWINGS ARE APPROXIMATE. COORDINATE ALL BACKBOX SIZES, CONDUIT DIAMETER, COUNDIT ROUTING, AND LOCATIONS FOR PROJECTORS, SPEAKERS, AND OTHER PLANETARIUM EQUIPMENT WITH VENDOR. 'P' SUBSCRIPT INDICATES PROJECTOR AND 'S' SUBSCRIPT INDICATES SPEAKER.
2. ADDITIONAL BACKBOX AND CONDUIT INFRASTRUCTURE MAY BE REQUIRED. COORDINATE ALL REQUIREMENTS WITH PLANETARIUM SHOP DRAWINGS AND VENDOR.
3. CONDUIT TO 'ES' DATA DROPS AT THE FRONT OF THE DOME SHALL BE ROUTED BELOW GRADE AND EXTENDED UP TO ACCESSIBLE CEILING OR TO THE BASKET TRAY. COORDINATE FINAL BACKBOX ELEVATION AND LOCATIONS WITH ARCHITECT.

ROUTE DATA CABLING WITHIN THE BOUNDARY TO MAIN LEVEL IT ROOM.

ROUTE DATA CABLING WITHIN THE BOUNDARY TO MAIN LEVEL IT ROOM.

AREA A

AREA B

AREA C

1 TELECOM - MAIN LEVEL - AREA B
1/8" = 1'-0"

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NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT — ROBERT S. LARAIA — No. 32 — LICENSED COMMUNICATION TECHNOLOGY CONSULTANT

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

TELECOM - MAIN LEVEL
AREA B

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

T1.02B

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Docusign Envelope ID: 7421B099-F7EC-4432-ADA3-BA95722BE871

SHEET KEYNOTES

1. STANDARD CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.05
2. LARGE CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 2/T5.05
3. SUGGESTED J-HOOK AND/OR CABLE SLING PATHWAY. SEE PATHWAY NOTES ON T0.01.
4. PROVIDE (1) 1.25" CONDUIT FROM FLOOR BOX TO A/V BACKBOX BEHIND DISPLAY.
5. SPECIALTY CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.06



1 TELECOM - MAIN LEVEL - AREA C
1/8" = 1'-0"

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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KEY PLAN



DRAWING TITLE

TELECOM - MAIN LEVEL AREA C

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
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5	05/19/2026	100% CD

T1.02C

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SHEET KEYNOTES

1. STANDARD CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.05
2. LARGE CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 2/T5.05
3. SUGGESTED J-HOOK AND/OR CABLE SLING PATHWAY. SEE PATHWAY NOTES ON T0.01.
4. PROVIDE (1) 1.25" CONDUIT FROM FLOOR BOX TO A/V BACKBOX BEHIND DISPLAY.
5. PROVIDE (2) 4" CONDUITS ACROSS HARD CEILING AREA.
6. SPECIALTY CLASSROOM SOUND REINFORCEMENT SYSTEM. SEE DETAIL 1/T5.06
7. COORDINATE TERMINATION AND LOCATION OF DATA DROP WITH SECURITY DOOR CONTROLLER PANELS.



1 TELECOM - UPPER LEVEL
1/8" = 1'-0"

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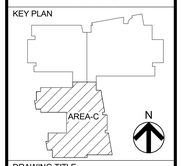
KEY PLAN



DRAWING TITLE

T.8
TELECOM - UPPER LEVEL

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OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
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ISSUE DATES

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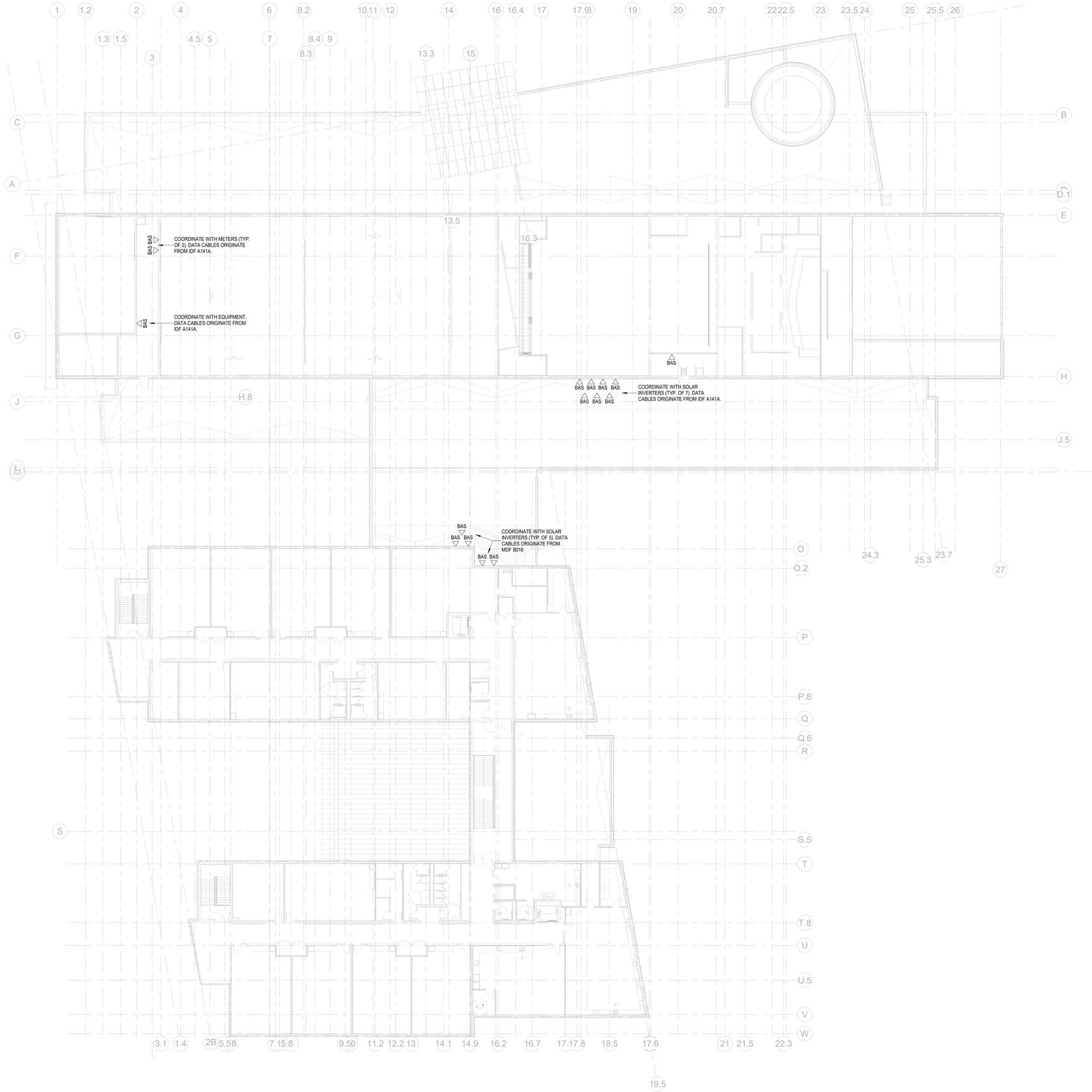

1 TELECOM ROOF PLAN
1/16" = 1'-0"

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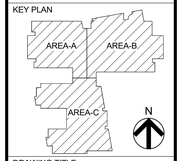
KEY PLAN



DRAWING TITLE

TELECOM - ROOF LEVEL

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/16" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

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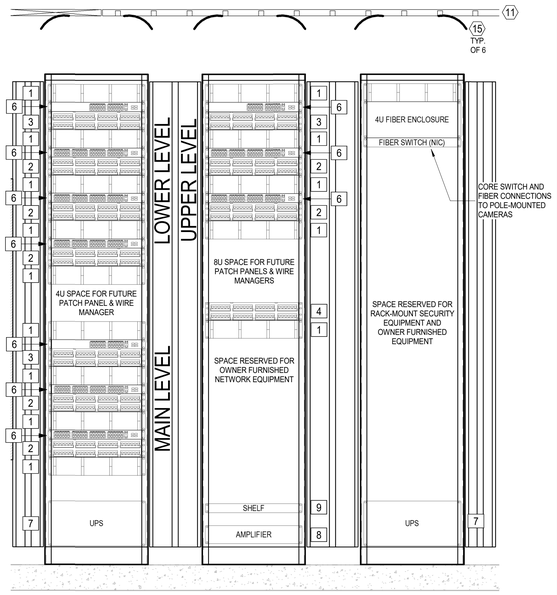
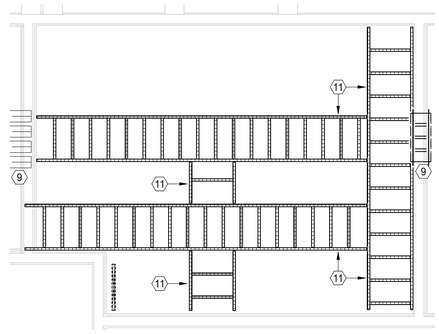
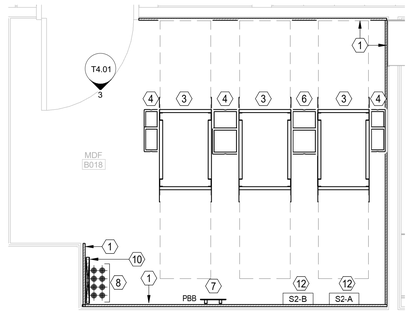


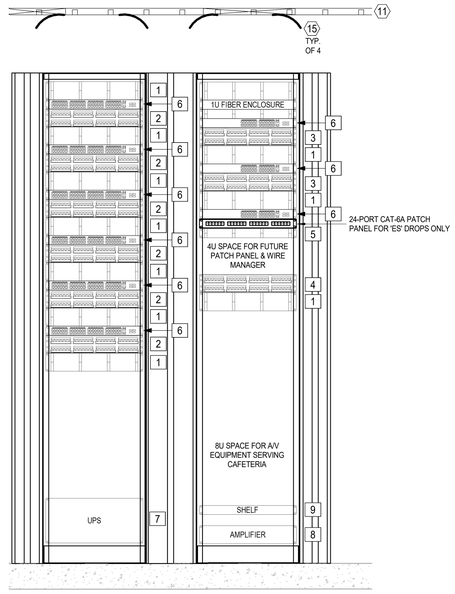
3 TELECOM RACK ELEVATION - MDF B018
1" = 1'-0"



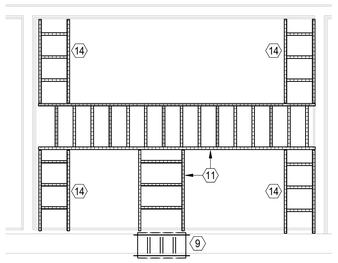
2 MDF B028 - ENLARGED PLAN - ABOVE PLAN 7' 6"
1/2" = 1'-0"



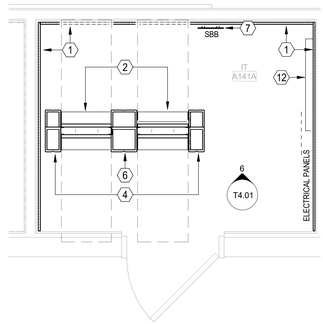
1 LOWER LEVEL MDF B018 - ENLARGED PLAN - BELOW 7' 6"
1/2" = 1'-0"



6 TELECOM RACK ELEVATION - IT ROOM A141A
1" = 1'-0"



5 IT ROOM A141A - ENLARGED PLAN - ABOVE PLAN 7' 6"
1/2" = 1'-0"



4 IT ROOM A141A - ENLARGED PLAN - BELOW PLAN 7' 6"
1/2" = 1'-0"

TELECOM ENLARGED PLANS NOTES:

1. TELECOM ROOM ENLARGED PLANS REPRESENT PROPOSED EQUIPMENT LAYOUT. FINAL LAYOUT TO BE COORDINATED WITH THE OWNERS IT DEPARTMENT PRIOR TO FINAL INSTALLATION.
2. TELECOM CONTRACTOR SHALL COORDINATE FINAL RACK PLACEMENT WITH ELECTRICAL CONTRATOR FOR POWER RECEPTACLE PLACEMENT PRIOR TO INSTALLATION OF THE RACKS.
3. REFER TO CONDUIT RISER DIAGRAM FOR BACKBONE CONDUIT REQUIREMENTS BETWEEN FLOORS AND FOR UTILIZATION OF INDIVIDUAL VERTICAL CONDUITS AND SLEEVES.
4. TELECOM PLYWOOD BACKBOARD SHALL BE 3/4" AC GRADE VOID FREE PLYWOOD PAINTED WITH TWO COATS OF LIGHT COLOR FIRE RESISTANT PAINT. IF PLYWOOD IS ALSO FIRE RESISTANT, THE FIRE RATING STAMP SHALL NOT BE PAINTED OVER. MOUNT PLYWOOD AT 6" AFF WITH C-SIDE TO FACE WALL.
5. INSTALL LADDER TYPE CABLE RUNWAY AND ASSOCIATED FITTINGS, BENDS, AND TRANSITIONS FOR SUPPORT AND DISTRIBUTION OF HORIZONTAL AND BACKBONE CABLING IN EACH TELECOM ROOM. THE LAYOUT OF CABLE RUNWAY IN THE TELECOM ROOMS IS INTENTED TO SHOW DESIGN INTENT AND IS SUBJECT TO CHANGE BASED ON SITE CONDITIONS. MODIFICATIONS TO THE LAYOUT SHALL BE COORDINATED WITH THE DESIGN TEAM.

#

TELECOM ENLARGED PLANS KEYED NOTES:

1. 3/4" PLYWOOD BACKBOARD – SEE GENERAL NOTE 4.
2. **8'H**, 19"W 2-POST TELECOM RACK.
3. **8'H**, 19"W 4-POST EQUIPMENT RACK.
4. 6" W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
5. 8" W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
6. 10"W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
7. TELECOM BONDING BUSBAR. SEE CONDUIT AND GROUNDING RISER DIAGRAM FOR ADDITIONAL INFORMATION.
8. (8) - 2" SCHEDULE 40 PVC SERVICE ENTRANCE CONDUITS. SEE SITE PLAN AND RISER DIAGRAM FOR ADDITIONAL INFORMATION.
9. (4) - 4" CONDUIT SLEEVES FOR HORIZONTAL CABLING TO CORRIDOR CABLE TRAY SYSTEM.
10. VERTICALLY MOUNTED SECTION OF LADDER TYPE CABLE RUNWAY. LADDER TRAY SHALL BE EQUIVALENT OF THE CROSS-SECTIONAL WIDTH OF THE CONDUIT SLEEVES. EXAMPLE: PROVIDE 18"W SECTION OF LADDER TRAY FOR (4) - 4" CONDUITS.
11. 18"W LADDER TYPE CABLE RUNWAY.
12. SPACE RESERVED FOR SECURITY ACCESS CONTROL ENCLOSURES AND POWER SUPPLIES.
13. (8) 4" CONDUITS BETWEEN MAIN LEVEL CABLE TRAY ABOVE AND CABLE RUNWAY IN THE MDF. CONDUITS INTENDED FOR FIBER OPTIC AND HORIZONTAL CABLING ROUTING INTO THE MDF ROOM FROM ABOVE.
14. 12"W LADDER TYPE CABLE RUNWAY.
15. CABLE RUNWAY RADIUS DROP (MATCH WIDTH OF CABLE RUNWAY)

RACK ELEVATION KEYNOTES #

1. 2RU HORIZONTAL WIRE MANAGER.
2. 2RU 48-PORT MODULAR CAT-6 PATCH PANEL.
3. 2RU 48-PORT MODULAR CAT-6A PATCH PANEL
4. 2RU 48-PORT MODULAR CAT-6A PATCH PANEL (CLOCKS ONLY)
5. 1RU HORIZONTAL WIRE MANAGER
6. 48-PORT SWITCH (NIC)
7. 5KVA RACK-MOUNT UPS WITH 2-POST OR 4-POST MOUNTING KIT
8. AMPLIFIER FOR 70V PAGING SPEAKERS
9. 1U RACK-MOUNT SHELF

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KEY PLAN



DRAWING TITLE

TELECOM ENLARGED PLANS - TELECOM ROOMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	05/19.2026
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ISSUE DATES

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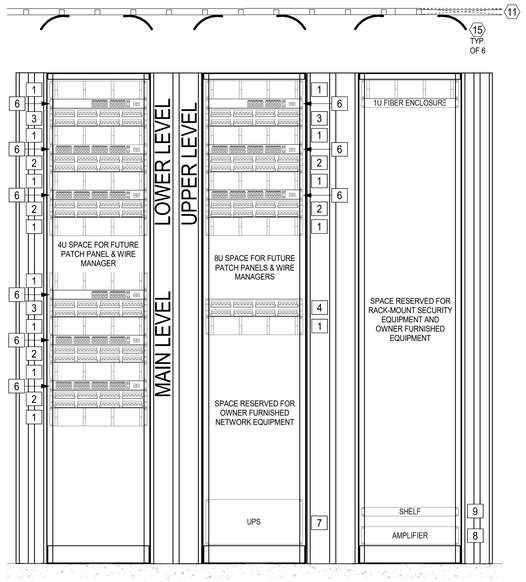
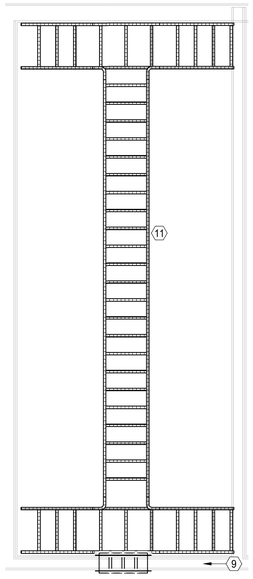
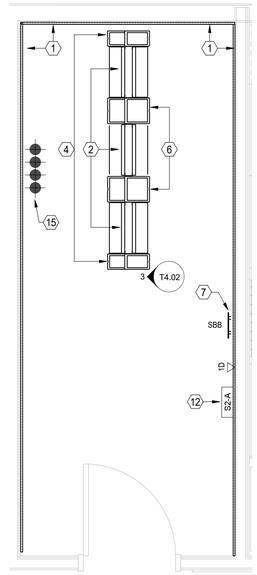


3 TELECOM RACK ELEVATION - UPPER IT ROOM B229B
1" = 1'-0"



2 IT ROOM B229B - UPPER LEVEL - ABOVE PLAN 7' 6" ENLARGED PLAN
1/2" = 1'-0"



1 IT ROOM B229B - UPPER LEVEL - BELOW 7' 6" ENLAGED PLAN
1/2" = 1'-0"

PATCH CORDS

FURNISH THE FOLLOWING PATCH CORDS TO THE OWNER, EXCEPT AS NOTED:

1. AT WIRELESS ACCESS POINTS, CONNECT ONE 5' GREEN PATCH CORDS TO THE FACEPLATE OR BISCUIT AND LEAVE FOR FINAL CONNECTION TO DEVICE.
2. AT CLASSROOM FIXED WALL-MOUNT DISPLAYS, CONNECT ONE HDMI CABLE TO HDBASE-T RECEIVER AND COIL INSIDE IN-WALL AV BOX FOR FINAL CONNECTION TO INTERACTIVE DISPLAY.
3. AT POLE MOUNTED CAMERAS, CONNECT ONE 1-METER YELLOW PATCH CORD BETWEEN THE FIBER ENCLOSURE AND THE MEDIA CONVERTER

TYPE	LENGTH	COLOR	QTY	NOTES
CAT-6 RJ-45 TO RJ-45	1'	BLUE	350	PATCH PANEL TO SWITCH - GENERAL
CAT-6 RJ-45 TO RJ-45	1'	YELLOW	100	PATCH PANEL TO SWITCH - SECURITY
CAT-6 RJ-45 TO RJ-45	1'	WHITE	60	PATCH PANEL TO SWITCH - CLASSROOM A/V / SOUND REINFORCEMENT SYSTEM
CAT-6 RJ-45 TO RJ-45	1'	VIOLET	45	PATCH PANEL TO SWITCH - BAS, INVERTERS, ETC.
CAT-6A RJ-45 TO RJ-45	1'	GREEN	140	PATCH PANEL TO SWITCH - WIRELESS
CAT-6A RJ-45 TO RJ-45	1'	BROWN	15	PATCH PANEL TO SWITCH - E-SPORTS GAMING PC
CAT-6 RJ-45 TO RJ-45	1'	RED	30	PATCH PANEL TO SWITCH - CRITICAL DEVICES
CAT-6 RJ-45 TO RJ-45	7"	RED	20	EQUIPMENT TO SWITCH - CRITICAL DEVICES
CAT-6 RJ-45 TO RJ-45	10'	RED	20	EQUIPMENT TO SWITCH - CRITICAL DEVICES
CAT-6 RJ-45 TO RJ-45	14'	RED	20	EQUIPMENT TO SWITCH - CRITICAL DEVICES
CAT-6 RJ-45 TO RJ-45	7"	GRAY	200	WORKSTATIONS
CAT-6 RJ-45 TO RJ-45	10'	GRAY	150	WORKSTATIONS
CAT-6 RJ-45 TO RJ-45	14"	GRAY	50	WORKSTATIONS
CAT-6 RJ-45 TO RJ-45	5'	VIOLET	45	FACEPLATE OR BISCUIT TO EQUIPMENT
CAT-6 RJ-45 TO RJ-45	3'	YELLOW	10	POLE MOUNTED MEDIA CONVERTER TO CAMERA
CAT-6A RJ-45 TO RJ-45	5'	GREEN	140	WIRELESS ACCESS POINT - BISCUIT TO DEVICE ABOVE CEILING
CAT-6A RJ-45 TO RJ-45	7'	GRAY	15	E-SPORTS GAMING - COMPUTER TO FACEPLATE)
LC-LC SINGLEMODE	1-METER	YELLOW	20	FIBER ENCLOSURE TO SWITCH
LC-LC SINGLEMODE	1-METER	YELLOW	10	MEDIA ENCLOSURE FIBER TO MEDIA CONVERTER
LC-LC SINGLEMODE	2-METER	YELLOW	12	FIBER ENCLOSURE TO SWITCH
LC-LC SINGLEMODE	2-METER	YELLOW	10	MDF FIBER ENCLOSURE FOR POLE-MOUNTED CAMERAS TO FIBER SWITCH
LC-LC SINGLEMODE	3-METER	YELLOW	12	FIBER ENCLOSURE TO SWITCH
HDMI	6'	BLACK	30	DIGITAL SIGNAGE OR HDBASE-T RECEIVER TO DISPLAY

ADDITIONAL EQUIPMENT

FURNISH AND INSTALL THE FOLLOWING EQUIPMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION:

DESCRIPTION	QUANTITY	NOTES
RACK-MOUNT UPS WITH NETWORK CARD	3	ONE PER TELECOM ROOM
4-POST RACK UPS MOUNTING KIT	1	FOR MDF ROOM RACK
2-POST RACK UPS MOUNTING KIT	2	FOR IDF ROOMS
VERTICAL POWER STRIP	6	TWO PER TELECOM ROOM
VERTICAL POWER STRIP STANDOFF KIT	6	ONE PER POWER STRIP
RACK SCREWS	800	ONE PACK OF 100 PER RACK; MATCH RACK THREAD

TELECOM ENLARGED PLANS NOTES:

1. TELECOM ROOM ENLARGED PLANS REPRESENT PROPOSED EQUIPMENT LAYOUT. FINAL LAYOUT TO BE COORDINATED WITH THE OWNERS IT DEPARTMENT PRIOR TO FINAL INSTALLATION.
2. TELECOM CONTRACTOR SHALL COORDINATE FINAL RACK PLACEMENT WITH ELECTRICAL CONTRATOR FOR POWER RECEPTACLE PLACEMENT PRIOR TO INSTALLATION OF THE RACKS.
3. REFER TO CONDUIT RISER DIAGRAM FOR BACKBONE CONDUIT REQUIREMENTS BETWEEN FLOORS AND FOR UTILIZATION OF INDIVIDUAL VERTICAL CONDUITS AND SLEEVES.
4. TELECOM PLYWOOD BACKBOARD SHALL BE 3/4" AC GRADE VOID FREE PLYWOOD PAINTED WITH TWO COATS OF LIGHT COLOR FIRE RESISTANT PAINT. IF PLYWOOD IS ALSO FIRE RESISTANT, THE FIRE RATING STAMP SHALL NOT BE PAINTED OVER. MOUNT PLYWOOD AT 6" AFF WITH C-SIDE TO FACE WALL.
5. INSTALL LADDER TYPE CABLE RUNWAY AND ASSOCIATED FITTINGS, BENDS, AND TRANSITIONS FOR SUPPORT AND DISTRIBUTION OF HORIZONTAL AND BACKBONE CABLING IN EACH TELECOM ROOM. THE LAYOUT OF CABLE RUNWAY IN THE TELECOM ROOMS IS INTENTED TO SHOW DESIGN INTENT AND IS SUBJECT TO CHANGE BASED ON SITE CONDITIONS. MODIFICATIONS TO THE LAYOUT SHALL BE COORDINATED WITH THE DESIGN TEAM.

TELECOM ENLARGED PLANS KEYED NOTES: #

1. 3/4" PLYWOOD BACKBOARD – SEE GENERAL NOTE 4.
2. **8'H**, 19"W 2-POST TELECOM RACK.
3. **8'H**, 19"W 4-POST EQUIPMENT RACK.
4. 6" W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
5. 8" W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
6. 10"W DOUBLE-SIDED VERTICAL CABLE MANAGER (7' H OR 8' H TO MATCH RACK).
7. TELECOM BONDING BUSBAR. SEE CONDUIT AND GROUNDING RISER DIAGRAM FOR ADDITIONAL INFORMATION.
8. (8) - 2" SCHEDULE 40 PVC SERVICE ENTRANCE CONDUITS. SEE SITE PLAN AND RISER DIAGRAM FOR ADDITIONAL INFORMATION.
9. (4) - 4" CONDUIT SLEEVES FOR HORIZONTAL CABLING TO CORRIDOR CABLE TRAY SYSTEM.
10. VERTICALLY MOUNTED SECTION OF LADDER TYPE CABLE RUNWAY. LADDER TRAY SHALL BE EQUIVALENT OF THE CROSS-SECTIONAL WIDTH OF THE CONDUIT SLEEVES. EXAMPLE: PROVIDE 18"W SECTION OF LADDER TRAY FOR (4) - 4" CONDUITS.
11. 18"W LADDER TYPE CABLE RUNWAY.
12. SPACE RESERVED FOR SECURITY ACCESS CONTROL ENCLOSURES AND POWER SUPPLIES.
13. (8) 4" CONDUITS BETWEEN MAIN LEVEL CABLE TRAY ABOVE AND CABLE RUNWAY IN THE MDF. CONDUITS INTENDED FOR FIBER OPTIC AND HORIZONTAL CABLING ROUTING INTO THE MDF ROOM FROM ABOVE.
14. 12"W LADDER TYPE CABLE RUNWAY.
15. CABLE RUNWAY RADIUS DROP (MATCH WIDTH OF CABLE RUNWAY

RACK ELEVATION KEYNOTES #

1. 2RU HORIZONTAL WIRE MANAGER.
2. 2RU 48-PORT MODULAR CAT-6 PATCH PANEL.
3. 2RU 48-PORT MODULAR CAT-6A PATCH PANEL
4. 2RU 48-PORT MODULAR CAT-6A PATCH PANEL (CLOCKS ONLY)
5. 1RU HORIZONTAL WIRE MANAGER
6. 48-PORT SWITCH (NIC)
7. 5KVA RACK-MOUNT UPS WITH 2-POST OR 4-POST MOUNTING KIT
8. AMPLIFIER FOR 70V PAGING SPEAKERS
9. 1U RACK-MOUNT SHELF

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STATE OF CONNECTICUT · ROBERT S. LARAIA · No. 32 · LICENSED TELECOMMUNICATION TECHNOLOGY CONSULTANT

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using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

TELECOM ENLARGED PLANS - TELECOM ROOMS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
2	12/15/2025	DD Pricing Set
3	03/16/2026	50% CD
5	05/19/2026	100% CD

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5/18/2026 9:29:45 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-BTG_R26.rvt

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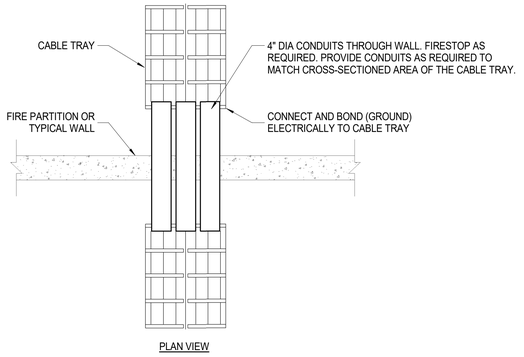
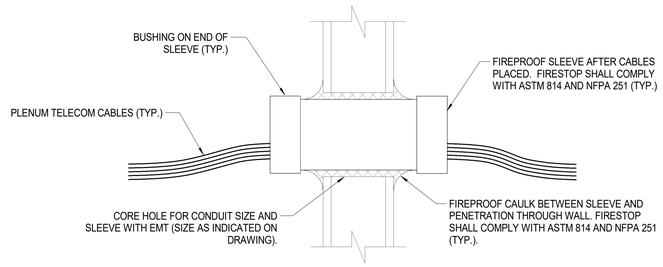


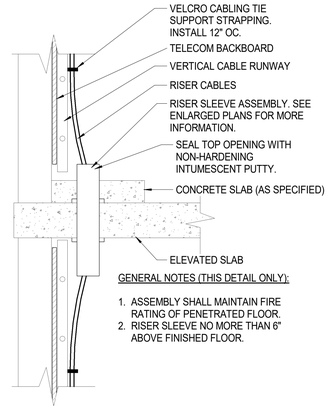
PLAN VIEW

NOTES:
1. MAINTAIN FIRE RATING WHEN PASSING THROUGH FIRE RATED PARTITIONS.

3 CABLE TRAY WALL PENETRATION
NO SCALE



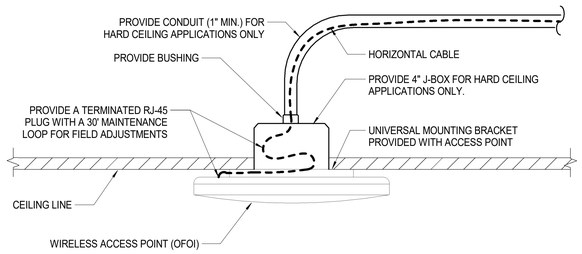
2 WALL PENETRATION FIRESTOP
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):

1. ASSEMBLY SHALL MAINTAIN FIRE RATING OF PENETRATED FLOOR.
2. RISER SLEEVE NO MORE THAN 6" ABOVE FINISHED FLOOR.

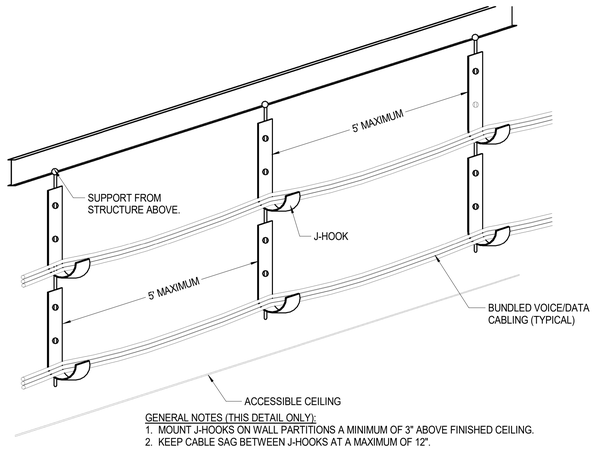
1 TYPICAL FLOOR SLEEVE DETAIL
NO SCALE



GENERAL NOTES: (THIS DETAIL ONLY)
1. REFER TO TELECOM FLOOR PLANS FOR GENERAL LOCATIONS.
2. CONTRACTOR SHALL PROVIDE A 30' MAINTENANCE LOOP FOR FIELD ADJUSTMENTS.
3. REAM AND BUSH CONDUITS ENDS.
4. ACCESS POINTS ARE OWNER PROVIDED AND INSTALLED.

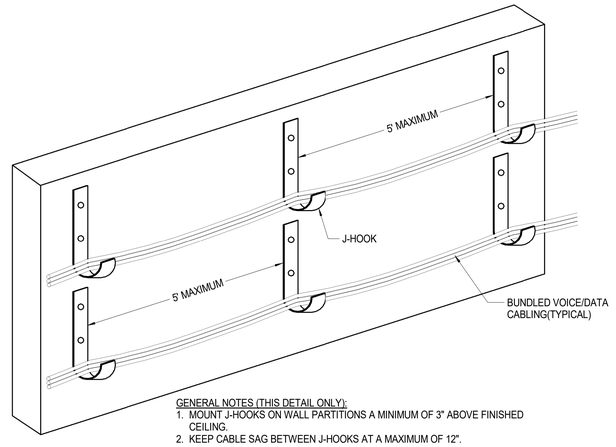
AP

6 CEILING MOUNTED WIRELESS ACCESS POINT DETAIL
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):
1. MOUNT J-HOOKS ON WALL PARTITIONS A MINIMUM OF 3" ABOVE FINISHED CEILING.
2. KEEP CABLE SAG BETWEEN J-HOOKS AT A MAXIMUM OF 12".

5 STRUCTURE MOUNTED J-HOOK DETAIL
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):
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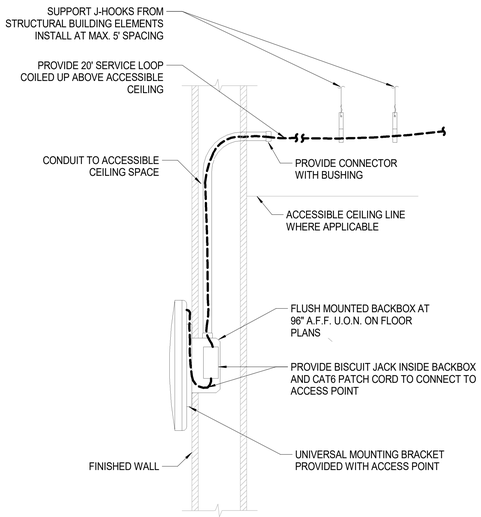
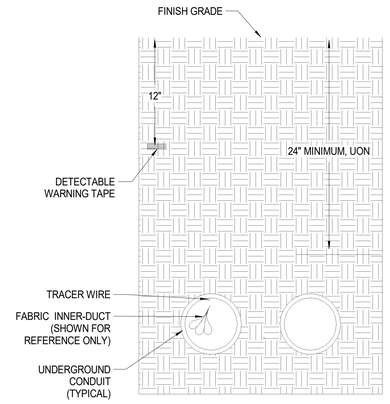
2. KEEP CABLE SAG BETWEEN J-HOOKS AT A MAXIMUM OF 12".

4 WALL MOUNTED J-HOOK DETAIL
NO SCALE

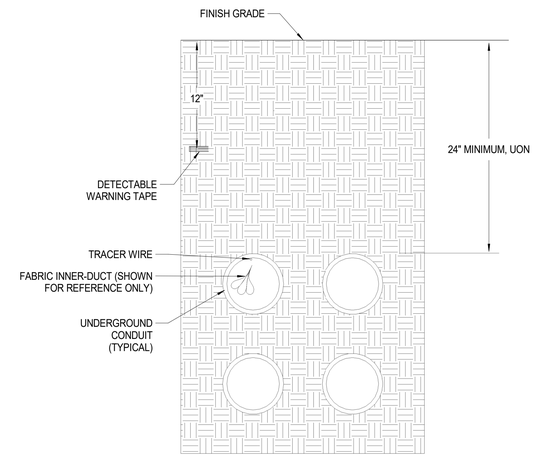


8 WIRELESS ACCESS POINT WALL MOUNT - VERTICAL
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):
1. GROUND AND BOND TRACER WIRES.
2. PROVIDE PULL STRINGS/MULE TAPE IN EACH CONDUIT.
3. PROVIDE MESH FABRIC INNERDUCTS IN TWO OF THE CONDUITS FOR SERVICE PROVIDER USE.
4. PROVIDE CONCRETE ENCASEMENT OF CONDUITS ONLY WHERE SPECIFIED ON SITE PLAN DRAWING.

7 2-WAY DUCTBANK DIRECT BURIED - HORIZONTAL
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):
1. GROUND AND BOND TRACER WIRES.
2. PROVIDE PULL STRINGS/MULE TAPE IN EACH CONDUIT.
3. PROVIDE MESH FABRIC INNERDUCTS IN TWO OF THE CONDUITS FOR SERVICE PROVIDER USE.
4. PROVIDE CONCRETE ENCASEMENT OF CONDUITS ONLY WHERE SPECIFIED ON SITE PLAN DRAWING.

9 4-WAY DUCTBANK DIRECT BURIED
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Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

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100% CD

KEY PLAN



DRAWING TITLE

TELECOM DETAILS - PATHWAYS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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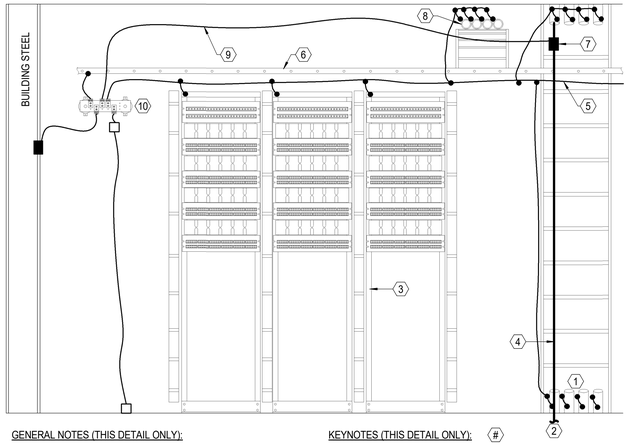


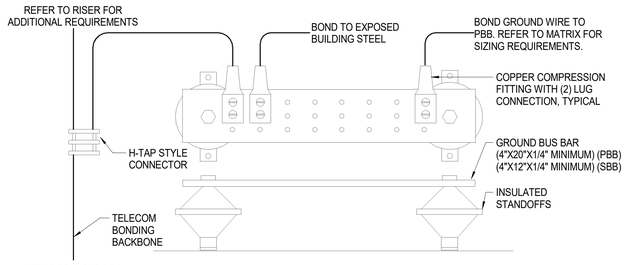
GENERAL NOTES (THIS DETAIL ONLY):

1. THE INSIDE BEND RADIUS OF TELECOMMUNICATIONS BONDING CONDUCTORS TERMINATED AT THE PBB OR SBB SHALL HAVE AN INSIDE BEND RADIUS OF 8 IN. AT OTHER LOCATIONS, BENDS IN THE BONDING CONDUCTORS SHOULD BE LIMITED TO THE GREATEST PRACTICAL INSIDE BEND RADIUS WITH A MINIMUM BEND RADIUS OF 10 TIMES THE BONDING CONDUCTOR DIAMETER. IN ALL CASES, THE MINIMUM BEND RADIUS ANGLE SHALL BE 90° OR GREATER.
2. WHEN THE SBB (THE BONDING CONNECTION POINT FOR TELECOMMUNICATIONS SYSTEMS AND EQUIPMENT IN THE AREA SERVED BY A DISTRIBUTOR) IS NOT BONDED DIRECTLY TO THE TBB, THE SBC IS USED TO BOND THE SBB TO THE TBB. THE MINIMUM SBC SIZE SHALL BE THE GREATER OF 6 AWG OR THE LARGEST CONDUCTOR BONDED TO THE ASSOCIATED SBB.

KEYNOTES (THIS DETAIL ONLY): (#)

1. 4" RISER CONDUITS (REFER TO FLOOR PLANS OR ENLARGED PLANS FOR ACTUAL QUANTITIES).
2. CONNECT TBB TO ELECTRICAL PRIMARY BONDING BUSBAR WITH IRREVERSIBLE BOND. SEE ELECTRICAL PLANS FOR ADDITIONAL INFORMATION.
3. RACK BONDING BUSBAR (RBB). PROVIDE ONE PER RACK AND BOND ACCORDINGLY. VERTICAL OR HORIZONTAL RBB PER SPECS.
4. TELECOM BONDING BACKBONE (TBB).
5. TELECOM EQUIPMENT BONDING CONDUCTOR (TEBC).
6. CABLE RUNWAY, PROVIDE BONDING JUMPERS BETWEEN EACH RUNWAY SECTION AND FITTING. BOND RUNWAY TO SBB.
7. C-TAP CONNECTION TO TBB.
8. 4" CONDUIT SLEEVES FOR HORIZONTAL DISTRIBUTION (REFER TO FLOOR PLANS OR ENLARGED PLANS FOR ACTUAL QUANTITIES).
9. TELECOM BONDING CONDUCTOR (TBC).
10. SECONDARY BONDING BUSBAR (SBB).
11. GROUNDING/BONDING CONNECTION TO THE STATIC DISAPPATIVE TILE FLOOR.
12. BOND THE CONDUIT CONUIT SLEEVES ENTERING THE IDF TO THE CABLE TRAY OUTSIDE THE ROOM OR PROVIDE A DEDICATED BONDING CONDUCTOR TO GROUND THE CABLE TRAY OUTSIDE THE ROOM AS SPECIFIED

2 COMM ROOM BONDING AND GROUNDING REQUIREMENTS - TIA 607-D
NO SCALE

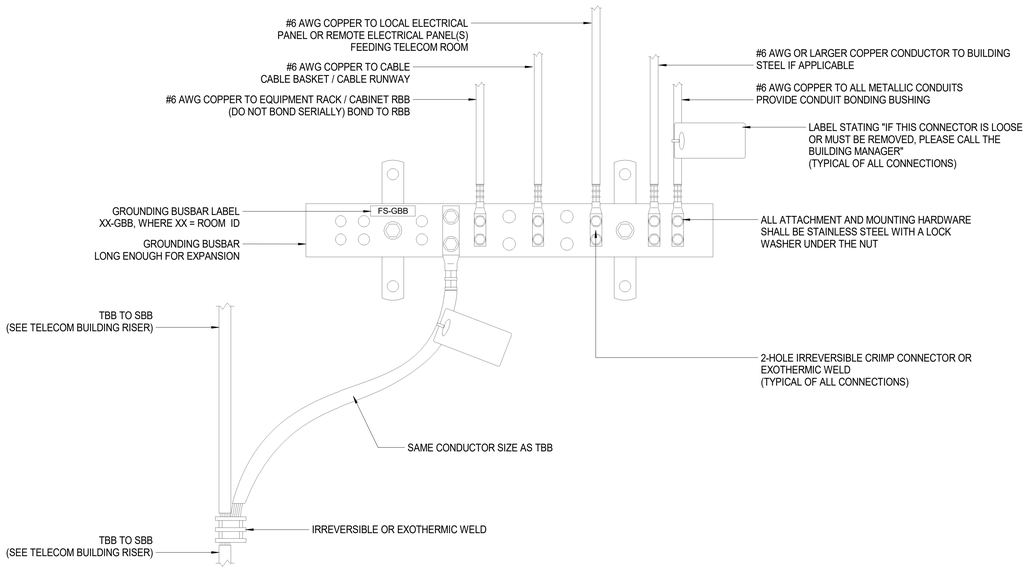


GENERAL NOTES (THIS DETAIL ONLY):

1. PROVIDE (1) GROUND BUSBAR PER TELECOM ROOM.
2. BOND SECONDARY BONDING BUSBAR (SBB) TO THE MAIN GROUND BUS BAR (PBB) WITH A GROUND WIRE, SIZED FROM CHART.
3. BOND MAIN GROUND BUSBAR TO MAIN ELECTRICAL GROUND (MDG).
4. BOND GROUND WIRES TO BUSBAR WITH TERMINAL BLOCKS.
5. BOND EACH GROUND BUSBAR TO BUILDING STEEL.
6. MAINTAIN MINIMUM BENDING RADIUS IN ROUTING BONDING CONDUCTORS.
7. BONDING CONDUCTORS SHOULD NOT BE SPLICED AT 90 DEGREE BENDS.
8. MOUNT TELECOM GROUND BUS BAR 6" BELOW CABLE RUNWAY IN EACH TELECOM ROOM.
9. INSTALL EACH CONDUCTOR IN SEPARATE CONDUITS.
10. PROVIDE GREEN SHEATHED BONDING CONDUCTORS.

GROUND WIRE LENGTH (LINEAR FT.)	SIZE (AWG)
LESS THAN 13	6 (0.162")
14 TO 20	4 (0.232")
21 TO 26	3 (0.260")
27 TO 33	2 (0.292")
34 TO 41	1 (0.332")
42 TO 52	1/0 (0.373")
53 TO 66	2/0 (0.419")
67 TO 84	3/0 (0.470")
85 TO 105	4/0 (0.528")
106 TO 125	250 kcmil (0.575")
126 TO 150	300 kcmil (0.630")
151 TO 175	350 kcmil (0.681")
176 TO 250	500 kcmil (0.813")
251 TO 300	600 kcmil (0.893")
GREATER THAN 301	750 kcmil (0.998")

1 GROUND BUSBAR W/ H-TAP
NO SCALE



GENERAL NOTES (THIS DETAIL ONLY):

1. REFER TO ANSI/TIA-607-D FOR GROUNDING AND BONDING SPECIFICATIONS.
2. ALL BONDING CONDUCTORS SHALL BE IRREVERSIBLE CRIMP OR EXOTHERMIC WELD WHERE ACCESSIBLE, AND EXOTHERMIC WELD ONLY WHERE INSPECTION IS IMPRACTICAL.
3. REFER TO THE TELECOM BUILDING RISER FOR TBB AND BBC SIZES.
4. WHERE INSULATED, BONDING CONDUCTORS SHALL BE GREEN, GREEN WITH A YELLOW STRIPE OR MARKED WITH A DISTINCTIVE COLOR.
5. DO NOT SPLICE THE TBB OR BBC UNLESS NECESSARY, AND THE BUSBAR SHALL NOT BE USED TO JOIN SECTIONS OF THE TBB.
6. BUSBAR CONNECTIONS SHALL BE CLEANED AND ANTIOXIDANT GREASE SHOULD BE APPLIED PRIOR TO FASTENING CONNECTORS TO THE BUSBAR.
7. THE INSIDE BEND RADIUS OF ALL BONDING CONDUCTORS ATTACHED TO THE PBB SHALL HAVE AN INSIDE BEND RADIUS OF 8 IN, 200 MM. AT OTHER LOCATIONS, BENDS IN THE BONDING CONDUCTORS SHOULD BE LIMITED TO THE GREATEST PRACTICAL INSIDE BEND RADIUS WITH A MINIMUM BEND RADIUS OF 10 TIMES THE BONDING CONDUCTOR DIAMETER RECOMMENDED. IN ALL CASES, THE MINIMUM BEND RADIUS ANGLE SHALL BE 90 DEGREES OR GREATER.
8. MAINTAIN A MINIMUM OF 2" OF SEPARATION FROM ALL ELECTRICAL CONDUCTORS.

3 GROUND BUS BAR W/ H-TAP
NO SCALE

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KEY PLAN



DRAWING TITLE

TELECOM DETAILS - GROUNDING

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OFFICE PROJ. NO.	250501
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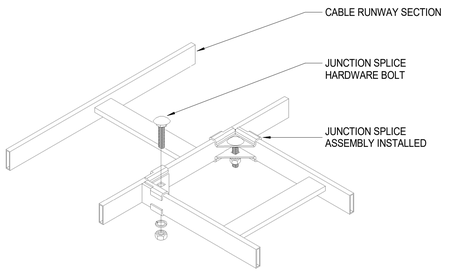
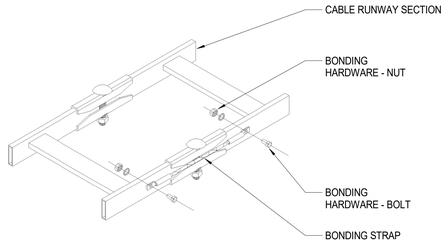
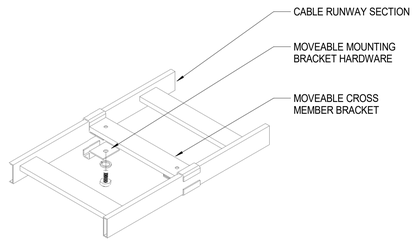


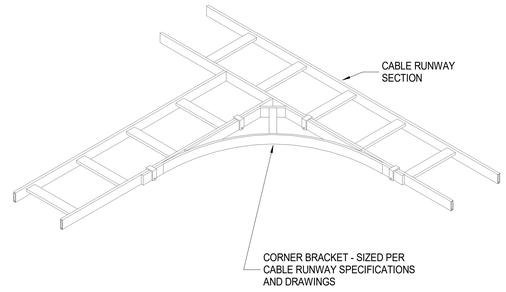
CABLE RUNWAY CORNER JUNCTION KIT



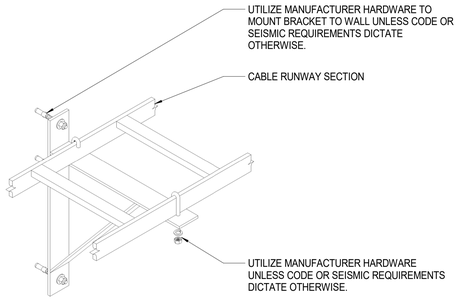
CABLE RUNWAY INLINE SPLICE
AND GROUND STRAP



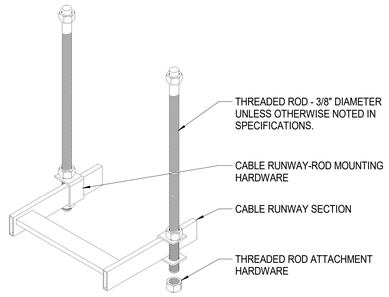
CABLE RUNWAY MOVEABLE CROSS MEMBER



CABLE RUNWAY CORNER BRACKET

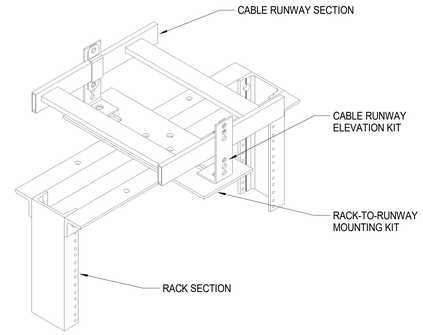


CABLE RUNWAY WALL ANGLE
SUPPORT ASSEMBLY

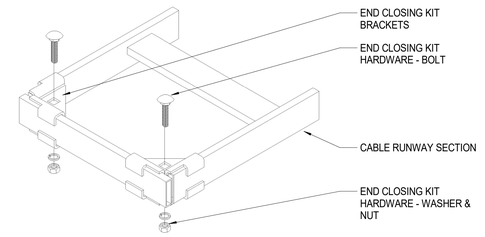


NOTE:
UTILIZE ROD STIFFENER ASSEMBLY AS REQUIRED ON HANGER RODS THAT HAVE SEISMIC BRACING ATTACHED TO THE HANGER OR TRAPEZE ASSEMBLY, UNLESS OTHERWISE REQUIRED BY CODE.

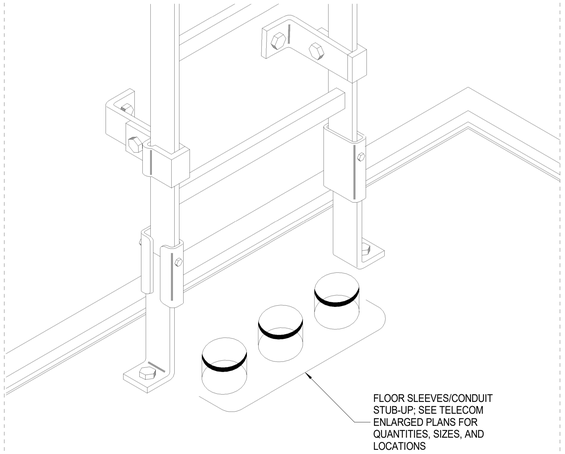
CABLE RUNWAY THREADED ROD SUPPORT



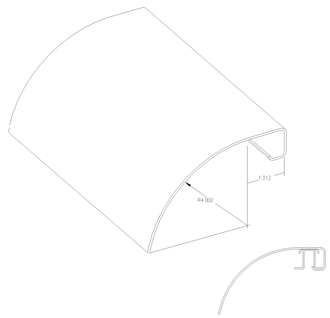
CABLE RUNWAY-TO-RACK
ELEVATION KIT ASSEMBLY



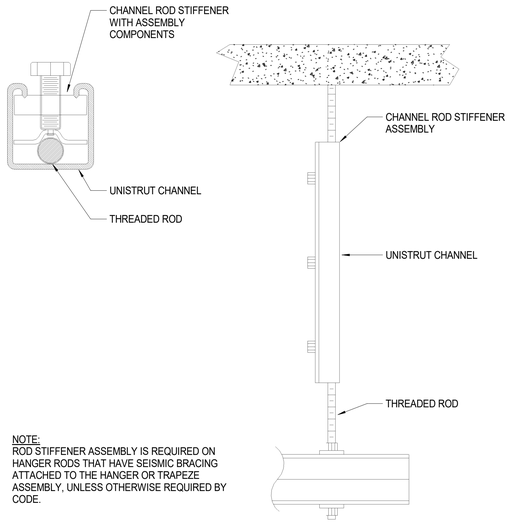
CABLE RUNWAY END CLOSING KIT



VERTICAL CABLE RUNWAY SUPPORTS & RISER
SLEEVES

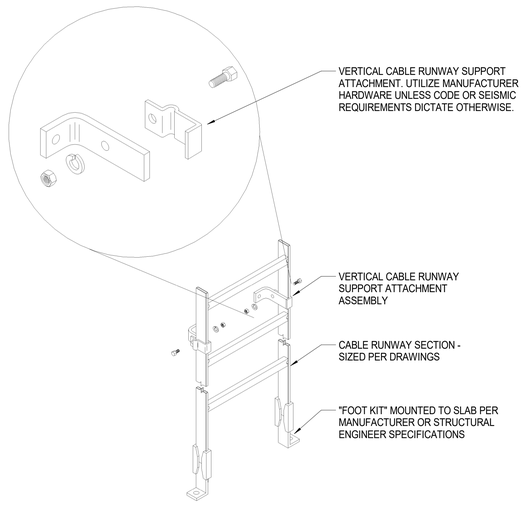


CABLE RUNWAY WATERFALL/DROP-OUT
ATTACHMENT



NOTE:
ROD STIFFENER ASSEMBLY IS REQUIRED ON HANGER RODS THAT HAVE SEISMIC BRACING ATTACHED TO THE HANGER OR TRAPEZE ASSEMBLY, UNLESS OTHERWISE REQUIRED BY CODE.

CABLE RUNWAY VERTICAL ROD
STIFFENER SUPPORT ASSEMBLY



VERTICAL CABLE RUNWAY SUPPORT ASSEMBLY

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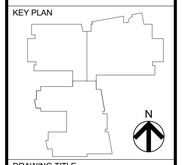
100% CD

KEY PLAN



DRAWING TITLE

TELECOM DETAILS - CABLE RUNWAY

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NO SCALE
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

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3	03/16/2026	50% CD
5	05/19/2026	100% CD

T5.03

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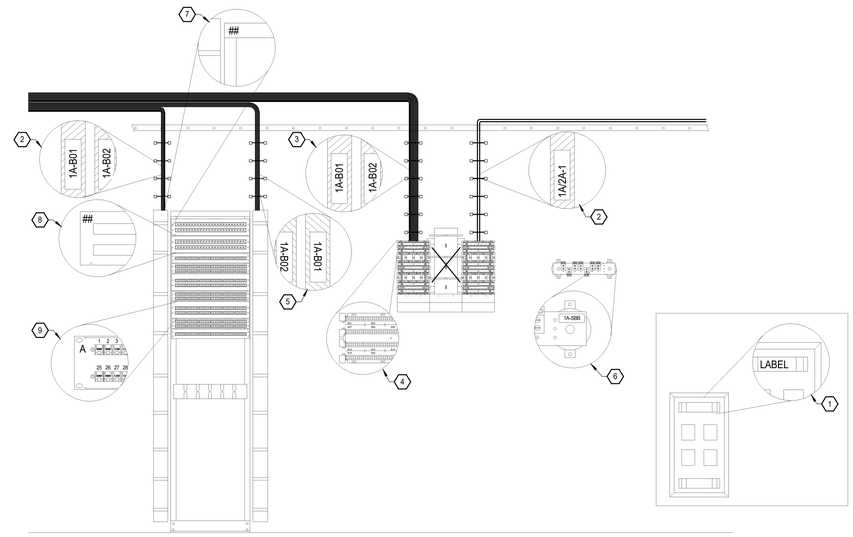
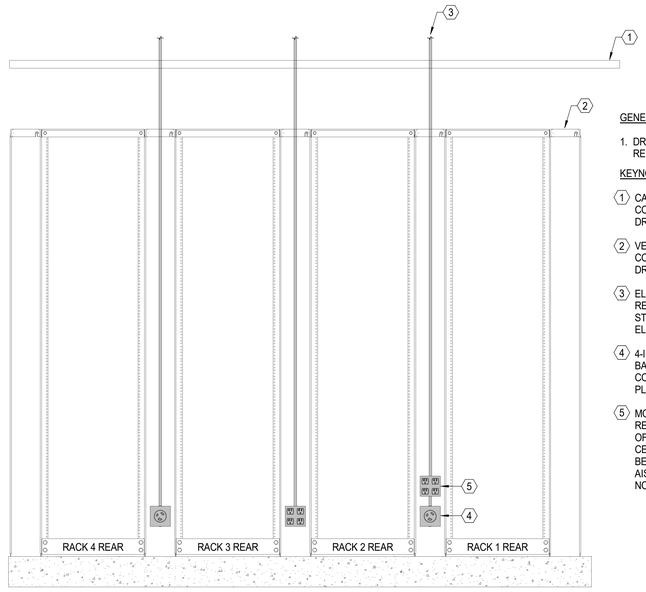


GENERAL NOTES (THIS DETAIL ONLY):
1. EQUIPMENT LOCATION AND SIZE ARE OUT OF SCALE FOR CLARITY. PORTIONS OF CABLE MANAGEMENT NOT SHOWN FOR CLARITY.
2. COORDINATE FINAL LABELING REQUIREMENTS WITH NORTHSIDE IT.
3. USE ASSOCIATED KEYNOTES BELOW FOR THIS DETAIL ONLY.
4. **REFER TO THE APPROVED NSH LABELING STANDARDS AND REQUIREMENTS IN DIV 27 SPECS.**

KEY NOTES (THIS DETAIL ONLY):

1. NETWORK PORT/JACK LABELING (WALL PLATE):
   PROVIDE MACHINE PRINTED LABELS FIXED ON THE FACEPLATE. ONE LABEL ON TOP AND ONE ON BOTTOM.
2. BACKBONE CABLE LABELING:
   PROVIDE A MACHINE PRINTED LABEL SECURED WITH SHRINK WRAP TO EACH BACKBONE CABLE.
3. ANALOG VOICE CABLE LABELING:
   PROVIDE A MACHINE PRINTED LABEL SECURED WITH SHRINK WRAP TO EACH BACKBONE CABLE.
4. IDC PUNCH DOWN BLOCKS LABELING:
   PROVIDE MACHINE PRINTED LABELS THAT MOUNT IN THE IDC LABEL HOLDERS AND SNAP INTO IDC BLOCK.
5. HORIZONTAL NETWORK DATA CABLE LABELING:
   PROVIDE MACHINE PRINTED LABEL SECURED WITH SHRINK WRAP TO EACH END OF EVERY HORIZONTAL CABLE.
6. GROUND BUS:
   PROVIDE A MACHINE PRINTED LABEL PERMANENTLY FIXED TO THE BUSBAR.
7. TELECOM RACK LABELING:
   PROVIDE MACHINE PRINTED LABELS PERMANENTLY FIXED ON THE FRONT UPPER LEFT OF RACK.
8. FIBER OPTIC ENCLOSURE:
   PROVIDE MACHINE PRINTED LABELS PERMANENTLY FIXED TO ENCLOSURE.
9. PATCH PANELS:
   PROVIDE MACHINE PRINTED LABELS PERMANENTLY FIXED ON THE FRONT UPPER LEFT OF PATCH PANEL.

2 LABELING REQUIREMENTS - ANSI/TIA 606-D
NO SCALE



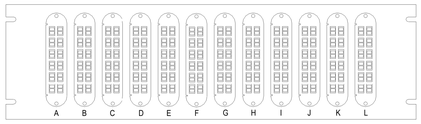
GENERAL NOTES (THIS DETAIL ONLY):
1. DRAWING IS DIAGRAMMATIC, AND TO REFERENCE ELECTRICAL DRAWINGS

KEYNOTES (THIS DETAIL ONLY)

1. CABLE RUNWAY STRINGER (SIDE VIEW). COORDINATE HEIGHT WITH TELECOM DRAWINGS.
2. VERTICAL WIRE MANAGER (TYP.). COORDINATE LOCATION WITH TELECOM DRAWINGS.
3. ELECTRICAL CONDUIT FEEDING RECEPTACLES BELOW CABLE RUNWAY STRINGER. CONDUIT SIZE PER NATIONAL ELECTRICAL CODE (NEC) REQUIREMENTS.
4. 4-INCH SQUARE ELECTRICAL RECEPTACLE BACKBOX (TYP.). EXACT RECEPTACLE CONFIGURATION PER ELECTRICAL POWER PLANS.
5. MOUNT TOP OF 4-INCH SQUARE ELECTRICAL RECEPTACLE BACKBOX TO ALIGN WITH TOP OF CABLE RUNWAY STRINGER AND CENTERED ABOVE VERTICAL WIRE MANAGER BELOW. RECEPTACLES SHALL FACE REAR AISLE OF EQUIPMENT UNLESS OTHERWISE NOTED.

1 ELECTRICAL RECEPTACLE - VERTICAL WIRE MANAGER MOUNTED
NO SCALE

MDF B018



A. 24-STRAND ARMORED SINGLEMODE TO IT A141A
B. 24-STRAND ARMORED SINGLEMODE TO IT B229B
C. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-1 (STRANDS 1-24)
D. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-1 (STRANDS 25-48)
E. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-2 (STRANDS 1-24)
F. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-2 (STRANDS 25-48)
G. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-3 (STRANDS 1-24)
H. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-3 (STRANDS 25-48)
I. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-4 (STRANDS 1-24)
J. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-4 (STRANDS 25-48)
K. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-5 (STRANDS 1-24)
L. 48-STRAND OUTDOOR SINGLEMODE TO HANDHOLE-5 (STRANDS 25-48)

IT A141A



A. 24-STRAND INDOOR ARMORED SINGLEMODE FROM MDF B018.
B. 24-STRAND INDOOR ARMORED SINGLEMODE FROM IT B229B.
C. BLANK PLATE.

IT B229B



A. 24-STRAND INDOOR ARMORED SINGLEMODE FROM MDF B018.
B. 24-STRAND INDOOR ARMORED SINGLEMODE FROM IT A141A.
C. BLANK PLATE.

MEDIA PRODUCTION B026 (LOCATED INSIDE A/V RACK)



A. 24-STRAND LC ADAPTER PLATE
   1. 6-STRAND INDOOR ARMORED SINGLEMODE FROM GYM A121
   2. 6-STRAND INDOOR ARMORED SINGLEMODE FROM GYM A121
   3. 6-STRAND INDOOR ARMORED SINGLEMODE FROM GYM A121
   4. 6-STRAND INDOOR ARMORED SINGLEMODE FROM CONTROL A139A
B. 24-STRAND LC ADAPTER PLATE
   1. 6-STRAND INDOOR ARMORED SINGLEMODE FROM BLACK BOX A140
   2. 6-STRAND INDOOR ARMORED SINGLEMODE FROM BLACK BOX A140
   3. 6-STRAND INDOOR ARMORED SINGLEMODE FROM BLACK CAFETERIA A137
   4. 6-STRAND INDOOR ARMORED SINGLEMODE FROM PLANETARIUM A150
C. BLANK PLATE.

3 FIBER ENCLOSURE DETAILS
NO SCALE

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N&B PROJECT: 25-0104
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KEY PLAN



DRAWING TITLE

TELECOM DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
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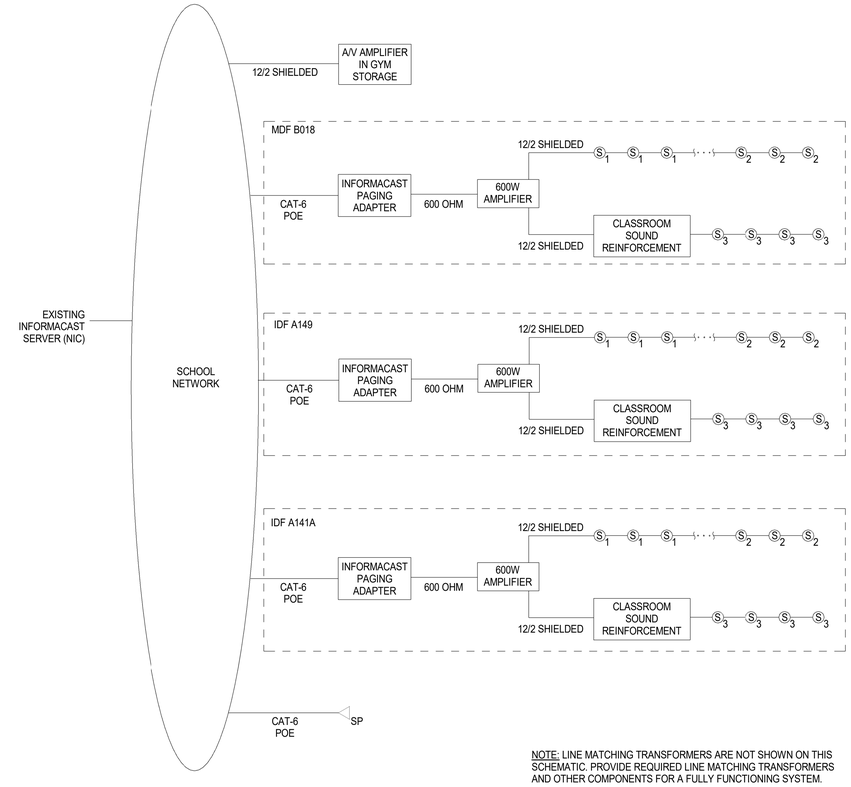
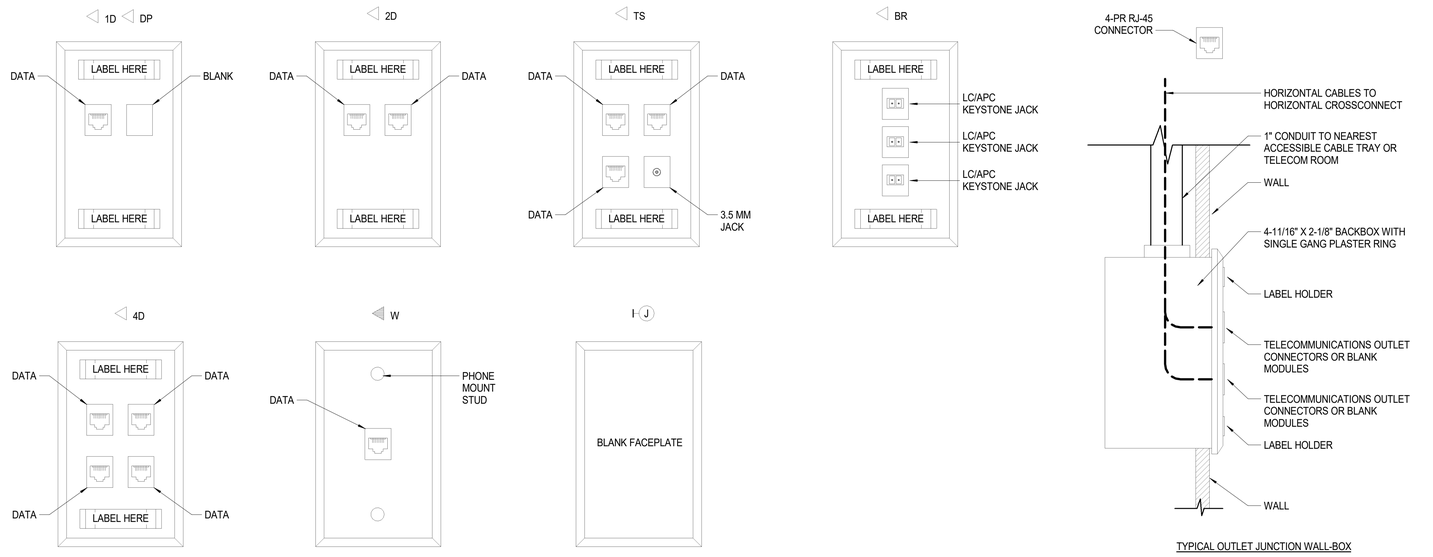


NOTE: LINE MATCHING TRANSFORMERS ARE NOT SHOWN ON THIS SCHEMATIC. PROVIDE REQUIRED LINE MATCHING TRANSFORMERS AND OTHER COMPONENTS FOR A FULLY FUNCTIONING SYSTEM.

1 PAGING SCHEMATIC DRAWING
NO SCALE



TYPICAL OUTLET JUNCTION WALL-BOX

2 TELECOM FACEPLATE DETAILS
NO SCALE

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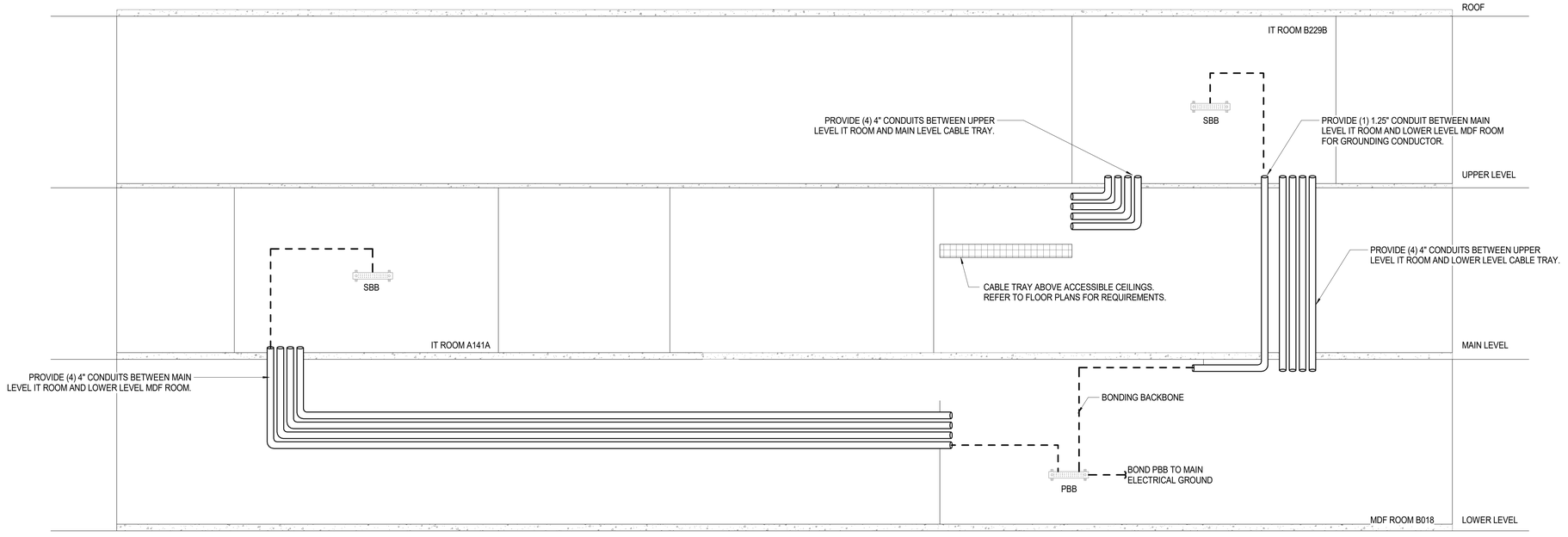
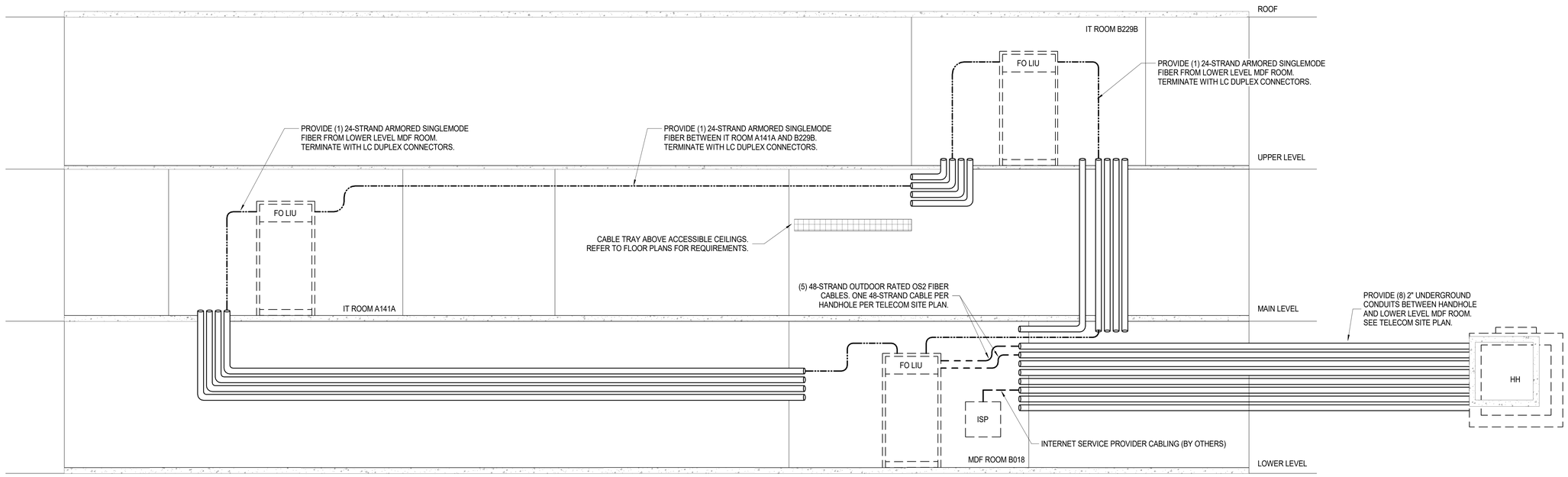


1 TELECOM CONDUIT AND GROUNDING RISER DIAGRAM
NO SCALE



2 TELECOM FIBER OPTIC BACKBONE RISER DIAGRAM
NO SCALE

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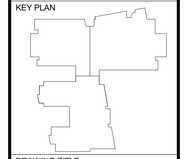

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TELECOM DETAILS

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OFFICE PROJ. NO.	250501
SCALE	NO SCALE
DATE	05/19.2026
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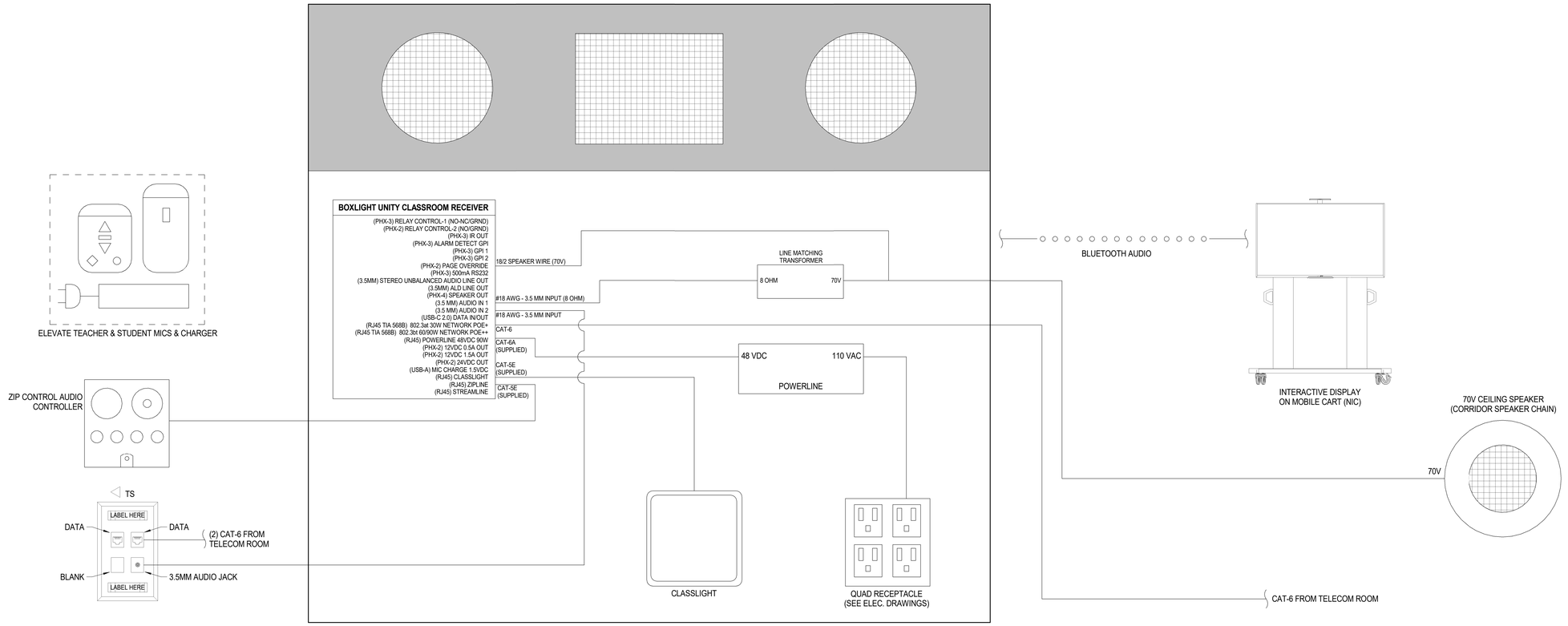
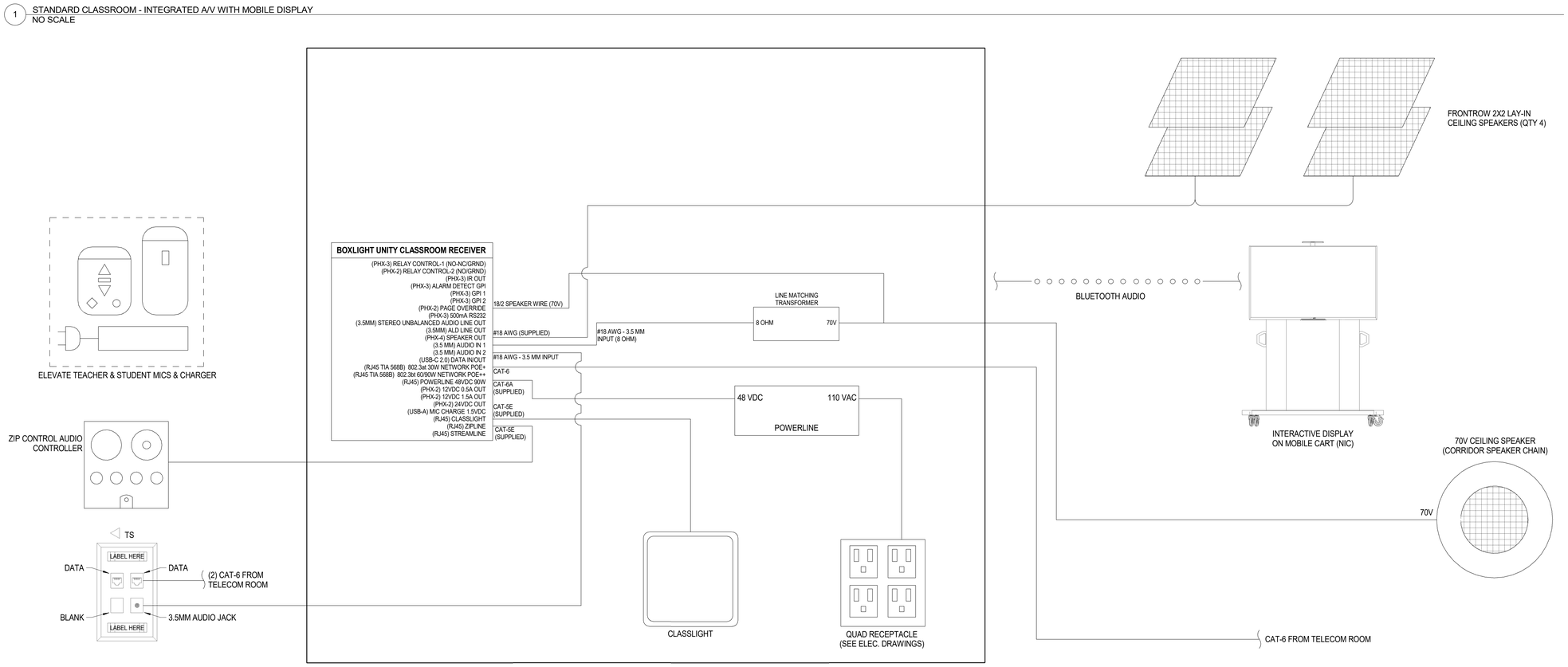


1 STANDARD CLASSROOM - INTEGRATED A/V WITH MOBILE DISPLAY
NO SCALE



2 LARGE CLASSROOM - INTEGRATED A/V WITH MOBILE DISPLAY
NO SCALE

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TELECOM DETAILS - CLASSROOM A/V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	NO SCALE
DATE	05/19.2026
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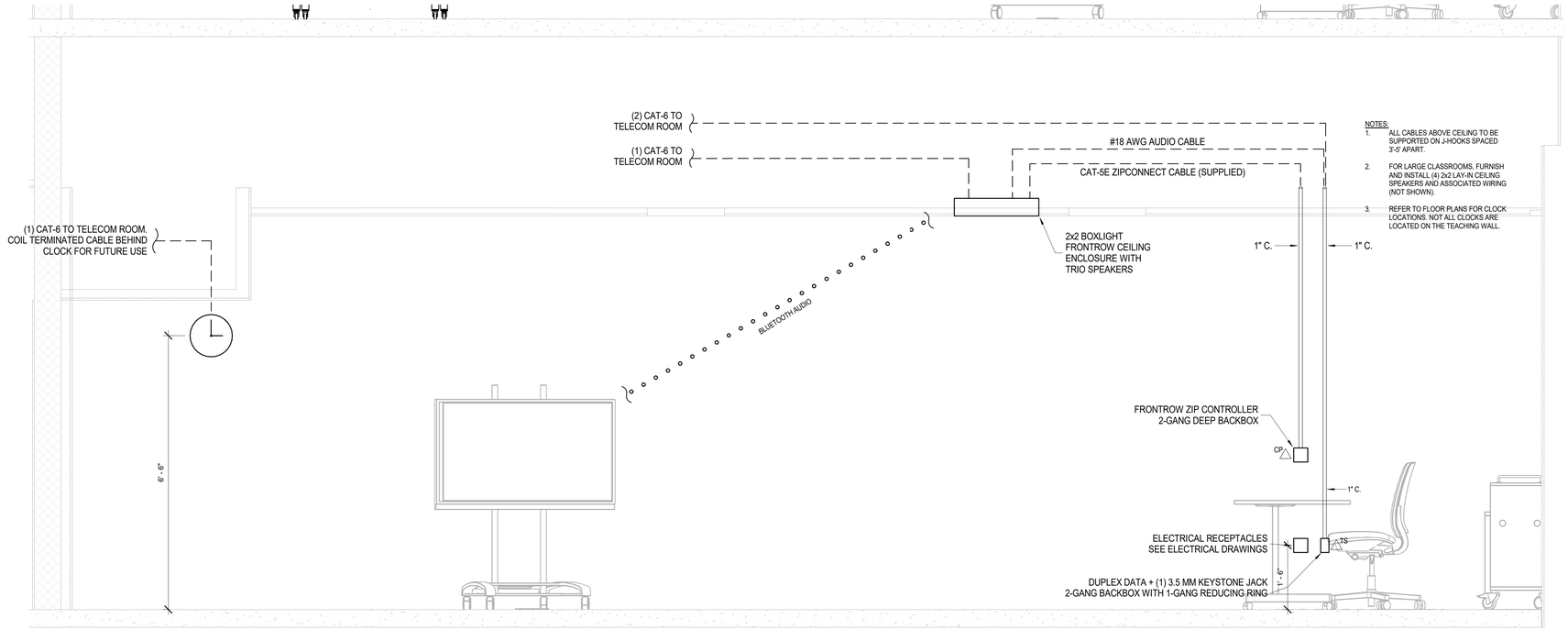

1 CLASSROOM TEACHING WALL - MOBILE INTERACTIVE DISPLAY
3/4" = 1'-0"

NOTES:
1. ALL CABLES ABOVE CEILING TO BE SUPPORTED ON J-HOOKS SPACED 3'-5' APART.
2. FOR LARGE CLASSROOMS, FURNISH AND INSTALL (4) 2x2 LAY-IN CEILING SPEAKERS AND ASSOCIATED WIRING (NOT SHOWN).
3. REFER TO FLOOR PLANS FOR CLOCK LOCATIONS. NOT ALL CLOCKS ARE LOCATED ON THE TEACHING WALL.

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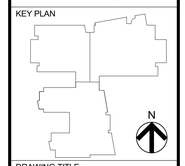
KEY PLAN



DRAWING TITLE

TELECOM DETAILS - CLASSROOM A/V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	3/4" = 1'-0"
DATE	05/19.2026
DRAWN BY	GTH
APPROVED BY	RSL

ISSUE DATES

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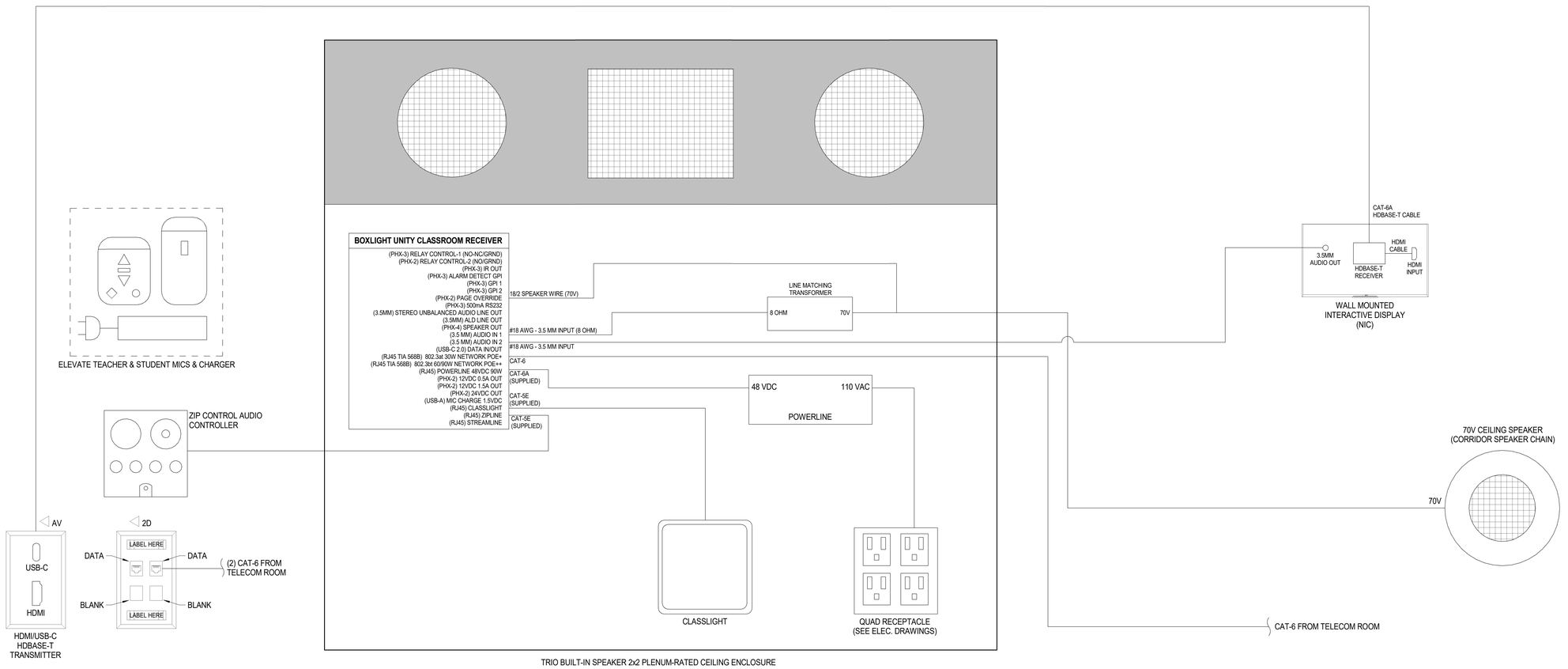
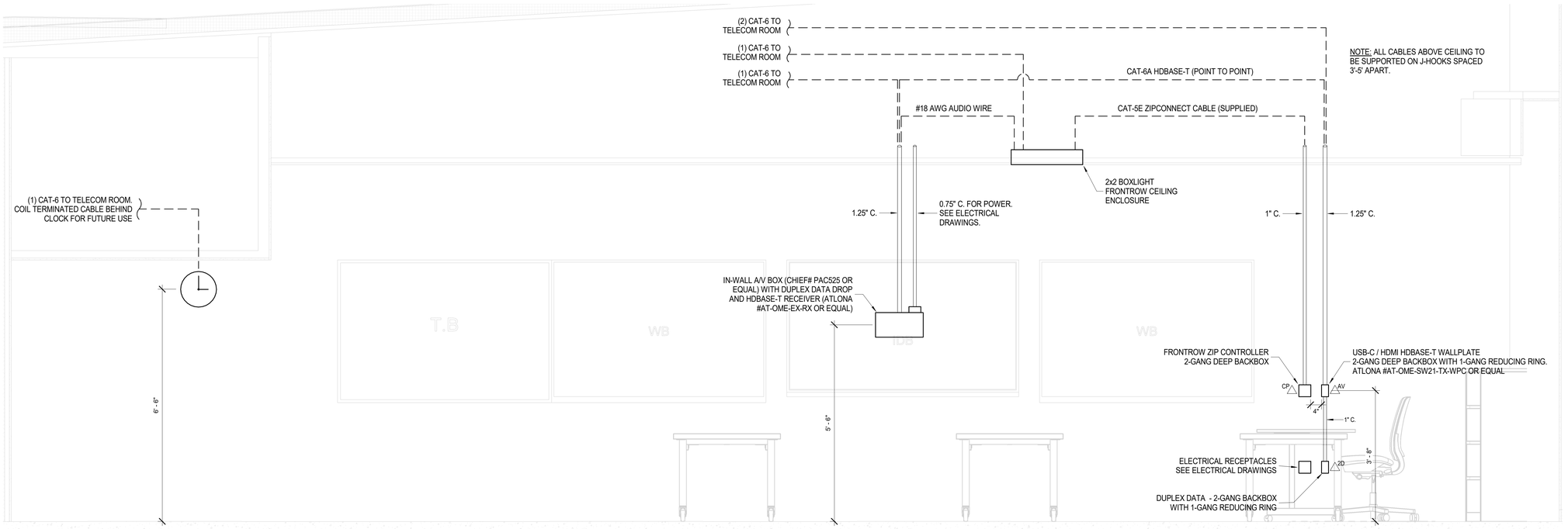


1 STANDARD CLASSROOM - INTEGRATED A/V WITH FIXED DISPLAY
NO SCALE



2 CLASSROOM TEACHING WALL - FIXED INTERACTIVE DISPLAY
3/4" = 1'-0"

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KEY PLAN



DRAWING TITLE

TELECOM DETAILS - CLASSROOM A/V

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	05/19.2026
DRAWN BY	GTH
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THEATRICAL SYSTEMS INFRASTRUCTURE & SYMBOL LEGEND

SYMBOL	NAME	BACKBOX SIZE	Box Note	MOUNTING HEIGHT UON (IN. AFF)	CONDUIT TYPE 1			Detail (sheet / #)	NOTES	POWER Notes (BY ELECTRICAL)	Data Notes
					QTY	SIZE (IN)	DESTINATION UON				
PB W1	W1 - LIGHTING PUSH BUTTON PANEL	1-gang		48	1	1"	LIGHTING RACK	TH5.01	ETC - ECHO E104	NA	NA
ET W2	TOUCH SCREEN	2-gang		18	1	1"	LIGHTING RACK	TH5.01	ETC - ECHO TOUCH	NA	NA
DX W2	W2-DX	2-gang		18	1	1"	LIGHTING RACK	TH5.01	BY ETC OR CUSTOM BY CONTRACTOR	NA	NA
DN W2	W2- NET2	2-gang		18	1	1"	LIGHTING RACK	TH5.01	BY ETC OR CUSTOM BY CONTRACTOR	NA	NA
DN W3	W3-DX/NET	3-gang		18	1	1"	LIGHTING RACK	TH5.01	BY ETC OR CUSTOM BY CONTRACTOR	NA	NA
LCR-X	LIGHTING CONTROL RACK	NA					SEE RISER	TH6.01	ETC 10 RU	12V/20A	1D
LRP-X	LIGHTING RELAY PANEL	NA					SEE RISER	TH0.20	ETC SENSOR IQ48	120/208 3 PHASE 400A	NA
DR4 W4	4 CIRCUIT LIGHTING CONNECTOR PANEL	4 GANG		18			LRP(S) SEE SCHEDULE TH0.20	TH5.01	ETC - TBD	NA	NA
HDX SDX	LIGHTING GRID DISTRIBUTION BOX	CUSTOM		TO GRID	1,1	2", 1"	LRP(S) SEE SCHEDULE TH0.20	TH5.01	ETC COLORSOURCE RACEWAY	NA	NA

NOTES:
1. CONDUIT DESTINATIONS ARE IN SAME ROOM UNLESS OTHERWISE NOTED.
2. "CABLE TRAY" MEANS TO STUB THE CONDUIT DIRECTLY TO THE CABLE TRAY USING THE SHORTEST POSSIBLE ROUTE. - UON
3. "AAC" STUB CONDUIT ABOVE FINISHED ACCESSABLE CEILING IN THE SAME ROOM AS THE BOX, UNLESS OTHERWISE NOTED.
4. NA = NOT APPLICABLE

WALL DEVICES

ZZ AFF — XX WX — WALL BOX

ZZ AFF — XX D# — LIGHTING CIRCUIT WALL BOX

FLOOR DEVICES

XX — XX F — FLOOR BOX

CEILING DEVICES

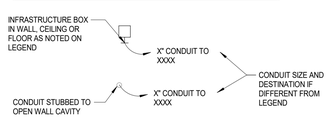
XX J — CEILING JUNCTION BOX

XX CX — CEILING CONNECTOR BOX

XX CXB — CEILING LIGHTING CONNECTOR BOX

XX CXX — CEILING LIGHTING CONNECTOR BOX

CONDUIT CALLOUT



NOTES:
1. CONDUIT SIZE AND DESTINATION ARE SHOWN ONLY WHEN REQUIREMENTS DIFFER FROM LEGEND.
2. CONDUIT CONNECTED TO BOX PER MANUFACTURES INSTRUCTIONS.
3. CONDUIT STUBBED TO OPEN WALL CAVITY REAM AND BUSH CONDUIT END.

SUB-LABEL LEGEND

XX = EQUIPMENT OR PLATE TYPE MARK

ZZ = HEIGHT OF INFRASTRUCTURE IF DIFFERENT FROM INFRASTRUCTURE LEGEND

LIGHTING EQUIPMENT PLATE MARK

ANT - ANTENNA
DN - DMX - LIGHTING NETWORK
DX - DMX
CTL - CONTROL PANEL OR CONTROL TOUCH PANEL
PB - PUSH BUTTON PANELD
D# - LIGHTING DIMMER CIRCUIT #
R# - LIGHTING RELAY #
MP - MOTOR POWER
MC - MOTOR CONTROL
MCP - MOTOR CONTROL PANEL

ABBREVIATIONS

ABV	ABOVE
AFF	ABOVE FINISHED FLOOR
ARF	ABOVE RAISED FLOOR
AFC	ABOVE FINISHED CEILING
BFC	BELOW FINISHED CEILING
ARCH	ARCHITECT/ARCHITECTUAL
BEL	BELOW
C	CONDUIT
CLG	CEILING
CONN	CONNECT/CONNECTION
CONT	CONTINUATION/CONTINOUS
FL	FLOOR
LAN	LOCAL AREA NETWORK
N/A	NOT APPLICABLE
N/I	NOT ISSUED
NTS	NOT TO SCALE
NIC	NOT IN CONTRACT
OFE	OWNER FURNISHED EQUIPMENT
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
SCRN	PROJECTOR SCREEN
SPEC	SPECIFICATIONS
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED

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PROFESSIONAL SEAL



Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

THEATRICAL TITLE & LEGEND

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

TH0.00

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STAGE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Curtains and Rigging Systems:
1. Stage curtains and tracks.
2. Rope and dead hung rigging.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Rated capacities, construction details, material descriptions, dimensions of individual components, profiles, and finishes.

C. Shop Drawings:
1. Submit component and project specific installation drawings, cut sheets, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. Submit for approval before beginning any fabrication, installation, or erection.
2. Include fabrication and installation details. Distinguish between factory and field work.
3. Include plans, elevations, sections, attachments and work by other trades.
4. Include wiring diagrams when applicable.
5. Indicate seismic bracing and fastening requirements as applicable.
6. For theater seating, develop sightline plan and sections through seating areas using sightlines program and sightline rules. Include options placement, electrical schematic for aisle lighting and placement of seating with table arms as applicable.

D. Coordination Drawings: Project-specific Coordination Drawings, indicating the following items drawn and coordinated with each other. Include information required by Installers of each item in order to coordinate the Work. Include the following:
1. Relationship of items shown on separate Shop Drawings.
2. Dimensions and required clearances of adjacent or related work.
3. Order of assembly of separate items.
4. Information required for interface with other trades and components, including mechanical, electrical, and communication work.

E. Product Schedule:
1. Use designations indicated on the Drawings.
2. Include room locations, dimensions, accessories, finishes, and project specific notes.

F. Verification Samples:
1. Exposed Finishes and Finish Materials: Not less than 4 by 4 inches (102 by 102 mm), for each type, color, pattern, surface and material selected.

G. Closeout Submittals:
1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
2. Warranty: Submit manufacturer's warranty.
3. As-Built Drawings: For completed work.

H. Field Quality Control Reports: Documenting inspections and demonstrations of installed products and equipment.

1.3 QUALITY ASSURANCE

A. Curtain and Rigging Systems, Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.
1. Theatrical rigging systems are specialized overhead lifting systems. Due to the highly specialized nature of theatrical rigging equipment, and the safety requirements of the equipment, the rigging products provided for this work shall be the products of a single rigging manufacturer for quality, consistency and ease of integration. Accessory items such as wire rope, fittings, and curtain tracks may be from other specialty manufacturers.
2. The rigging manufacturer shall have the following programs in place.
   a. The manufacturer shall have a product testing program, including determination of recommended working loads for products based on destructive testing and review by a licensed engineer.
   b. The manufacturer shall carry primary product and general liability insurance of $2,000,000 each, with excess liability coverage of $10,000,000 and a Contractors Professional Liability policy with $2,000,000 coverage.

B. Rigging Systems, Installer Qualifications: Manufacturer's authorized representative, trained and approved for installation of units required for this Project.
1. The Rigging Contractor shall be an approved rigging manufacturer or an authorized representative or dealer of an approved manufacturer. The contractor shall have been installing stage rigging systems for a period of five years or more, and shall have completed at least ten installations of this type and scope. The AHJ shall be the final judge of the suitability of experience.
2. The Rigging Contractor shall employ an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger. A Certified Rigger shall be either the project manager or site foreman, and be responsible for the overall project including the layout, inspection, and onsite user training.

C. Rigging Systems, Minimum Standards of Safety, the following factors shall be used:
1. Cables and Fittings: 8:1 Safety Factor.
2. Cable D/d ratio: Sheave tread diameter is the minimum D/d ratio per the "Wire Rope User Manual" or recommended by the wire rope manufacturer.
3. Maximum Fleet Angle: 1-1/2 degrees.
4. Steel: 1/5 of yield strength or per AISC Specification.
5. Bolts: Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.

B. Handle and install materials to avoid damage.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
1. Coordinate installation and location of blocking and supports as requested.
2. Verify openings, clearances, storage requirements and other dimensions relevant to the installation and final application.
3. Where applicable, coordinate locations of electrical junction boxes.

C. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
1. Coordinate locations of electrical junction boxes.

D. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.6 WARRANTY

A. Special Warranty for Curtain Systems: Provide manufacturer's standard limited 3 year warranty against defects in materials or workmanship from the date of Substantial Completion. The warranty is contingent on inspection of the equipment and training of its use being provided annually by an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger at the Owner's expense. It is the responsibility of the end user to make arrangements for the annual inspection and training. Failure to obtain the inspection and training annually shall result in a one year warranty. The warranty shall not cover equipment that has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper maintenance, or used not in a manner intended.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Requests for substitutions shall be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
1. Manufacturers seeking approval shall submit the following:
   a. Product data, including third-party certified acoustical data and proposed graphic/drawing layout for this project.
   b. Project references: Minimum of 5 installations not less than 3 years old, of comparable size, scope and complexity of this project, complete with owner contact information.
   c. Sample warranty.
2. Submit substitution request not less than required days prior to bid date.
3. Approval shall be indicated by issuance of written Addendum.
4. Approved manufacturers shall meet separate requirements of Submittals Article.
5. Manufacturers' products that are either listed as pre-approved in these Specifications or who have been granted approval as an alternate must still demonstrate all of the material performance and operational characteristics required by this Section.

B. Rigging Systems, Requirements for Approval: Other equipment manufacturers seeking approval shall submit the following information at least 2 weeks prior to the bid opening date. Approval of manufacturers shall be by addenda. Failure to submit any of the required information shall automatically disqualify the manufacturers from consideration of approval.
1. Evidence that the manufacturer has been in business for a minimum of ten years manufacturing stage equipment.
2. A listing of 10 equivalent installations, including:
   a. Name, address and telephone number of owner.
   b. Name, address and telephone number of architect.
   c. Scope of work.
3. A brief written description of the manufacturer's operation including facilities, financial capabilities, and experience of key personnel.
4. Written, third party evidence showing that the manufacturer has the testing, quality management and insurance programs required above in place.

2.2 STAGE CURTAINS AND TRACKS

A. Tracks:
1. Product: 280 Track.
2. Manufacturer: ADC, I-weiss
3. Color Black

B. Stage Curtains:
1. Description and Sizes: As shown on drawings.
2. Fabric Types:
   a. Main Drape Fabric: 22 oz. Charisma Velour, 100 percent polyester IFR velour, Rose Brand, KM Fabrics, I-Weiss, standard color to be selected.
   b. Blacks Fabric: 15 oz. Charisma Velour, 100 percent polyester IFR velour, Rose Brand, KM Fabrics, I-Weiss, color BLACK.
3. Flame Resistance:
   a. All Polyester fabrics are woven from fibers that are inherently flame retardant for the life of the fabric. These curtains never need to be re-treated for flame retardancy.
   b. 100 percent cotton fabrics are to be chemically mill treated by an immersion process. This process lasts approximately 5 years and then shall be re-done for flame retardancy according to the requirements of the National Fire Protection Association's NFPA #701 together with dry cleaning.
   c. A Certificate of Flame Resistance is to be provided for each fabric supplied. The certificates shall be issued by the fabric manufacturer or converter. Certificates issued by the supplier or fabricator are not acceptable.
   d. Each curtain is to be labeled with a permanent tag giving the flame retardancy information and providing a suggested date for testing, if applicable.
4. Fabrication:
   a. See Drapery Schedule for sizes and operation.
   b. General: Curtains are to be fabricated in the sizes and fabrics shown in the curtain schedule. Curtains are to be stitched with thread matching the color of the curtain using a single needle lock stitched. No less than full widths of fabric are to be used in leg curtains. All fabrics with a grain or pile shall have all strips running in the same direction.
   c. Fullness: Fullness as listed in the Curtain Schedule is to be in addition to allowances for seams, side hems and turn backs.
   d. Pleats: Where fullness is indicated in the Curtain Schedule, pleats shall be box type on 12 inch (305 mm) centers. Valances and borders are to have their pleats arranged to conceal the seams.
   e. Top Finish: 3-1/2 inch (89 mm) jute webbing or 3 inch (76 mm) Poly webbing shall be double stitched to the top of the curtain with 2 inch (50.8 mm) of face fabric turned under the webbing. Brass rustproof grommets shall be inserted in pleat centers (12 inch (305 mm)) centers on flat curtains.
   f. Track-mounted curtains shall be supplied with plated wire S-hooks or CCF-2 curtain to carrier snap hooks. Batten-mounted curtains are to be supplied with 36 inch (914 mm) braided #4 cotton tie lines. Tie lines shall be black or white to best match the curtains with the center line in an alternate color to aid in hanging curtains.
   g. Bottom Hems:
      1) Valances and borders shall have 4 inch (102 mm) bottom hems.
      2) All full height curtains shall have 6 inch (152 mm) bottom hems complete with separate interior chain pockets filled with #8 plated jack chains. Chain pockets shall be stitched so that the chain shall ride 2 inch (51 mm) above the finished bottom edge of the curtain.
      3) Scrims, drops and cycloramas shall have an additional strip of webbing with ties on 12 inch (305 mm) centers sewn to the back of the hem and shall be furnished with a 3/4 inch (19 mm) pipe batten, threaded and coupled every 10 feet-0 inch (305 mm).
   h. Side Hems:
      1) All lined traveler curtains shall have 1/2 width of face fabric turned back at the leading edge.
      2) All other side hems shall be 2 inch (51 mm).
   i. Lining: Lining, if required in the above listing, shall conform to the following requirements.
      1) Lining shall be in the same fullness as face fabric.
      2) Lining shall finish 2 inch (51 mm) shorter than face fabric.
      3) Lining shall be attached to the face fabric along the sides and bottom hems by 4 inch (102 mm) twill tape.

C. Heavy Duty Curtain Track:
1. 280 HD Curtain Track.
2. All track carriers and mounting hardware shall be BLACK.
3. See Drapery Schedule for sizes and operation.
4. Track shall be of 14 ga (1.980 mm) galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 ft (6,096 mm) shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 ft (6,096 mm).
5. Carriers shall be constructed of nylon, supported from two heavy-duty polyethylene wheels held in the ball bearing by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving swivel and sufficient trim chain to accommodate a curtain S-hook. Each carrier shall have a back-pack. Rubber washers shall be provided between each back-pack and carrier to reduce noise.
6. The Master Carrier block shall be constructed of plated steel having two cable clips to clamp the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
7. Live and dead end pulleys shall be adjustable, equipped with oil-impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable, demountable floor pulley shall be furnished. Stretch-resistant, fiberglass center operating cord shall be 3/8 inch (9.5 mm) in diameter.
8. Track shall be hung by pipe clamps to a batten via pipe clamps.
9. The batten shall be rigged to the pipe grid via
10. Track shall be rigged for bi-parting operation with a 36 inch (914.4 mm) center overlap. Hanging clamps shall be provided for suspension at 6 ft (1,829 mm) foot maximum intervals.
11. The operating cord / Hand Line: 3/8” synthetic center color BLACK.
12. Provide 8” Floating Sand Bag Tension Pulley for the operating lines.

D. Pipe Batten:
1. All battens shall be 1-1/2 inches (38.1 mm) nominal diameter, schedule 40 pipe in lengths as shown on the drawings or Bill of Materials. All joints shall be spliced with 18 inches (457.2 mm) long sleeves with 9 inches (228.6 mm) extending into each pipe and held by two 3/8 inch (9.5 mm) hex bolts and lock nuts on each side of the joint.
2. Battens shall be suspended from the pipe grid.

2.3 ROPE AND DEAD HUNG RIGGING

A. Pipe Grid:
1. Pipes shall be painted matte BLACK.
2. Pipe grids shall be constructed from lengths of 1.5 inches (38.1 mm) nominal I.D. schedule 40 iron pipe. All joints shall be sleeve spliced with 18 inches (457.2 mm) long sleeves with 9 inches (228.6 mm) into each pipe and held by two 3/8 inch (9.5 mm) hex bolts and lock nuts on each side of the joint. Grids shall be installed as indicated on the drawings with pipes intersecting on four foot by four-foot centers.
3. Intersecting pipes shall be joined with a Cross Grid Clamp or by an approved equal. The cross grid clamp shall have a recommended working load of at least 1,500 lbs (680 kg). U-bolts are not acceptable.
4. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
5. The grid shall be rigidly hung from the overhead steel structures on centers not exceeding 8 feet in either direction using 1/4 inch (6.4 mm), 7x19 galvanized utility cable ending in 6 inches x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps or connector strip hanging brackets. At each hanging point the cable shall attach to the overhead structure with an appropriate fitting. Cables shall be formed over thimbles of correct size and fastened with two forged cable clips or Nicopress sleeves. Turnbuckles shall be safetied with tie wire after final trim.
6. Provide any additional structure required to install pipe grids. Supplemental structure is to be approved by the project structural engineer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with installation only after correction of unsatisfactory conditions.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - GENERAL

A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

B. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

3.4 INSTALLATION OF RIGGING SYSTEMS

A. Equipment shall be installed by fully trained superintendents and workmen. The Rigging Contractor shall employ Entertainment Technician Certification Program (ETCP) Certified theatre Riggers. Certified Riggers shall, at a minimum, be used as the project manager and site foreman and be responsible for the overall project including the layout, inspection, and onsite user training.

B. Equipment shall be installed per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.

C. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding shall be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).

D. Alignment: Mule blocks, cable rollers and guides shall be installed, as required, to provide proper alignment, to maintain specified fleet angles, and to prevent contact with other surfaces.

E. Attachments: All equipment shall be securely attached to the building structure.

3.5 INSPECTION AND TESTING OF RIGGING SYSTEMS

A. Inspection: During the installation of equipment the Rigging Contractor shall arrange for access as necessary for inspection of equipment by the Owner's representatives.

B. System Pre-Testing By Rigging Contractor: On completion of installation the Rigging Contractor shall conduct a complete test of the system to ensure it is working properly and in conformance with this specification.

C. Completion Testing: Upon completing the installation, the Rigging Contractor shall notify the Owner or Owner's Representative, who shall schedule inspection and testing of the full rigging system. At the time of testing, the Rigging Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Owner's representative. All testing equipment and personnel shall be at the Rigging Contractor's expense. Any equipment, which fails to meet with approval, shall be repaired or replaced with suitable equipment and the inspection shall be re-scheduled under the same conditions as previously specified. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of, and access to, all equipment. Final approval shall be withheld until all systems have been thoroughly tested and found to be in full working order and meets requirements herein.

D. The Owner or Owner's Representative shall witness and sign off on the inspection. A copy of the certificate shall be included in the permanent log turned over to the owner.

E. Upon completion of the work, the Rigging Contractor shall submit 3 copies of a comprehensive Operating and Maintenance Manual including as-built shop drawings, equipment descriptions, and parts lists. The Rigging Contractor shall provide a safety and instruction class with personnel designated by the owner to demonstrate and explain the operation and maintenance of the systems.

F. Signage with basic operating instructions and warnings shall be posted in the area where the equipment shall be operated. Signage shall be in conformance with ANSI-Z535.

3.6 RIGGING SYSTEMS, FOLLOW-UP INSPECTION

A. The Contractor shall return to site 12 months and 24 months after system turnover and provide the following services:
1. Inspection in accordance with ANSI E1.47 - Recommended Guidelines for Entertainment Rigging System Inspections.
2. Make all required adjustments.
3. Correct all warranty items and provide a written report to the Owner and Manufacturer.
4. Provide written recommendations to the Owner and Manufacturer for necessary repairs or changes not included in the warranty.
5. Conduct a rigging operation and safety class.

3.7 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain equipment. Turn over keys, tools, and operation and maintenance instructions to Owner.

3.8 CLEANING AND PROTECTION

A. Repair or replace defective work as directed by Architect upon inspection.

B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.

C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

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N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL



Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

THEATRICAL SPECIFICATIONS 1
STAGE EQUIPMENT

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
0	05/19/2026	100% CD

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PRODCTION LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All work of this section shall comply with the requirements of all other sections of the Project, and with all Drawings and all other Contract Documents, including all Addenda.

1.2 MODIFICATIONS TO GENERAL CONDITIONS

A. Where any requirements of this section modify, change or add to any part of the Project Specifications, the remaining, unaltered provisions of that part of that section shall remain in effect. Where any requirement of this section and any requirement of Project Specification conflict, the most rigorous provision shall apply.

1.3 DEFINITIONS

A. "Owner" as used in this section means the representative of the Farmington School District.

B. “Contractor” as used in this section refers to that subcontractor directly responsible for supply of the Stage Lighting

C. "Electrical Contractor" or "EC" as used in this section refers to the contractor responsible for supply and installation of all electrical wiring, conduit, fasteners, terminations and labor for the Project.

D. “Project” as used in this section refers to the construction of Farmington High School, including, but not limited to the work described in this section.

E. "Consultant" as used in this section refers to Newcomb & Boyd, LLP.

F. "Architect" as used in this section refers to TSKP.

G. “Construction Manager” as used in this section refers to the contractor responsible for the construction of the Project.

H. "Supply" as used in this section means, "to supply, complete with instruction for installation (installation by others)".

I. "Provide" as used in this section means "supply, install and make operable".

J. "NIC" as used in this section and on the contract drawings means "not included in this subcontract, not to be supplied".

K. "By Others" as used in this section and on the contract drawings means "not included in this subcontract, supplied as part of another subcontract".

L. "Or As Approved" as used in this section and on the contract drawings means "substitution only after written approval by Consultant.

1.4 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 SCOPE OF WORK

A. All equipment shall perform as specified in each part of this section when installed on site. All details of this section apply to completed work on site. Failure to meet any requirement of this section on site shall be deemed sufficient cause for rejection of equipment.

B. Examine all sections of Project Specifications and determine their relationship to the work of this section. Provide all products, and execute all work, of this section in accordance with applicable requirements of the Project Specification to provide an interrelated electrical system.

1.6 WORK INCLUDED IN THIS SECTION

A. Provide all Stage Lighting System components including: relay racks, emergency transfer devices, relay racks, dimmer banks, all dimmer modules and electronics as specified herein.

B. Provide all Stage Lighting System network racks, including all devices required to allow operation of the system.

c. Coordination with electrical contractor and other trades as may be required.

D. Provide all Stage Lighting System control systems including: control consoles, control accessories and video accessories; stage lighting control systems; and all control panels and pendants as specified herein.

E. Provide all Stage Lighting System distribution devices including: control outlet panels, plugging box panel faces, multi-circuit cables, and multi-cable junction as specified herein.

F. Provide of all back boxes for Stage Lighting System panels and devices.

G. Provide all Stage Lighting fixtures as specified.

H. Provide labor and an experienced supervisor to:

1. Unpack and assemble stage lighting fixtures
2. Install stage lighting fixtures per TH-series drawings
3. Focus the stage lighting fixtures per the TH-series drawings

I. Provide site inspection reports and installation instructions as specified.

J. Factory testing, engineering checkout, field-testing, and completion checkout as specified.

K. Provide "as built" drawings, guarantee and warranty, operations manuals, instruction, and software updates as specified.

1.7 RELATED WORK BY ELECTRICAL CONTRACTOR

A. The work of the Electrical Contractor shall specifically include, but not be limited to, all of the following:

1. Receipt and installation of Stage Lighting System
2. Electrical service from power mains through fused safety switches, to primary terminals of dimmer racks.
3. Emergency power supply, distribution and protection, except as noted.
4. Placement and installation of equipment, except as noted herein.
5. All materials (conduit, wire and junction boxes) and labor
6. All wire terminations for:
   a. 120-volt power wiring into the Stage Lighting dimmer bank
   b. 120-volt, branch circuit, load wiring from the dimmer bank to all of the distribution devices and/or branch circuits or fixtures
   c. Architectural lighting fixtures
   d. Any architectural lighting control systems that are not part of the Stage Lighting system
   e. Work lighting fixtures, receptacles, and local low voltage switches

1.8 RELATED WORK BY OTHERS

A. Stage Rigging

B. Stage Draperies

1.9 RESPONSIBILITIES

A. All work of this Section shall be furnished under a single subcontract and be the responsibility of a single Stage Lighting Systems contractor, except where specifically assigned to the Electrical Contractor.

B. Make any and all alterations to standard design and construction of any equipment necessary to meet any and all requirements of this Section.

C. The Stage Lighting System Contract Documents describe performance attributes of systems to be provided, including means of operation and control, dimensions and profiles, and visual appearances. Assume all responsibility for engineering of systems described, including modification of and addition to any details as required fulfilling the design intent of Stage Lighting Contract Documents.

D. Provide timely inspection, and instruction to the Electrical Contractor to ensure proper installation of all elements of Stage Lighting System. This paragraph also includes any elements noted on the Stage Lighting Contract Documents (as " NIC.") for installation at a later date.

E. Omissions and/or errors within Stage Lighting Contract Documents shall not relieve the Electrical and Stage Lighting Contractors of the responsibility for providing a properly functioning installation of the Stage Lighting System as described.

F. Correct or replace, at no cost to Owner, any system or part of system found not meeting specifications at time of Completion Checkout, or any time during warranty period.

1.10 QUALIFICATIONS

A. The Contractor shall be the exclusive designer and engineer of all electronic dimming and control equipment. The Contractor shall provide the following information as part of their bid package:

B. List of representative current projects and approximate contract value. Include list of names, phone numbers and addresses of owner, owner's representatives and architect.

C. For projects described, above, list of names of persons who supervised preparation of shop drawings, manufacture of components, and installation of equipment.

D. List of names, phone numbers, and addresses of persons who would do project management, product engineering, supervision of shop drawing, supervision of testing and user training for
Stage Lighting System should this contract be awarded.

E. The Contractor shall maintain a full-time field engineering staff.

F. Listed stage lighting contractors are:

1. Barbizon Stage Lighting
2. Candela Controls
3. Supertech

1.11 BASIS OF BID

A. Work of this section is based upon equipment manufactured by ETC www.etcconnect.com.

B. Listing of equipment and components manufactured by ETC is not an endorsement of those items, but a point of reference and a basis for the Stage Lighting system design.

C. Proposed substitutions for any work of this section to be submitted to Theater Consultant for approval two (2) prior to bid due date. Identify the specific component/system with an explanation for the substitution and a demonstration of its equivalency to the Basis of Bid.

D. Approval of any proposed substitution to be at the sole discretion of the Theater Consutant.

1.12 CODES AND STANDARDS

A. Provide materials, components and assemblies that are UL, CE listed and meet all applicable codes, standards, and specifications applying to the work of this section.

1.13 OWNER'S TESTING AGENCY

A. If any work is required to be specially tested or approved, whether by the Owner's instructions or by any laws, ordinances or any public authority, the Contractor shall give Owner's representative timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities, through General Contractor. Contractor is responsible for time, labor, materials and fees associated with such.

1.14 SCHEDULE OF SHOP DRAWING SUBMITTALS

A. Submit a proposed schedule of submittals, fabrication, and installation work.

1.15 PROJECT MEETING

A. Meet with Architect and Consultant, at offices of Architect, Consultant or General Contractor, after schedule has been submitted and prior to beginning work on shop drawings. Project manager and project engineer must attend, and be prepared to review schedule and to discuss concepts described in Stage Lighting contract documents and proposed methods of execution of those concepts.

1.16 SHOP DRAWINGS

A. Provide the number of sets of shop drawings required in Project Specifications, for submittal to Consultant. Provide 1 copy of each cut sheet and equipment manual with each set of shop drawings. Submit all shop drawings as directed for distribution.

B. Prepare all shop drawings under supervision of a qualified project engineer. Include names and contact telephone numbers of project manager and project engineer with shop drawing package.

C. Engineer, design and draft all shop drawings to represent actual fabrication and installation drawings and details. Copies or tracings of contract drawings will not be acceptable as shop drawings and shall be rejected.

D. Submit shop drawings as a package containing all drawings, details, layouts, schedules and schematics necessary to fully explain design features, appearance, fabrication, installation, function and operation of each system completely. Provide a fully referenced index of drawings.

E. Include the following information and data with shop drawing submission:

1. Wiring diagrams for all control systems, clearly identifying any changes from the Electrical contract documents.
2. Power supply requirements, clearly identifying any changes from the Electrical contract documents.
3. Scale floor plans of all dimmer rooms, showing locations of all Stage Lighting System equipment, noting any necessary clearances for cooling or access, and noting acceptable locations for control, power and load conduit entries.
4. Installation instructions for all items supplied in this section for installation by EC.
5. Details of all distribution panels and back boxes.
6. Details of all control panels and back boxes.
7. Duplicate of bill of materials described above.
8. Complete detailed list of all spare parts and assemblies.
9. Specification sheets as may be appropriate.

F. Shop drawings shall not be reviewed prior to approval of schedule of submittals, or prior to post-tender meeting.

G. Shop drawing packages that are incomplete will not be reviewed until such time as complete set of relevant drawings, cut sheets and other information is submitted.

H. Review of shop drawings by Consultant is for conformance with design concept and for conformance with information given in the Stage Lighting contract documents. Nonconformities and errors detected during review shall be noted on shop drawings and returned to Contractor on completion of review. Consultant is not responsible for completeness or accuracy of the Contractor shop drawings. Acceptance of shop drawings including deviations and inconsistencies not detected during review shall not relieve the Contractor from sole responsibility to provide materials and work conforming to the letter and spirit of the Stage Lighting contract documents.

I. No Stage Lighting equipment shall be manufactured, fabricated, shipped or installed prior to shop drawings being reviewed by Architect, Engineer, General Contractor and Consultant.

J. If field dimensions obtained after approval of shop drawings require changes in size, detail or similar considerations, revised shop drawings shall be submitted for review.

K. All shop drawings shall identify Newcomb & Boyd, LLP, as the theater consultant.

1.17 SAMPLES

A. Submit all samples identified Project Specifications, or as requested by Consultant or Archtect.

1.18 MOCK UPS

A. Submit samples of all control and panel covers and all labels.

B. Provide other samples as requested by Consultant or Architect.

1.19 INSTALLATION INSTRUCTIONS

A. Provide installation instructions for all items supplied in this section, as reviewed and approved with the shop drawings, to Electrical Contractor for coordination. Such instructions shall be fully coordinated with trades doing adjoining work and with site conditions. Instructions shall include inter-equipment connection diagrams with terminal designations.

1.20 INSPECTION REPORTS

A. If conditions exist that are contrary to proper installation of Stage Lighting System, directly inform Electrical Contractor and Consultant of the discrepancies. Failure to inform Electrical Contractor shall constitute acceptance of installation and place responsibility for any revisions or additions necessary to properly install work of this section with Contractor.

1.21 OPERATIONS MANUALS

A. Provide five (2) copies of an Operations Manual, in approximately 8-1/2" (205) x 11" (275) 3-ring binders. Where page is larger than 8-1/2" x 11", said page shall be folded to fit within the binder. Each Manual shall contain; a complete description of the system operation, all equipment operating instructions, all equipment schematics, all equipment service manuals, recommended maintenance procedures, all equipment data sheets, all system test data, all warranty information, and all as built drawings. The manuals shall be fully indexed for ease of use.

B. Provide (2) copies in PDF format via download link and USB Thumb drive.

C. Use the following outline to organize the Operations Manual:

1. Table of Contents (w/ page reference)
2. List of Illustrations
3. List of Tables
4. Operator Safety Summary
5. Servicing Safety Summary
6. Section 1 - Specification of System
7. Section 2 - Operating Instructions (Manuals and Cut sheets)
8. Section 3 - Maintenance
   a. Preventive Maintenance
   b. Trouble Shooting
9. Section 4 - Manufacturer Information
10. Section 5 - Warranty (include complete documents)
    a. Contact information first year service.
11. Section 6 –As Built Drawings (11x17).
12. Section 7 - Schematic Drawings of All Electronic Equipment
13. Index

D. Submit a draft to Architect and Consultant for review at least 4 weeks prior to completion checkout. If manual is rejected, revise as needed and resubmit prior to delivering to Owner.

1.22 RECORD DRAWINGS

A. The Contractor shall provide “as built" record shop drawings including any late changes or adjustments which occur as corrections to punch list items or as change orders after Substantial Completion of Contract. As-Builts shall be in the form of a PDF file designed to print to 11x17. At Substantial Completion of Contract, the Contractor shall prepare a complete set of their shop drawings for incorporation into the Operations Manual.

B. Provide one copy in the Lighting control Rack.

C. Provide (2) copies in PDF format via download link and USB Thumb drive.

1.23 GUARANTEE AND WARRANTY

A. Provide a one (1) year written guarantee covering all labor, materials and workmanship incorporated into the work. Warranty shall commence from date of Owner acceptance. Indicate date of expiration on warranty.

B. Carry out all warranty work with no additional cost to Owner for any parts, labor, or transportation. Provide warranty replacement equipment within 24 hours of notice by Owner. Provide on- site warranty repair within 2 days of notice.

C. If a particular component, part or piece of equipment fails more than three times during the warranty period; the failure shall be deemed due to an error in product engineering. In that case, within 24 hours of notice by Owner, take whatever action is necessary to modify or correct the defect by design change. Provide temporary backup or replacement equipment within 24 hours of notice. Provide permanent, redesigned, replacement equipment on a work schedule that does not conflict with rehearsals or performances.

D. Warranty on components and equipment modified or replaced due to error in product engineering shall be same as for original components and equipment and shall commence from date of installation of modified or replaced component or equipment.

1.24 CONTINUING MAINTENANCE PROPOSAL

A. After Substantial Completion, submit to the Owner a proposal for continuing maintenance and service, to commence upon expiration of the warranty period.

1.25 TRAINING

A. Provide training to Owner's operating personnel on operation and care of system for not less than eight (8) hours. Instruction shall include, but not be limited to: operation of the systems and equipment, proper maintenance of all systems, trouble-shooting, replacement procedures for user replaceable parts, and operating procedures to obtain maximum usage of systems.

B. Deliver all copies of approved Operations Manual to Owner prior to first instruction session, and review it as part of that session. Owner shall schedule training session at their convenience.

C. Instruction must be by qualified expert operators who have actual experience with systems in performance conditions. Submit instructor's qualifications to Consultant for approval at least 2 weeks prior to Completion Checkout.

1.26 SOFTWARE UPDATES

A. Provide, at no cost to Owner, any software updates of the operating programs of any and all specified control consoles and other equipment through end of the warranty period via download from the manufacture's website or on a disk.

B. This software update provision shall in no way be construed as relieving Contractor of responsibility to provide operating programs capable of meeting specification at time of delivery of equipment, during warranty period, or after warranty period.

1.27 DESCRIPTION OF SYSTEMS

A. The Stage Lighting System and fixtures for the Black Box as shown.

PART 2-PRODUCTS

2.2 Control Console

A. Provide control consoles noted on the TH-series drawings

2.3 Dimmer/Relay Bank

A. Provide as noted on the TH-series drawings.

2.4 Lighting Control Rack

A. Provide as noted on the TH-series drawings.

2.5 House Light Control

A. Provide as noted on the TH-series drawings.

2.6 Work Light Control

A. Provide as noted on the TH-series drawings.

2.7 Lighting Network Distribution

A. Provide as noted on the TH-series drawings.

2.8 Circuit Distribution

A. Provide as noted on the TH-series drawings.

2.9 Stage Lighting Fixtures

A. Provide as noted on the TH-series drawings.

2.10 Loose Equipment

A. Provide as noted on the TH-series drawings.

2.11 Miscellaneous Supplies

A. Provide as noted on the TH-series drawings.

PART 3-EXECUTION

3.1 STAGE LIGHTING SYSTEM INTEGRATOR

A. Assume responsibility to Provide equipment and instruction for complete and working installation of all Stage Lighting Equipment specified in this section, coordinated with work of EC and all other subcontractors. Coordinate with EC and other subcontractors through GC.

3.2 COORDINATION WITH OWNER AND CONSULTANT

A. CONTRACTOR shall submit all drawings, schedules, and other communications relating to work of this section as directed.

3.3 ENVIRONMENTAL CONDITIONS

A. Ship Stage Lighting System equipment to site only after notification by EC that storage facilities are available to protect equipment prior to installation, as described below. EC shall install Stage Lighting equipment only when site conditions provide mechanical, electrical, and weather protection for each class of equipment, as described below.

B. Pack all equipment in sturdy containers to provide mechanical protection during shipping and storage. Provide padding as necessary to protect equipment from vibration and shock. Provide inner plastic sheeting to protect equipment from moisture and dust. Keep plastic covers on equipment until such time as installation areas have been completed and conditions exist as indicated below.

c. Maintain storage and installation conditions for each class of equipment according to the following:

1. CLASS 1
   a. Distribution apparatus, back boxes, face plates, terminal boxes, and empty dimmer rack frames may be stored in weather protected spaces under "normal" construction site conditions provided that no electronic components are contained within devices, that storage boxes are sturdy and well-sealed, and that equipment is protected with imperforate inner plastic sheeting.
   b. EC may install this class of equipment in weather protected spaces under "normal" construction site conditions provided that equipment is protected from dust and moisture by sturdy imperforate plastic sheeting and completely covered with corrugated cardboard held securely in place by duct tape. Cardboard covers shall not be removed until area is broom cleaned. Under no circumstances shall equipment remain uncovered overnight during installation or while work that causes high dust or moisture levels in area of placement is taking place.
2. CLASS 2
   a. Dimmer modules, dimmer control assemblies, control panels, spare parts and test equipment shall be stored and protected per Class 1 devices, except that all equipment shall be stored in air conditioned, secure space. Do not ship this class of
   equipment until such space exists on site and is approved by Architect, Consultant
   and Owner.
   b. EC shall not install equipment in this class until area of installation is broom cleaned, "blown" clean with pressurized air, mopped, air conditioned and secure. EC may install control panels with electronic components under Class 1 conditions, but electronic components must be removed and not installed until area of installation meets Class 2 conditions.
3. CLASS 3
   a. Control Consoles, Designer Remotes, Focus Remotes, Video Monitors, Printers, and computer component spare parts shall not be shipped to site until control and dimmer rooms are finished, air conditioned, broom cleaned, "blown" clean with pressurized air, mopped, secure and in all respects complete and ready for occupation. This class of equipment shall not be unpacked until Stage Lighting system is complete in all other respects.
   b. If control and dimmer rooms are complete in time to use this Class of equipment for Engineering Checkout and Field Testing and Adjustment, equipment may be unpacked for this purpose, but must be re-packed should there be a lapse of time greater than 2 weeks between completion of these testing and Completion Checkout.
   c. Under no circumstances may equipment in this Class be removed from control or dimmer rooms into or through spaces which are not in all respects complete and ready for occupation

3.4 REVIEW OF FIELD CONDITIONS

A. Confirm by site visit and by report from EC all field conditions that may affect manufacture and installation of Stage Lighting System equipment prior to fabrication. Provide any additional hardware, panels and back boxes to accommodate field conditions. Submit all changes to equipment and mounting details to Consultant for review prior to fabrication.

3.5 INSTALLATION INSTRUCTION

A. Provide specific, detailed direction to EC as required for proper installation of all Stage Lighting System equipment, coordinated with actual site conditions, as per Part 1 of this section.

B. ITEMS PLACED AND ATTACHED TO EXISTING WORK

1. CONTRACTOR shall Provide all items required to properly install and secure Stage Lighting System equipment in place.
2. EC shall place, install, and connect all Stage Lighting System equipment.

3.6 ALTERATION OF EQUIPMENT DETAILS

A. If any panel, distribution box, or other device requires relocation or change of mounting detail, and this fact is not known until after shipment due to sequence of work, modify equipment or

provide new equipment to fit revised location or mounting detail. Notify Consultant of any such changes, and submit all changes to Consultant for review prior to fabrication.

3.7 WIRING

A. CONTRACTOR shall describe to the EC appropriate length cable loops, terminations, etc.; or any other wiring procedure (beyond customary trade practice) required for successful operation.

3.8 MARKING

A. All equipment shall be permanently and logically marked for ease of EC installation.

3.9 PAINTING AND TOUCH UP

A. Provide EC with all paint and supplies to correct minor cosmetic damage to equipment. Ensure that all equipment is clean and in perfect condition at time of Completion Checkout.

B. Repair or replace any equipment that has suffered non-cosmetic damage prior to time of
Completion Checkout. Claims arising from repair or replacement of such damage shall be considered only after final acceptance of system by Owner.

3.10 CLEAN UP

A. CONTRACTOR shall instruct EC to clean all racks, panels and boxes of dirt, dust, and debris, re-assemble all equipment, and replace all panels, covers and screws prior to time of
Completion Checkout.

3.11 PROTECTION OF CONTROL EQUIPMENT

A. Do use any control equipment intended for installation for the purpose of checking out wiring or circuitry prior to proper conditions existing on site, as specified above. Equipment may be used for such testing only in specific areas where such proper conditions exist.

3.12 ENGINEERING CHECKOUT

A. Prior to energizing of Stage Lighting control systems, perform complete system checkout to verify that all items are correctly installed and shall safely operate as specified herein.

B. FIELD TESTING AND ADJUSTMENT

C. Perform all tests and adjustments specified below upon completion of installation of Stage Lighting System, but no later than six weeks prior to Beneficial Occupation of facility, or portion of facility containing Stage Lighting System, by Owner.

3.13 TEST PROCEDURES

A. Prior to Consultant's inspection perform all following tests:

1. Inspect all device labels to ensure that devices are correctly and clearly labeled as specified and shown in drawings.
2. Test all circuits for proper wiring, polarity, and connection to proper dimmer; and inspect
for correct labeling.
3. Test all power receptacles provided in this section.
4. Test video systems for clear screen and high resolution of characters with no interference, "snow", color degradation, pixel shift, etc.
5. Test all extension cables, adapters, etc.
6. Repair or replace any equipment that fails to conform to specification.
7. Upon completion of testing, Provide Owner, Architect and Consultant a complete report on all field-testing and adjustment, certifying that system conforms to specification and that installation is complete and ready for inspection.

3.14 COMPLETION CHECKOUT

A. Schedule inspection by Owner, Architect and Consultant no earlier than upon receipt of above specified report, but no later than four (4) weeks prior to Beneficial Occupation of facility, or portion of facility containing Stage Lighting System, by Owner.

B. At request of Consultant, repeat any and all test specified in "Field Testing and Adjustment" above in presence of Owner, Architect and Consultant.

C. Should Owner, Architect or Consultant judge that any equipment fails to conform to specification, repair or replace that equipment within 15 days. Should work inspected not be substantially complete at time of Completion Checkout, complete that work and schedule a second checkout. Provide all equipment and personnel specified above.

D. It is the intent of this specification section that Completion Checkout occurs over a period of two (2) site visits by the Consultant. The second visit is intended for review of CONTRACTOR compliance with punch list items prepared during first visit.

E. Should additional visits by Consultant be required due to CONTRACTOR failure to comply with FIELD TESTING AND ADJUSTMENT, above; and/or should Stage Lighting installation be insufficiently complete to allow Completion Checkout to occur, then the CONTRACTOR shall be liable for all of Consultant's expenses related to additional visits. (These expenses shall include, but not be limited to: airfare, lodging and local travel.)

3.15 FINAL SUBMITTALS

A. After Completion Checkout, submit all of the following to the Owner:

1. Receipts for delivery of uninstalled miscellaneous items, including all spare parts as detailed in Part 2.
2. 5 copies of the Operations Manual, as detailed in Part 1.
3. Record Drawings, as detailed in Part 1.
4. Guarantee and Warranty, as detailed in Part 1.
5. Continuing Maintenance Proposal, as detailed in Part 1.
6. All equipment door locks, as detailed in Part 2.

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303 Peachtree Center Avenue, NE
Suite 525
Atlanta, GA 30303-1277
T 404 730-8400
NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

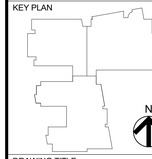
STATE OF CONNECTICUT · ROBERT S. LARAIA · 32121 · LICENSED PROFESSIONAL ENGINEER

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

THEATRICAL SPECIFICATIONS 2
PRODUCTION LIGHTING SYSTEM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

TH0.11

5/18/2026 8:53:33 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-STG_R26.rvt

Docusign Envelope ID: C45FA5A9-6263-8109-8223-2A85F9C09AA2

SOFT GOODS SCHEDULE

DRAPERY ID	DESCRIPTION	FABRIC	FACE COLOR	LINED	MOUNTING	PANEL WIDTH	PANEL HEIGHT	Fullness %	TRACK	TRACK ID	TRACK LENGTH	Operation
M-SL	MAIN DRAPE	22oz IFR VELOUR	BY ARCHITECT	Yes	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND
M-SR	MAIN DRAPE	22oz IFR VELOUR	BY ARCHITECT	Yes	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND
MST-SL	MID STAGE BLACK	15oz IFR VELOUR	BLACK	No	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND
MST-SR	MID STAGE BLACK	15oz IFR VELOUR	BLACK	No	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND
US BLACK	UP STAGE BLACK	15oz IFR VELOUR	BLACK	No	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND
UST-SR	UP STAGE BLACK	15oz IFR VELOUR	BLACK	No	TRACK / GRID	18' - 0"	21' - 0"	50	TRAVELER		21' - 6"	HAND

THEATRICAL FIXTURE SCHEDULE

QUANTITY	Type	Description	Manufacturer	Model	Type Comments	Comments
8	M1	Theatrical Moving Light Fixture	MARTIN	ERA 400	WITH 5' powerCON TRUE1 TO EDISON CABLE, PIPE CLAMP, SAFETY CABLE	
48	PAR	LED PAR	ETC, Inc.	CSPAR	WITH 5' powerCON TRUE1 TO EDISON CABLE, PIPE CLAMP, SAFETY CABLE	
20	S26	RGBL Spot W/ 26 Deg. Lens	PROLIGHTS	EclProfile FS ECLPRL26BK / PIET4260LT	WITH 5' powerCON TRUE1 TO EDISON CABLE, PIPE CLAMP, SAFETY CABLE	
44	S50	RGBL Spot W/ 50 Deg. Lens	PROLIGHTS	EclProfile FS ECLPRL50BK / PIET450LT	WITH 5' powerCON TRUE1 TO EDISON CABLE, PIPE CLAMP, SAFETY CABLE	

SENSOR IQ 48 RELAY PANEL: LRP 1

JOB NUMBER: 25-0104 | JOB NAME: TRUMBULL HILCREST MIDDLE... | DA... ***** | REVISION: SUB | PROJECT NOTE: *****

SLOT	RELAY / DIMMER	AMP	ADDRESS UNI	ADDRESS ADD	DESCRIPTION	FIXTURE C...	FIXTURE TYPE	FIXTURE QTY	FIXTURE LOAD	LOAD PHASING A	LOAD PHASING B	LOAD PHASING C	FIXTURE LOAD	FIXTURE QTY	FIXTURE TYPE	FIXTURE C...	DESCRIPTION	ADDRESS ADD	ADDRESS UNI	AMP	RELAY / DIMMER	SLOT
1	1P RELAY/BREAKER	20	1	49	HLD 1 A			1	2400	2400			2400	1			HLD 1 B	50	1	20	1P RELAY/BREAKER	2
3	1P RELAY/BREAKER	20	1	51	HLD 1 C			1	2400		2400	2400	2400	1			HLD 1 D	52	1	20	1P RELAY/BREAKER	4
5	1P RELAY/BREAKER	20	1	53	HLD 1 E			1	2400			2400	2400	1			HLD 1 F	54	1	20	1P RELAY/BREAKER	6
7	1P RELAY/BREAKER	20	1	55	HLD 2 A			1	2400	2400			2400	1			HLD 2 B	56	1	20	1P RELAY/BREAKER	8
9	1P RELAY/BREAKER	20	1	57	HLD 2 C			1	2400		2400	2400	2400	1			HLD 2 D	58	1	20	1P RELAY/BREAKER	10
11	1P RELAY/BREAKER	20	1	59	HLD 2 E			1	2400			2400	2400	1			HLD 2 F	60	1	20	1P RELAY/BREAKER	12
13	1P RELAY/BREAKER	20	1	61	HLD 3 A			1	2400	2400			2400	1			HLD 3 B	62	1	20	1P RELAY/BREAKER	14
15	1P RELAY/BREAKER	20	1	63	HLD 3 C			1	2400		2400	2400	2400	1			HLD 3 D	64	1	20	1P RELAY/BREAKER	16
17	1P RELAY/BREAKER	20	1	65	HLD 3 E			1	2400			2400	2400	1			HLD 3 F	66	1	20	1P RELAY/BREAKER	18
19	1P RELAY/BREAKER	20	1	67	HLD 4 A			1	2400	2400			2400	1			HLD 4 B	68	1	20	1P RELAY/BREAKER	20
21	1P RELAY/BREAKER	20	1	69	HLD 4 C			1	2400		2400	2400	2400	1			HLD 4 D	70	1	20	1P RELAY/BREAKER	22
23	1P RELAY/BREAKER	20	1	71	HLD 4 E			1	2400			2400	2400	1			HLD 4 F	72	1	20	1P RELAY/BREAKER	24
25	1P RELAY/BREAKER	20	1	73	HLD 5 A			1	2400	2400			2400	1			HLD 5 B	74	1	20	1P RELAY/BREAKER	26
27	1P RELAY/BREAKER	20	1	75	HLD 5 C			1	2400		2400	2400	2400	1			HLD 5 D	76	1	20	1P RELAY/BREAKER	28
29	1P RELAY/BREAKER	20	1	77	HLD 5 E			1	2400			2400	2400	1			HLD 5 F	78	1	20	1P RELAY/BREAKER	30
31	1P RELAY/BREAKER	20	1	79	HLD 6 A			1	2400	2400			2400	1			HLD 6 B	80	1	20	1P RELAY/BREAKER	32
33	1P RELAY/BREAKER	20	1	81	HLD 6 C			1	2400		2400	2400	2400	1			HLD 6 D	82	1	20	1P RELAY/BREAKER	34
35	1P RELAY/BREAKER	20	1	83	HLD 6 E			1	2400			2400	2400	1			HLD 6 F	84	1	20	1P RELAY/BREAKER	36
37	1P RELAY/BREAKER	20	1	85	D4 NORTH			1	2400	2400			2400	1			D4 SOUTH	86	1	20	1P RELAY/BREAKER	38
39	1P RELAY/BREAKER	20	1	87	D4 NORTH			1	2400		2400	2400	2400	1			D4 SOUTH	88	1	20	1P RELAY/BREAKER	40
41	1P RELAY/BREAKER	20	1	89	D4 NORTH			1	2400			2400	2400	1			D4 SOUTH	90	1	20	1P RELAY/BREAKER	42
43	1P RELAY/BREAKER	20	1	91	D4 NORTH			1	2400	2400			2400	1			D4 SOUTH	92	1	20	1P RELAY/BREAKER	44
45	1P BREAKER	20	1	93	LCR-1			1	300		300	0						94	1	NONE	NONE	46
47	NONE	NONE	1	95								0	0					96	1	NONE	NONE	48

ADDRESSING:
UNIVERSE: 1
ADDRESS: 49
PM: *****
AE: *****

TOTAL WATTS	38400	33900	33600
TOTAL AMPS	320.00	282.50	280.00

ACCESSORY OPTIONS:

SNSR Q MAIN FUSE KIT 200A 240/277V (7131K1807)	0
IQ-CI CONTACT INPUT OPTION (7131K1001)	0
IQ-DALI DALI CONTROL OPTION (7131K1002)	0
IQ-LVD 0-10V DIMMING CONTROL OPTION (7131K1003)	**1**
IQ-RTO RIDE THRU OPTION (7131K1004)	0
IQ12 ISOLATED TECHNICAL GROUND (7131K1150)	0

CIRCUIT BREAKER COUNT

B15 120V IQ BREAKER;15A 1P (CB1025)	0
B20 120V IQ BREAKER;20A 1P (CB1026)	**1**
B30 120V IQ BREAKER;30A 1 P (CB1027)	0
B152 120V IQ BREAKER;15A 2P (CB1029)	0
B202 120V IQ BREAKER;20A 2P (CB1030)	0
B302 120V IQ BREAKER;30A 2P (CB1031)	0
B153 120V IQ BREAKER;15A 3P (CB1033)	0
B202 120V IQ BREAKER;20A 3P (CB1034)	0
B303 120V IQ BREAKER;30A 3P (CB1035)	0

RACK CONTENTS:
IQ48 120V 3PHASE ENCLOSURE W/O BREAKERS (7131A1061)
IQ TOP FEED 120V 400A 65kA 3P MCB (7131K1046)
IQ48 DOOR SURFACE MOUNT (7131A1551)

CIRCUIT BREAKER /RELAY COUNT

SNSR IQ CB W/RELAY 15A 1P 120V-TESTED (CB851-1)	0
SNSR IQ CB W/RELAY 20A 1P 120V-TESTED (CB852-1)	**44**
SNSR IQ CB W/RELAY 30A 1P 120V-TESTED (CB853-1)	0
SNSR IQ CB W/RELAY 15A 2P 120V-TESTED (CB854-1)	0
SNSR IQ CB W/RELAY 20A 2P 120V-TESTED (CB855-1)	0
SNSR IQ CB W/RELAY 30A 2P 120V-TESTED (CB856-1)	0
SNSR IQ CB W/RELAY 15A 3P 120V-TESTED (CB857-1)	0
SNSR IQ CB W/RELAY 20A 3P 120V-TESTED (CB858-1)	0
SNSR IQ CB W/RELAY 30A 3P 120V-TESTED (CB859-1)	0

SENSOR IQ 48 RELAY PANEL: LRP-2

JOB NUMBER: 25-0104 | JOB NAME: TRUMBULL HILCREST MIDDLE... | DA... ***** | REVISION: *** | PROJECT NOTE: *****

SLOT	RELAY / DIMMER	AMP	ADDRESS UNI	ADDRESS ADD	DESCRIPTION	FIXTURE C...	FIXTURE TYPE	FIXTURE QTY	FIXTURE LOAD	LOAD PHASING A	LOAD PHASING B	LOAD PHASING C	FIXTURE LOAD	FIXTURE QTY	FIXTURE TYPE	FIXTURE C...	DESCRIPTION	ADDRESS ADD	ADDRESS UNI	AMP	RELAY / DIMMER	SLOT
1	1P RELAY/BREAKER	20	1	1	SLD 1 A			1	2400	2400			2400	1			SLD 1 B	2	1	20	1P RELAY/BREAKER	2
3	1P RELAY/BREAKER	20	1	3	SLD 1 C			1	2400		2400	2400	2400	1			SLD 1 D	4	1	20	1P RELAY/BREAKER	4
5	1P RELAY/BREAKER	20	1	5	SLD 1 E			1	2400			2400	2400	1			SLD 1 F	6	1	20	1P RELAY/BREAKER	6
7	1P RELAY/BREAKER	20	1	7	SLD 1 G			1	2400	2400			2400	1			SLD 1 H	8	1	20	1P RELAY/BREAKER	8
9	1P RELAY/BREAKER	20	1	9	SLD 2 A			1	2400		2400	2400	2400	1			SLD 2 B	10	1	20	1P RELAY/BREAKER	10
11	1P RELAY/BREAKER	20	1	11	SLD 2 C			1	2400			2400	2400	1			SLD 2 D	12	1	20	1P RELAY/BREAKER	12
13	1P RELAY/BREAKER	20	1	13	SLD 2 E			1	2400	2400			2400	1			SLD 2 F	14	1	20	1P RELAY/BREAKER	14
15	1P RELAY/BREAKER	20	1	15	SLD 2 G			1	2400		2400	2400	2400	1			SLD 2 H	16	1	20	1P RELAY/BREAKER	16
17	1P RELAY/BREAKER	20	1	17	SLD 3 A			1	2400			2400	2400	1			SLD 3 B	18	1	20	1P RELAY/BREAKER	18
19	1P RELAY/BREAKER	20	1	19	SLD 3 C			1	2400	2400			2400	1			SLD 3 D	20	1	20	1P RELAY/BREAKER	20
21	1P RELAY/BREAKER	20	1	21	SLD 3 E			1	2400		2400	2400	2400	1			SLD 3 F	22	1	20	1P RELAY/BREAKER	22
23	1P RELAY/BREAKER	20	1	23	SLD 3 G			1	2400			2400	2400	1			SLD 3 H	24	1	20	1P RELAY/BREAKER	24
25	1P RELAY/BREAKER	20	1	25	SLD 4 A			1	2400	2400			2400	1			SLD 4 B	26	1	20	1P RELAY/BREAKER	26
27	1P RELAY/BREAKER	20	1	27	SLD 4 C			1	2400		2400	2400	2400	1			SLD 4 D	28	1	20	1P RELAY/BREAKER	28
29	1P RELAY/BREAKER	20	1	29	SLD 4 E			1	2400			2400	2400	1			SLD 4 F	30	1	20	1P RELAY/BREAKER	30
31	1P RELAY/BREAKER	20	1	31	SLD 4 G			1	2400	2400			2400	1			SLD 4 H	32	1	20	1P RELAY/BREAKER	32
33	1P RELAY/BREAKER	20	1	33	D4 STAGE RIGHT			1	2400		2400	2400	2400	1			D4 UP STAGE RIGHT	34	1	20	1P RELAY/BREAKER	34
35	1P RELAY/BREAKER	20	1	35	D4 STAGE RIGHT			1	2400			2400	2400	1			D4 UP STAGE RIGHT	36	1	20	1P RELAY/BREAKER	36
37	1P RELAY/BREAKER	20	1	37	D4 STAGE RIGHT			1	2400	2400			2400	1			D4 UP STAGE RIGHT	38	1	20	1P RELAY/BREAKER	38
39	1P RELAY/BREAKER	20	1	39	D4 STAGE RIGHT			1	2400		2400	2400	2400	1			D4 UP STAGE RIGHT	40	1	20	1P RELAY/BREAKER	40
41	1P RELAY/BREAKER	20	1	41	D4 UPSTAGE LEFT			1	2400			2400	2400	1			D4 DOWN STAGE LEFT	42	1	20	1P RELAY/BREAKER	42
43	1P RELAY/BREAKER	20	1	43	D4 UPSTAGE LEFT			1	2400	2400			2400	1			D4 DOWN STAGE LEFT	44	1	20	1P RELAY/BREAKER	44
45	1P RELAY/BREAKER	20	1	45	D4 UPSTAGE LEFT			1	2400		2400	2400	2400	1			D4 DOWN STAGE LEFT	46	1	20	1P RELAY/BREAKER	46
47	1P RELAY/BREAKER	20	1	47	D4 UPSTAGE LEFT			1	2400			2400	2400	1			D4 DOWN STAGE LEFT	48	1	20	1P RELAY/BREAKER	48

ADDRESSING:
UNIVERSE: 1
ADDRESS: 1
PM: *****
AE: *****

TOTAL WATTS	38400	38400	38400
TOTAL AMPS	320.00	320.00	320.00

ACCESSORY OPTIONS:

SNSR Q MAIN FUSE KIT 200A 240/277V (7131K1807)	0
IQ-CI CONTACT INPUT OPTION (7131K1001)	0
IQ-DALI DALI CONTROL OPTION (7131K1002)	0
IQ-LVD 0-10V DIMMING CONTROL OPTION (7131K1003)	0
IQ-RTO RIDE THRU OPTION (7131K1004)	0
IQ12 ISOLATED TECHNICAL GROUND (7131K1150)	0

CIRCUIT BREAKER COUNT

B15 120V IQ BREAKER;15A 1P (CB1025)	0
B20 120V IQ BREAKER;20A 1P (CB1026)	0
B30 120V IQ BREAKER;30A 1 P (CB1027)	0
B152 120V IQ BREAKER;15A 2P (CB1029)	0
B202 120V IQ BREAKER;20A 2P (CB1030)	0
B302 120V IQ BREAKER;30A 2P (CB1031)	0
B153 120V IQ BREAKER;15A 3P (CB1033)	0
B202 120V IQ BREAKER;20A 3P (CB1034)	0
B303 120V IQ BREAKER;30A 3P (CB1035)	0

RACK CONTENTS:
IQ48 120V 3PHASE ENCLOSURE W/O BREAKERS (7131A1061)
IQ TOP FEED 120V 400A 65kA 3P MCB (7131K1046)
IQ48 DOOR SURFACE MOUNT (7131A1551)

CIRCUIT BREAKER /RELAY COUNT

SNSR IQ CB W/RELAY 15A 1P 120V-TESTED (CB851-1)	0
SNSR IQ CB W/RELAY 20A 1P 120V-TESTED (CB852-1)	**48**
SNSR IQ CB W/RELAY 30A 1P 120V-TESTED (CB853-1)	0
SNSR IQ CB W/RELAY 15A 2P 120V-TESTED (CB854-1)	0
SNSR IQ CB W/RELAY 20A 2P 120V-TESTED (CB855-1)	0
SNSR IQ CB W/RELAY 30A 2P 120V-TESTED (CB856-1)	0
SNSR IQ CB W/RELAY 15A 3P 120V-TESTED (CB857-1)	0
SNSR IQ CB W/RELAY 20A 3P 120V-TESTED (CB858-1)	0
SNSR IQ CB W/RELAY 30A 3P 120V-TESTED (CB859-1)	0

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T 404 730-8400
NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL



Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

THEATRICAL SCHEDULES

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

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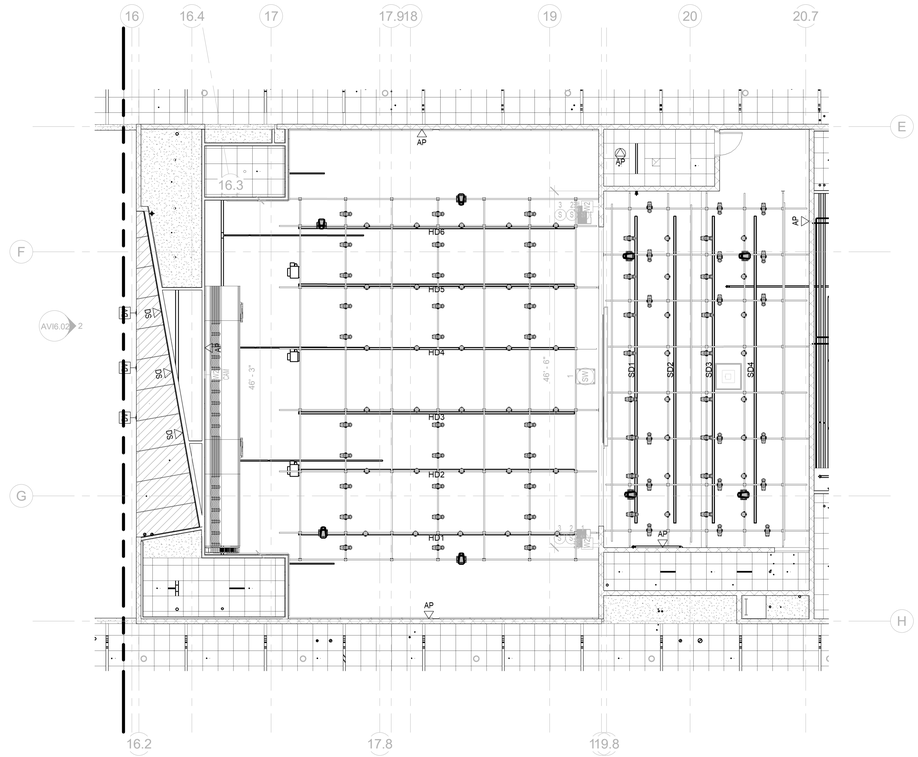
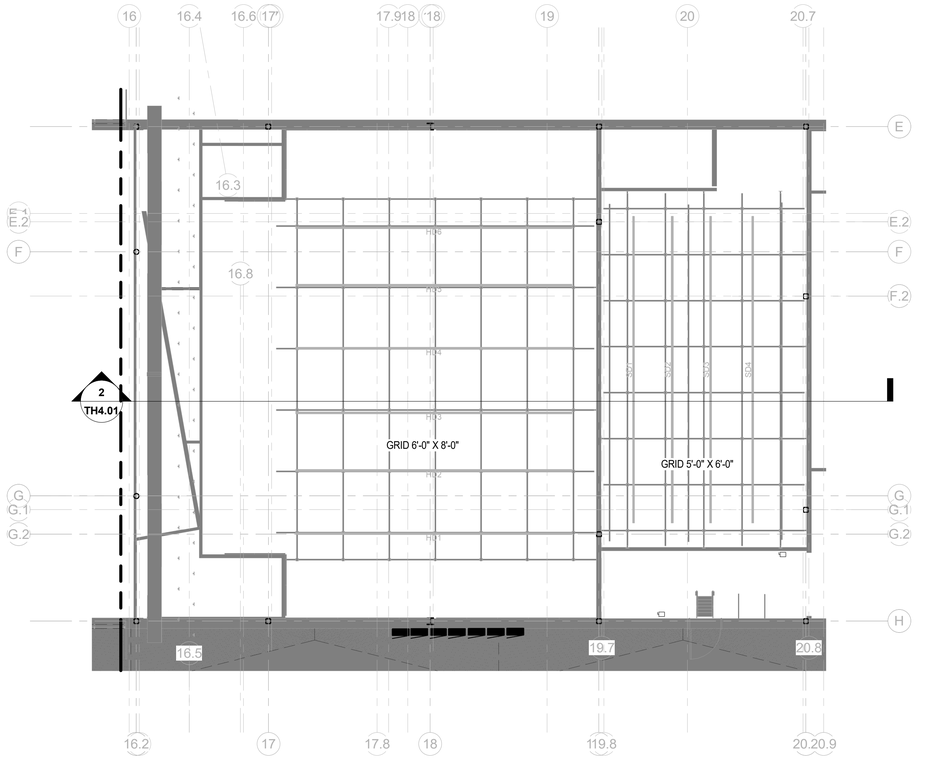
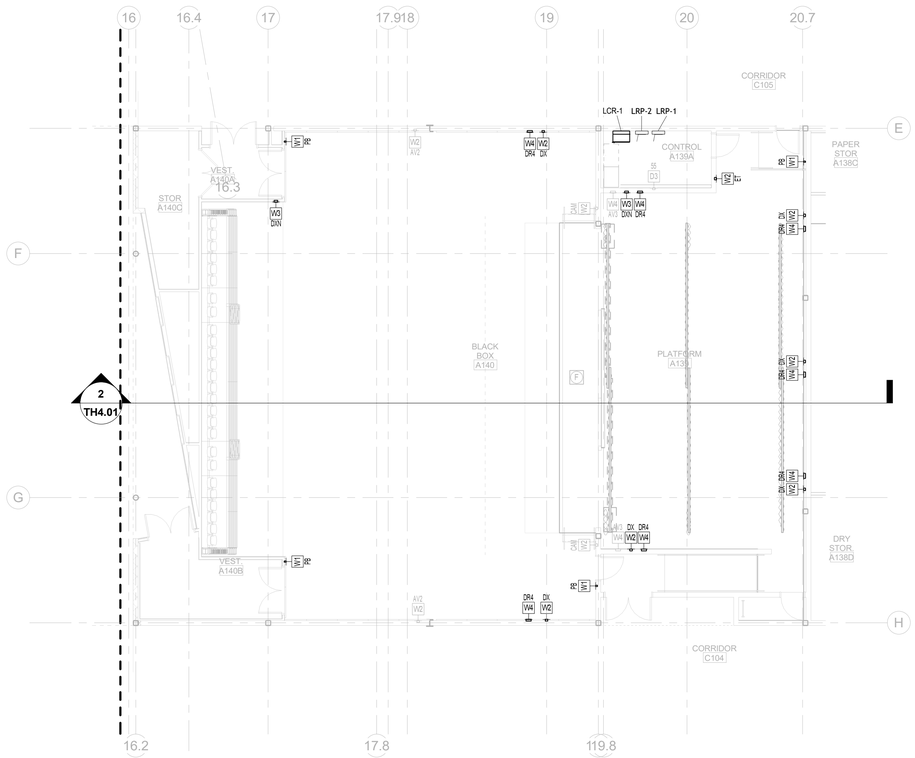


2 TH RCP
1/8" = 1'-0"



4 GRID LEVEL
1/8" = 1'-0"



1 THEATRICAL - MAIN LEVEL - AREA B - ENLARGED PLAN
1/8" = 1'-0"

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N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

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STATE OF CONNECTICUT
ROBERT S. LARAIA
32121
LICENSED PROFESSIONAL ENGINEER

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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KEY PLAN



DRAWING TITLE

THEATRICAL - BLACK BOX
ENLARGED PLAN & RCP

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/8" = 1'-0"
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

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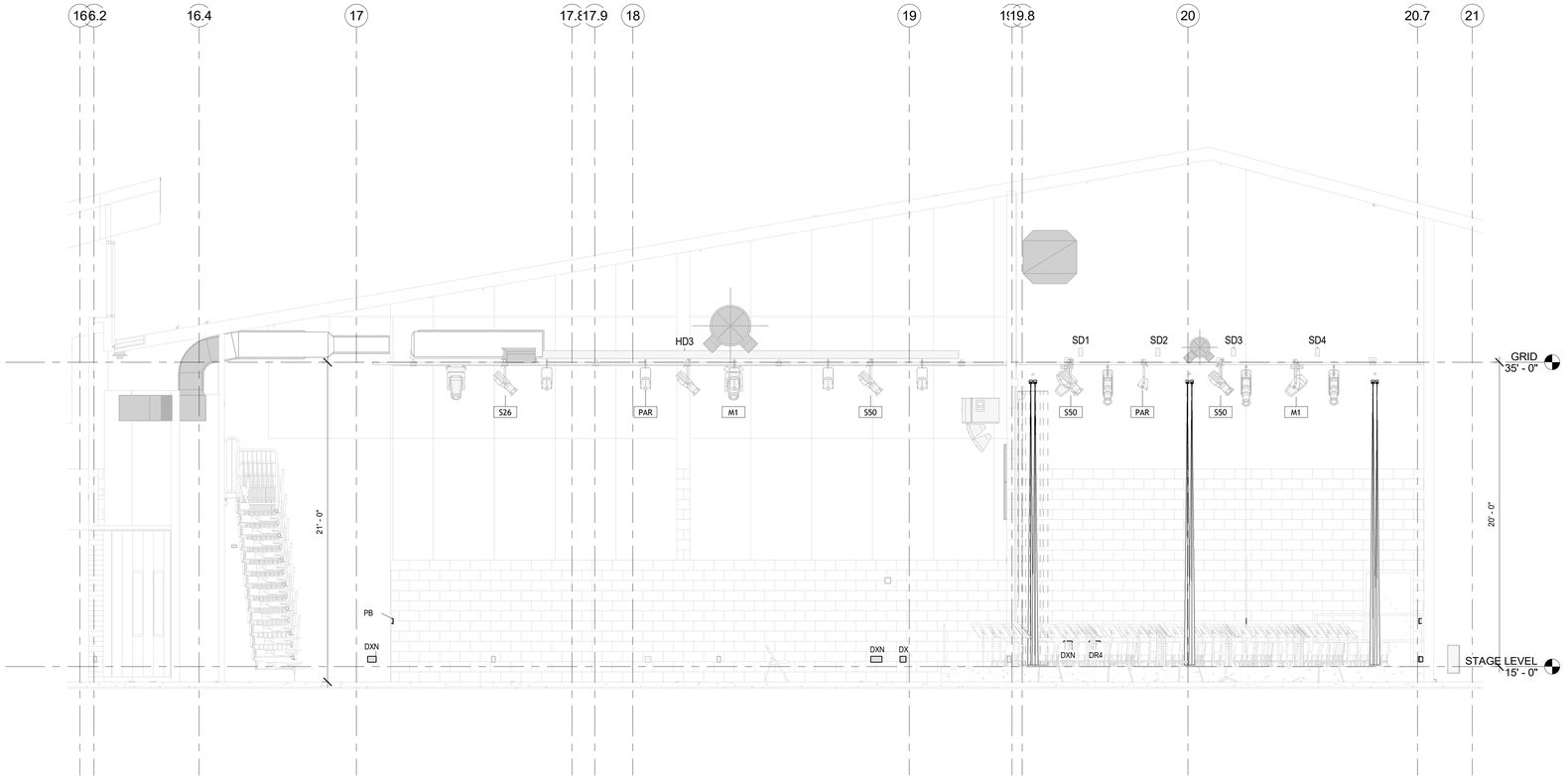

2 BLACK BOX SECTION
1/4" = 1'-0"

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32121
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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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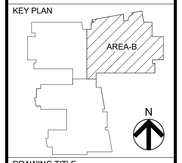
KEY PLAN



DRAWING TITLE

BLACK BOX SECTIONS & ELEVATIONS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

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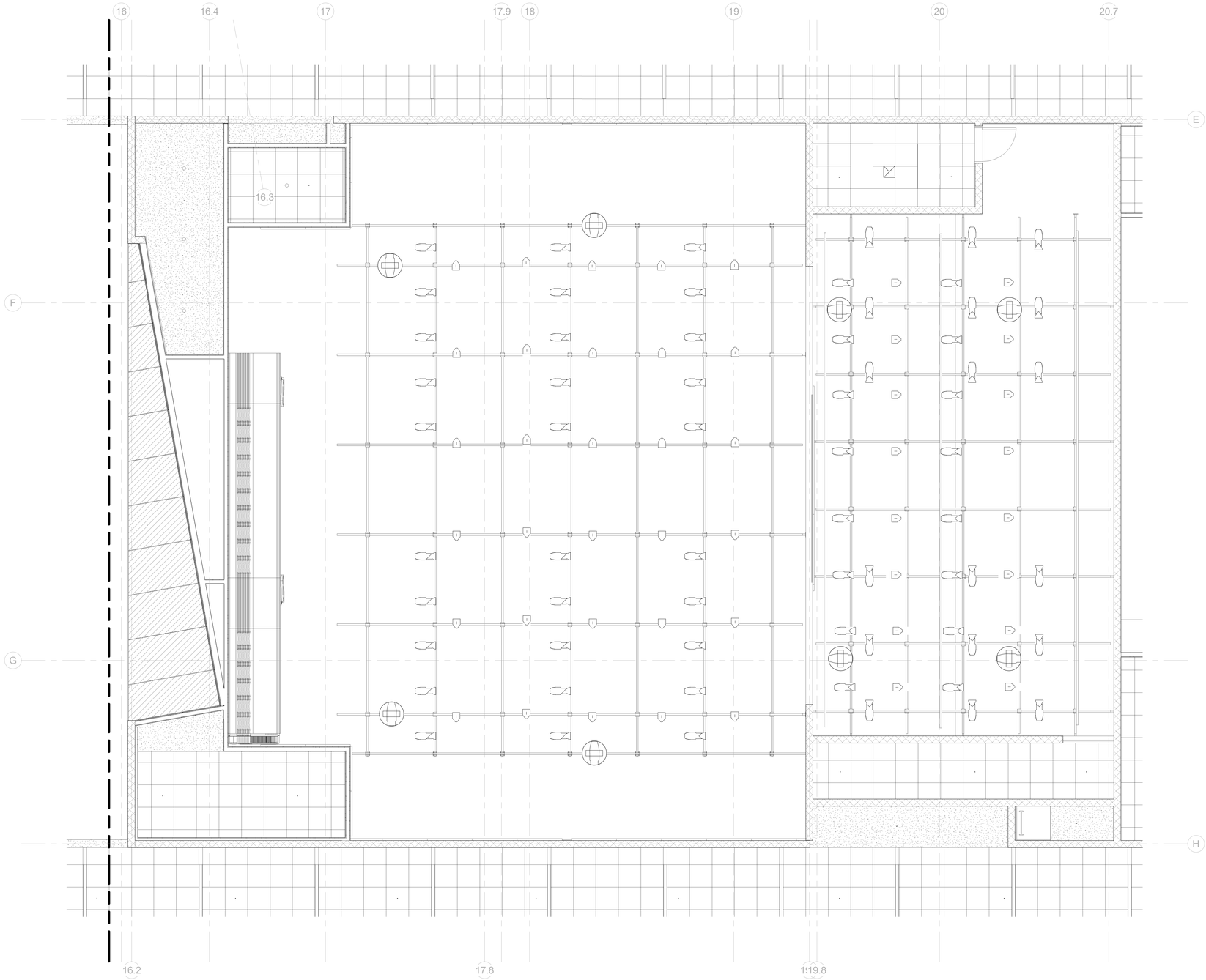

1 LIGHT PLOT
1/4" = 1'-0"

SYMBOL LEGEND

- S26 LED ELLIPSOIDAL SPOT LIGHT 26°
- S50 LED ELLIPSOIDAL SPOT LIGHT 50°
- PAR LED PAR LIGHT WIDE
- M1 LED MOVING LIGHT

NOTES: (THIS SHEET ONLY)

1. COORDINATE FINAL FIXTURE LAYOUT WITH THE OWNER PRIOR TO INSTALLATION
2. ALL FIXTURES SHALL HAVE CLAMPS, 5' CONNECTOR CABLE (POWERCON TO EDISON MALE) AND APPROPRIATE SAFETY CABLE.
3. SEE SCHEDULE ON SHEET TH0.20 FOR FIXTURE TYPES AND ADDITIONAL REQUIREMENTS

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

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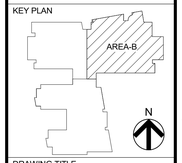
KEY PLAN



DRAWING TITLE

BLACK BOX FIXTURE PLOT

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1/4" = 1'-0"
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

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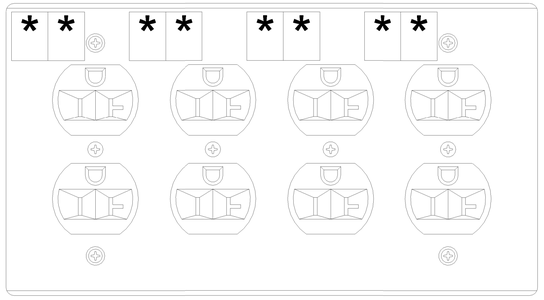
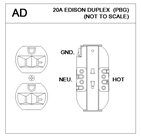
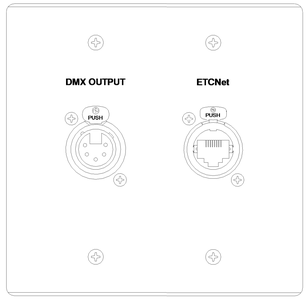


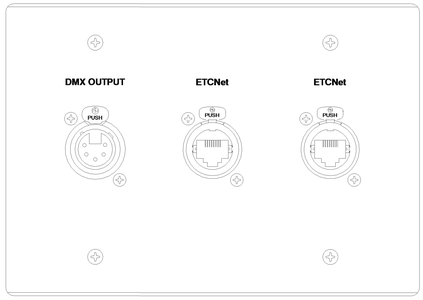
CIRCUIT CONNECTOR PANEL TYPE - DR4 / W4



FACE PANEL MATERIAL	.125 BEVELED ALUMINUM
FACE PANEL FINISH	BLACK FINE-TEXTURED POWDER COAT
LABEL TYPE	3/4" BLACK LEXAN LABELS WITH 9/16" WHITE TEXT
RECOMMENDED BACK BOX	NON-GANGABLE RACO #693
BASIS OF DESIGN	ETC #9804AD



LIGHTING CONNECTOR PANEL TYPE - DX / W2



LIGHTING CONNECTOR PANEL TYPE - DN / W3

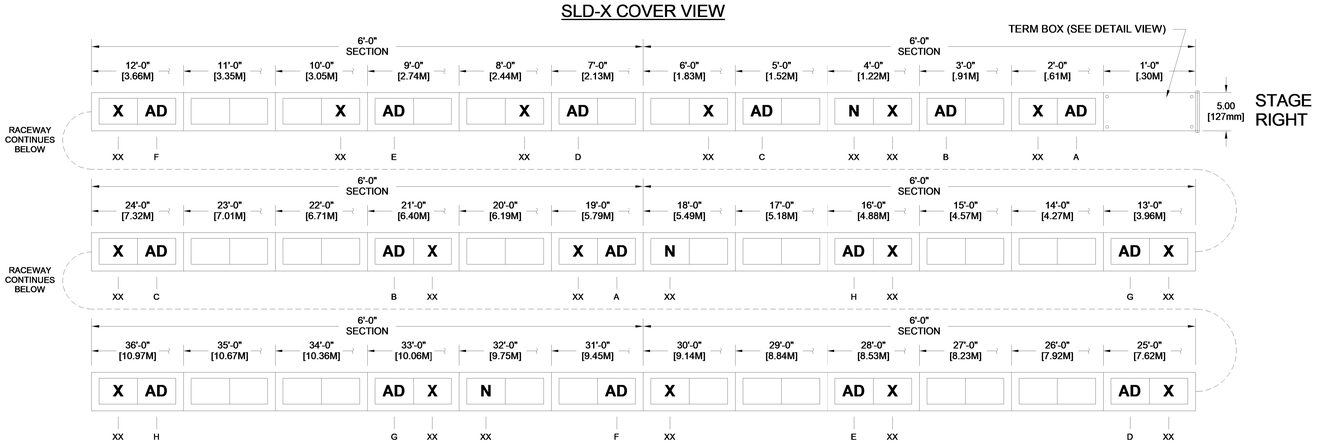
NOTES:

1.) FACE PANEL IS .08 ALUMINUM FINISHED IN A BLACK FINE-TEXTURED POWDER COAT.

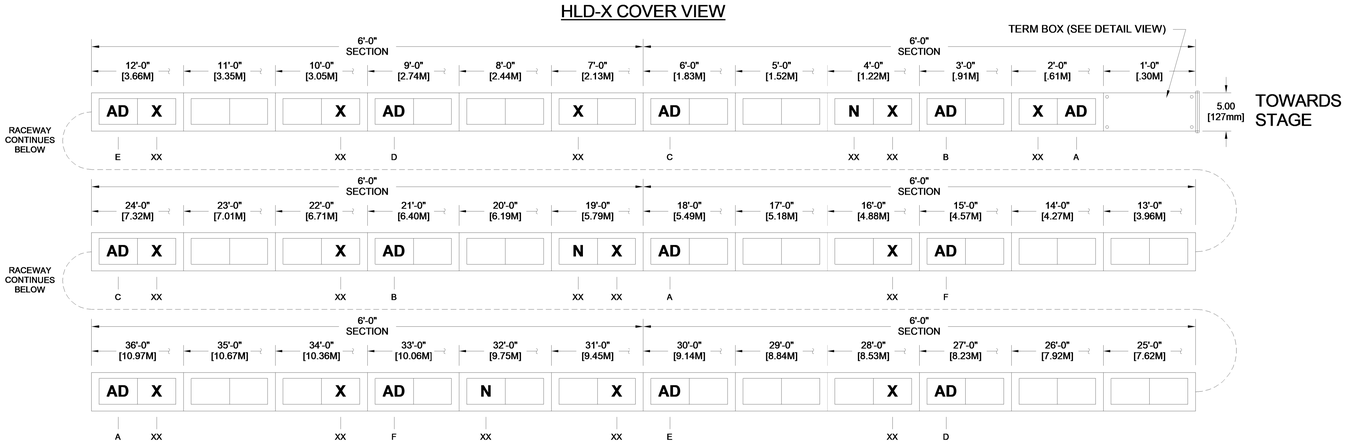
2.) ALL NOMENCLATURE IS ENGRAVED IN WHITE.

1 LIGHTING CONNECTOR PANELS

SLD-X COVER VIEW



HLD-X COVER VIEW



KEY:

AD
20A EDISON DUPLEX
(DETAIL NOT TO SCALE)



N
ETCNet
(DETAIL NOT TO SCALE)



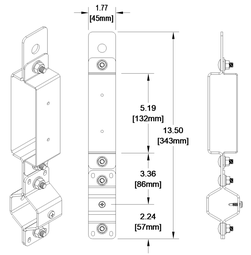
X
DMX OUTPUT
(DETAIL NOT TO SCALE)



NOTE: RACEWAY WITH MUTIPLE ACTIVE DMX OUTPUTS REQUIRING CONNECTION TO A NON-DIMMED CIRCUIT

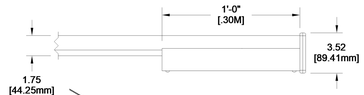
HANGER BRACKET DETAIL

(SCALE: 2:1)
10'-0" MAXIMUM DISTANCE BETWEEN BRACKETS



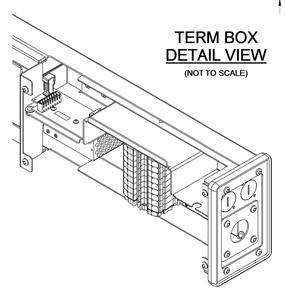
TERM BOX TOP VIEW

(NOT TO SCALE)



TERM BOX DETAIL VIEW

(NOT TO SCALE)



2 HLD-X HOUSE DISTRIBUTION STRIP

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TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

THEATRICAL SYSTEM DETAILS

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	As indicated
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

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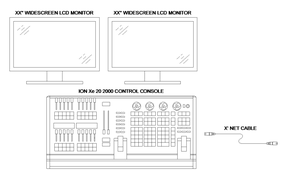
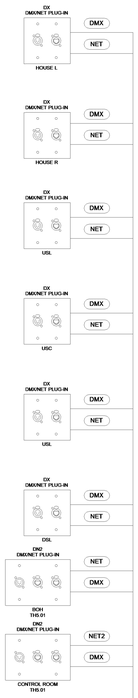
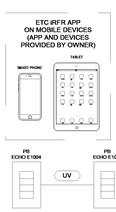
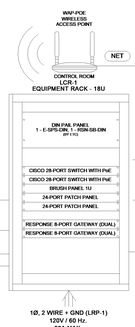
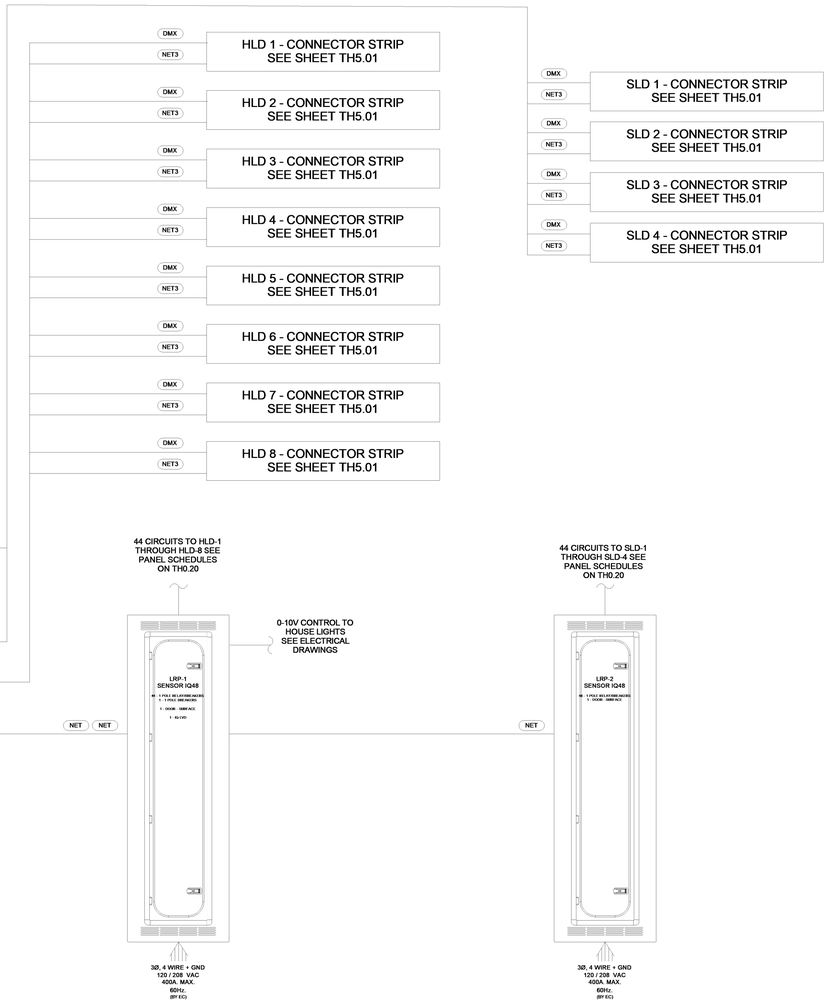


PROVIDE CART FOR CONSOLE AND MONITORS









CONTROL WIRING LEGEND	
UV	(1) TMB PCLP2PT (UNISON CIR ECHO + (2) 16 AWG VOLTAGE + (1) 14 AWG GND WIRE)
DMX	(1) TMB PC244T (DMX)
NET	(1) BELDEN #1583A (ETCNet - Cat5e)
NG	(1) BELDEN #1583A + (1) #14 AWG GND WIRE (ETCNet with GROUND- Cat5e)
BS	(1) BELDEN 8489 (BLUESSYSTEM CTRL+PWR+GND)

NOTES

1. ALL CONTROL WIRING IS PROVIDED BY ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE.
2. ALL ETCNet RUNS SHALL BE CONTINUOUS, UNSPLICED RUNS LESS THAN 300' (90M). ALL NETWORK CONNECTIONS TO BE TIA/EIA 568B.
3. TOTAL COMBINED LENGTH OF UNISON/ECHO WIRING RUNS CANNOT EXCEED 1640' (500M).
4. UNISON MAY BE HOME RUN, STAR, 'T', OR DAISY CHAINED.
5. PHOTO SENSOR RUN SHALL NOT EXCEED 1000 FEET (305 METERS) BETWEEN CONTROLLER AND REMOTE HEAD.
6. DMX RUNS MUST DAISY CHAIN AND CANNOT EXCEED 1500' IN LENGTH. DO NOT EXCEED QUANTITY OF 32 DEVICES IN ONE DMX CHAIN.

1 LIGHTING RISER

tskpstudio.com
TSKP STUDIO
One Hartford Square West
146 Wyllys Street, Bldg 1-203
Hartford, CT 06106
860.547.1970
ARCHITECTURE | PLANNING | INTERIORS

NEWCOMB & BOYD
303 Peachtree Center Avenue, NE
Suite 525
Atlanta, GA 30303-1277
T 404 730-8400
NB Contact: Robert S. Laraia
N&B PROJECT: 25-0104
Newcomb & Boyd, LLP

PROFESSIONAL SEAL

STATE OF CONNECTICUT · ROBERT S. LARAIA · 32121 · LICENSED PROFESSIONAL ENGINEER

Signed on 05/18/2026
using a Digital Signature.

TRUMBULL HILLCREST MIDDLE SCHOOL

530 Daniels Farm Road, Trumbull, CT 06611

100% CD

KEY PLAN



DRAWING TITLE

LIGHTING RISER DIAGRAM

STATE PROJ. NO.	144-0108N
OFFICE PROJ. NO.	250501
SCALE	1" = 1'-0"
DATE	05/19.2026
DRAWN BY	KRK
APPROVED BY	RSL

ISSUE DATES

NO.	DATE	PURPOSE
5	05/19/2026	100% CD

TH6.01

5/18/2026 8:55:19 AM Autodesk Docs://Trumbull Hillcrest Middle School/250501-Trumbull Hillcrest MS-STG_R26.rvt

Hillcrest Middle School
Trumbull, Connecticut

19 May 2026

Construction Documents
Specifications – Volume 1

State Project No. 144-0108 N

TSKP Project No. 250501

TSKP Studio
Architect

Langan
Civil/Landscape/Traffic/HazMat

Michael Horton Associates
Structural

CMTA
Mechanical/Elec/P/FP

Newcomb and Boyd
IT and Acoustics

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Owner-furnished/Contractor-installed products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Site enabling for Trumbull Hillcrest Middle School

1. Project Location: 530 Daniels Farm Road, Trumbull, Connecticut 06611

B. Owner: Town of Trumbull

C. Architect: TSKP Studio, 146 Wyllys Street, Hartford, CT.

D. Construction Manager: Bismark Construction

1. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Construction of a new 142,250 SF, three story middle school, associated site work, demolition of the existing school, and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a Construction Manager at Risk (CMr) form of Contract.

1.5 MULTIPLE WORK PACKAGES

A. Construction Documents for this Project will be issued in a series of Work Packages, each defining the Work under individual Contracts. Coordinate the Work under this Contract with separate contracts defined by other work packages.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed on site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
1. Furniture, fixtures and equipment.
2. Technology equipment.

1.7 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
1. Provide for delivery of Owner-furnished products to Project site.
2. Upon delivery, inspect, with Contractor present, delivered items.

    a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
3. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Receive, unload, handle, store, protect, and install Owner-furnished products.
3. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
4. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products: See Section 102800 “Toilet, Bath, and Laundry Accessories.”

1.8 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to emergency vehicles at all times. Do not use these areas for parking or storage of materials.

C. Full Owner Occupancy: Owner will occupy Project site and existing adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
1. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

D. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Traffic access to be coordinated with adjacent Pathways High School. No construction traffic during peak drop-off or pick-up times.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption with Owner.

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.

D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PRODUCTS (Not Used)

PART 2 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Division 0, Form of Proposal. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

END OF SECTION 012200

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the CT High Performance Building Standard (CTHPS) Mandatory Requirements and Goals as outlined in Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added or deducted from the Base Bid amount if the Owner accepts an alternate material or a reduced quantity of material, or a reduced warranty, as outlined in the Schedule of Alternates.

1. The add or deduct for each alternate is the net change to the Contract Sum. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

E. All alternate pricing is valid for the entire project schedule unless written notice is submitted to the Owner 60 days prior to a required decision that will not affect the contract schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Refer to the drawings for the location and extent of these Alternates.

PHASE 1:

Alternate #1.1: Parking: 44 Additional parking Spaces designated in the drawings North of the new Field adjacent to the main drive directing to the high school. Include storm water revisions.
Alternate #1.2: Additional Athletic Field as shown on drawing CS201.
Alternate #1.3: Pickleball Courts as shown on drawing CS201.
Alternate #1.4: Site Furnishings: Remove all site furnishings.
Alternate #1.5: Mill 2" down and add 2" of new Class I asphalt from Daniels's farm entrance and exit to 40' past student / parent drop off road entrance. Include Restripe.
Alternate #1.6: Geothermal Wells: Add an additional 10 wells to match designed geothermal well field as shown on UM1.01.
Alternate #1.7: Amphitheater and all associated work.
Alternate #1.8: Precast seating at the courtyard off the library.

PHASE 2:

Alternate #2.1: Add PV array, racks, and equipment on roof depicted on PV-0.01 Array 1
Alternate #2.2: Add PV array, racks, and equipment on roof depicted on PV-0.01 Array 1 and Array 2
Alternate #2.3: Delete Folding partition at B041, replace with corridor partition with GFCMU
Alternate #2.4: Delete horizontal and vertical solar shading devices on Curtain Wall and Storefront assemblies
Alternate #2.5: Delete exterior steel bus canopies, foundations, and cladding depicted on A4.27.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section.

Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 15 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect through Construction Manager at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content:

1. Identification: Include the following Project identification on the schedule of values:

   a. Project name and location.
   b. Contractor's name and address.
   c. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702/CMa and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.

4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. List of Contractor's principal consultants.
5. Copies of building permits.
6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."

6. AIA Document G707-1994, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. RFI number, numbered sequentially.
5. RFI subject.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. RFI number including RFIs that were returned without action or withdrawn.
2. RFI description.
3. Date the RFI was submitted.
4. Date Architect's response was received.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement provided by the Architect.

1.9 TRADE CONTRACTOR PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Contractor is responsible for recording significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.

d. CT High Performance Schools requirements.
e. Owner's occupancy requirements.
f. Responsibility for temporary facilities and controls.
g. Procedures for moisture and mold control.
h. Procedures for disruptions and shutdowns.
i. Construction waste management and recycling.
j. Progress cleaning.

4. Minutes: Contractor will record and distribute meeting minutes.

C. Sustainable Design Requirements Coordination Conference: Construction Manager will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner and Architect.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:

a. Sustainable design Project checklist.
b. General requirements for sustainable design-related procurement and documentation.
c. Project closeout requirements and sustainable design certification procedures.
d. Role of sustainable design coordinator.
e. Construction waste management.
f. Construction operations and sustainable design requirements and restrictions.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager , and Owner's Commissioning Authority of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. Contract Documents.
b. Options.
c. Related RFIs.

d. Related Change Orders.
e. Submittals.

f. Sustainable design requirements.
g. Review of mockups.
h. Possible conflicts.
i. Compatibility requirements.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's written instructions.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of authorities having jurisdiction.
s. Testing and inspecting requirements.
t. Installation procedures.
u. Coordination with other work.
v. Required performance results.
w. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Minutes: Contractor will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawing Plans for use in preparing Shop Drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days business days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Contractor.
    d. Name of subcontractor.
    e. Name of supplier.
    f. Name of manufacturer.

    g. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Location(s) where product is to be installed, as appropriate.
    k. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect and Construction Manager**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name of Contractor.
    d. Name of firm or entity that prepared submittal.
    e. Names of subcontractor, manufacturer, and supplier.
    f. Category and type of submittal.
    g. Submittal purpose and description.
    h. Specification Section number and title.
    i. Specification paragraph number or drawing designation and generic name for each of multiple items.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Related physical samples submitted directly.
    m. Indication of full or partial submittal.
    n. Transmittal number, numbered consecutively.
    o. Submittal and transmittal distribution record.
    p. Other necessary identification.
    q. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit five paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager**,** will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned.

E. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

F. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

G. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

H. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

I. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

J. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

K. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

L. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

M. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

N. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit documents signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of three previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1.6 INFORMATIONAL SUBMITTALS

A. Trade Contractor’s Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Trade Contractor’s Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Trade Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.

3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Trade Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Trade Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect**,** Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority**,** and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 015150 “Indoor Air Quality Construction Plan” for temporary barriers and additional moisture and mold control measures.
3. Section 321216 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
4. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

B. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide 4’ x 8’ Project specific identification sign as directed by Architect, and meeting all requirements of the CT Department of Administrative Services. See sign requirements at the end of this Section.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: See Section 142401 "Hydraulic Elevator Modernization," for temporary use of new elevators.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

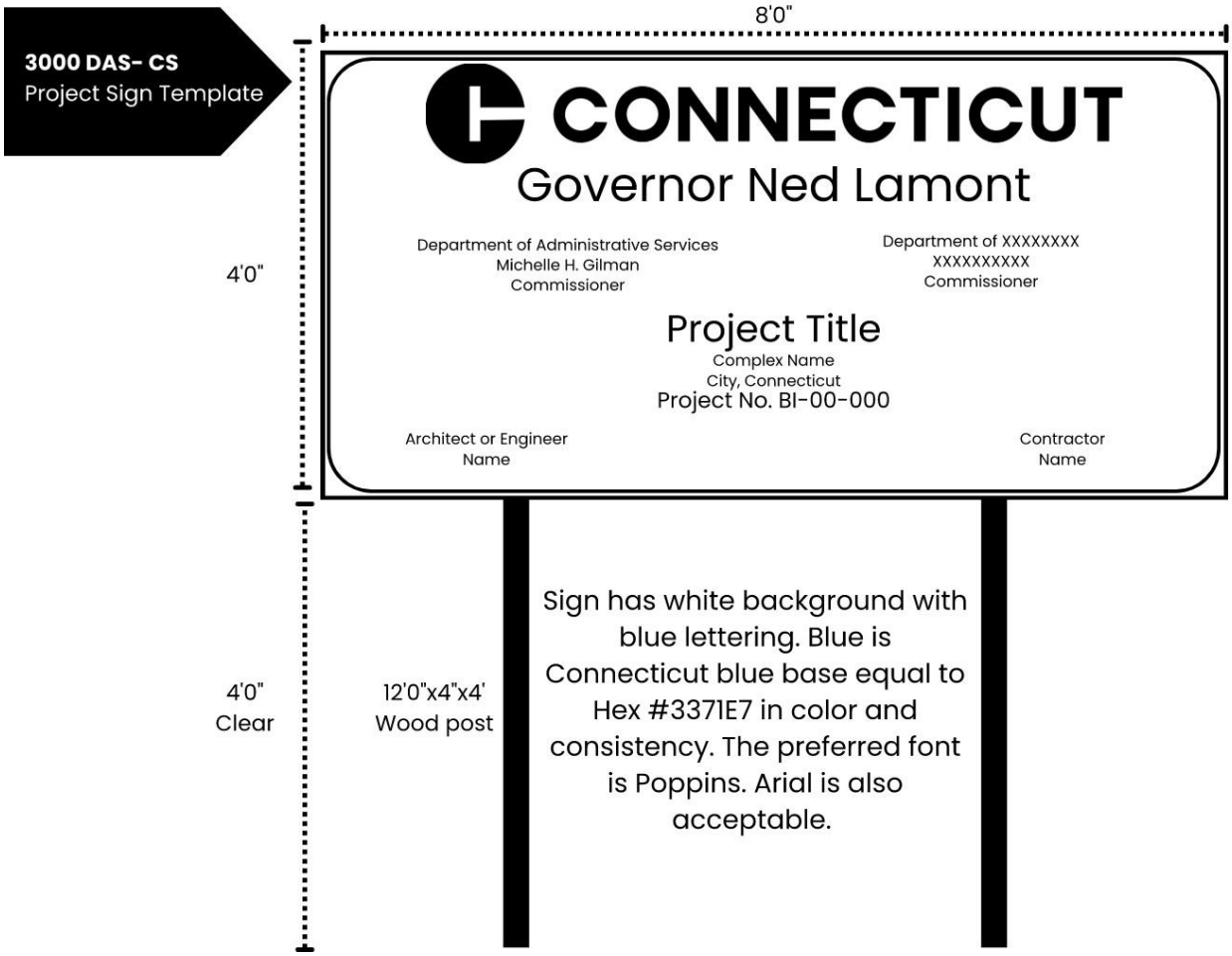
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

3.7 PROJECT SIGN:



END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Division 01 Section “Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Removal of manufacturer labels.
8. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.

3. Division 01 Section "Closeout Procedures" for submitting final Project Record Documents.

1.3 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Final Property Survey: Engage a land surveyor to prepare final record drawing(s) per Town of Manchester Public Improvement Standards Section 5.01.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 REMOVAL OF MANUFACTURER LABELS

A. Remove all manufacturer labels from products exposed to view in occupied areas.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017400 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. This Section includes requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.

B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for LEED certification requirements.

1. Construction and Demolition Waste Management Planning: Develop a waste management plan, quantifying material diversion by either weight or volume to recycle and/or salvage non-hazardous construction and demolition debris.

    a. Exclude excavated soil and land-clearing debris from calculations.
    b. Diverted waste includes recycled, salvaged, reused, and donated materials.
    c. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion).
    d. Include wood waste converted to fuel (bio-fuel) in the calculations as diversion. Other types of waste-to-energy are not considered diversion for this credit.

2. Construction and Demolition Waste Management: For non-hazardous construction and demolition debris comply with **one** of the following paths, as directed by the LEED Checklist:

    a. Divert at least 50 percent and **three** material streams.
    b. Divert at least 75 percent and **four** material streams.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 011000 - GENERAL REQUIREMENTS for general submittal requirements.
2. Section 024100 - DEMOLITION for demolition, salvage, and reuse requirements.
3. Section 028200 - ASBESTOS REMOVAL AND RELATED WORK for hazardous materials abatement and remediation.
4. Section 028300 - LEAD-BASED PAINT REMOVAL AND RELATED WORK for hazardous materials abatement and remediation.

1.3 INTENT

A. The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

1. With regard to these goals the Contractor shall develop, for the Architect's review, a Waste Management Plan (WMP) for this Project.

a. Final Waste Management Plan shall be submitted for LEED certification.
b. Include both demolition and construction waste management.

2. Each Subcontractor shall be responsible for segregating their own waste into different dumpsters as directed by the Contractor.
3. Source Separation, Definition: Source separated construction or demolition waste materials that are sorted into separate bins on the project site (aka on-site).

a. This waste strategy often isolates waste materials targeted for reuse, donation, or recycling programs.
b. Typically, sorted materials on-site include metals, wood, ceiling tiles, furniture, and concrete.

B. Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities, as defined by local authorities having jurisdiction.

C. Hazardous Wastes: Any unforeseen hazardous wastes shall be separated, stored, and disposed of according to local regulations and as directed by the Owner. Hazardous wastes shall not be included in diversion calculations.

1.4 SUBMITTALS

A. Construction and Demolition Waste Management Plan (WMP): Submit within 21 calendar days after receipt of Notice to Proceed, in a format acceptable to the Owner and in compliance with USGBC requirements. Demolition shall not begin until WMP has been approved.

1. Establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion. Approximate a percentage of the overall project waste that each material represents.
2. Construction and Demolition Handling Facilities:

a. Indicate the name(s) of the facilities where construction and demolition waste will be delivered and the applicable tipping fees.
b. Furnish Contractor’s statement of verification that facilities proposed for use are licensed for types of waste to be delivered and have sufficient capacity to receive waste from this project.
c. Landfill Options: The name of the landfills where the non-recyclable Construction and Demolition waste will be taken to be disposed of, applicable tipping fees and the projected cost of disposing of the Project waste in landfills.
d. Off-Site Sorting: The name of off-site sorting facilities to receive commingled demolition and construction debris collected in mixed materials containers on site.

1) If sorted off-site identify the sorting facilities and how the materials will be processed

e. Alternative daily cover (ADC) does not qualify as material diverted from disposal. Land-clearing debris is not considered construction, demolition, or renovation waste that can contribute to waste diversion.

3. Material Handling Procedures, at Construction and Demolition Handling Facilities:

a. Indicate annual recycling rates and material streams, as defined by local authorities having jurisdiction.
b. Specify which materials shall be source separated or commingled and describe the diversion strategies planned for the project. Describe where the materials will be taken and how the recycling facilities will process the materials.

4. Landfill Certification: Provide a statement of verification that the landfills proposed for use are licensed for types of waste to be deposited and have sufficient capacity to receive the estimated waste from this project
5. Co-Mingled Materials: Co-mingled waste may be considered only one material stream unless the facility can provide project specific diversion rates for specific materials. Provide one or both of the following for co-mingled materials collected in mixed containers on site and sorted off-site:

a. For Each Container: A detailed breakdown of the weight of each material after sorting, including materials diverted to landfills
b. For Each Sorting Facility: A detailed annual average recycling rate for EACH facility where off-site sorting takes place.
1) Additionally, provide documentation that the facility is State regulated.

6. Alternatives to Landfilling: A list of each material proposed to be salvaged or recycled during the course of the Project. Include the following and any additional items proposed:

a. Cardboard and paper products.
b. Clean dimensional wood. If means of diversion is Wood Derived Fuel (WDF) refer to submittal requirements below.
c. Beverage containers and employee food containers.
d. Concrete.
e. Slurry wall materials.
f. Bricks and masonry.
g. Asphalt.
h. Metals from framing, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
i. Mechanical and electrical equipment.
j. Building components which can be removed relatively intact from existing construction.
k. Packaging materials, including cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, and plastic pails.
l. Glass.
m. Scraps from new gypsum wall board (drywall).
n. Carpet and pad.
o. Acoustical ceiling panels.

p. Plastics, including plastic pails, polyethylene sheet, and bubble wrap.
q. Rigid foam.

7. Meetings: A description of the regular meetings to be held to address waste management.
8. Materials Handling Procedures, at Project Site: A description of the means by which any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

    a. Indicate which material streams shall be source separated and which shall be commingled.

9. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for offsite sorting) and destination of materials.

B. Waste Management Progress Reports: Concurrent with each Application for Payment, submit a written Waste Management Progress Report in the same format as required for Final Report.

1. Provide updated LEED v4 Construction and Demolition Waste Calculator with each progress report.

C. Waste Management Final Report: Prior to Substantial Completion, submit a written Waste Management Final Report summarizing the types and quantities of materials recycled and disposed of under the Waste Management Plan. Include the name and location of disposal facilities. Quantity may be measured by either weight or volume; be consistent in calculations. Include the following:

1. Material category, including source separated material streams.
2. Generation point of waste.
3. Total quantity of waste, by weight.
4. Quantity of waste salvaged, both estimated and actual.
5. Quantity of waste recycled, both estimated and actual.
6. Total quantity of waste diverted (salvaged plus recycled).
7. Total quantity of waste diverted (salvaged plus recycled) as a percentage of total waste.

D. Other Submittals:

1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and

that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

6. Specific LEED v4 Submittals:

    a. Provide completed LEED v4 Construction and Demolition Waste Calculator.
    b. Provide final report detailing waste streams generated, including tipping slips, disposal rates, and diversion rates.

E. Commingling Waste Vendor Submittals: Provide annual report from local or state government authority and summary attachment of diverted materials with the average annual recycling rate. Figures in the summary must be derived from the annual reports in concise clear language.

1. Commingling waste shall be considered one material stream.
2. Provide tipping invoices for commingled waste and the following:

    a. Vendor's most recent annual report from local or state government authority.
    b. Vendor's annual report summary attachment of diverted materials in tonnage, with the average annual recycling rate and percent ADC.

3. If Wood Derived Fuel (WDF) was listed as a diverted material in the above, vendors shall furnish a letter from the biomass plant stating their DOE operating permit number and that WDF was received from vendor, for the same year as the annual report.

1.5 CONTRACTORS

A. Contractor may subcontract work of this Section to a sub-contractor specializing in recycling and salvaging of construction waste.

B. Acoustical Ceiling Panel Recycling: Demolition and construction waste pulpable mineral fiber ceiling panels may be recycled by Armstrong World Industries and US Gypsum. Contact Armstrong at 1-877-ARMSTRONG (1-877-276-7876) or www.armstrongceilings.com/recycling or contact USG at 1-800-USG-4YOU (1-800-874-4968 x2) or www.usgdesignstudio.com, to coordinate recycling efforts, apply for product approvals, and receive reclamation procedure requirements.

C. Carpet Recycling: Demolition and construction waste carpet and carpet padding may be recycled by Carpet America Recovery Effort (CARE). Visit www.carpetrecovery.org to locate carpet reclaimers in local project area and reclamation procedure requirements.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. General: Implement Waste Management Plan as approved by the Architect. Provide containers, storage, signage, transportation, and other items as required to implement WMP for the entire duration of the Contract.

1. Deliver waste directly to construction and demolition handling facilities. Do not deliver to transfer stations.

B. Commingling Waste: Commingling waste at the job site may be allowed, provided that the following conditions are met:

1. Commingled materials shall be included in the Waste Management Plan (WMP).
2. Additional commingled materials must be pre-approved by the Architect via WMP addenda, prior to tipping on the job site.

C. Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

D. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

E. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

F. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Location shall be acceptable to the Architect.

1. Commingling: Waste commingling shall be approved prior to jobsite tipping, per requirements of this Section.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces with high-efficiency particulate arrestor (HEPA), removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain. For phased construction, HEPA vacuum the carpet daily in occupied areas.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017400 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.
3. Product maintenance manuals.
4. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to

ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit record digital data files and record digital data file plots.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

B. Format: Submit record Product Data as paper copy.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.

e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

D. All training agendas, materials and programs must be submitted to the CxA for review prior to scheduling any training sessions.

1.7 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings on CD-ROM or thumb drive.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

a. Name of Contractor/Installer.

b. Business address.
c. Business phone number.
d. Point of contact.
e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 018110 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain USGBC "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) certification.

1. Specific requirements for LEED are also included in other Sections.
2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
3. A copy of the LEED Project checklist, with certification level target, is attached at the end of this Section for information only.

    a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of Project that are not part of the Work of the Contract.

4. A copy of the LEED Product Data Submittals Form is attached at the end of this Section.
5. Definitions included in the "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
2. Section 018120 – CONSTRUCTION IAQ MANAGEMENT
3. Divisions 01 through 49 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.3 DEFINITIONS

A. Bio-Based Materials: Materials that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM D 6866 and be legally harvested, as defined by the exporting and receiving country.

B. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.

C. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer’s product and the product’s supply chain.

D. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.

1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
3. Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

E. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers’ products as postconsumer waste at the end of the products’ useful life.

F. Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.

G. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.

H. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

I. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.

J. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

K. Passive (As Related to MEP): Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings.

L. Recycled Content: Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost.

1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

M. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.

N. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method definition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Work of this project includes completed building and application for LEED certification. Work is not complete until Owner has accepted USGBC's final review of LEED certification.

1. Provide documentation required by LEED and LEED review.

B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.

C. Respond to questions and requests for additional information from Architect and the USGBC regarding LEED credits until the USGBC has made its determination on the project's LEED certification application.

D. LEED Online Submittals: Upload LEED documentation submittal data directly to USGBC project "LEED Online" website. Complete online forms at least bi-weekly and as necessary to document LEED credits for submittals required in this Section.

E. LEED Conference: Schedule and conduct a conference at a time convenient to Owner and Architect within 21 days prior to commencement of the work. Advise Architect, Owner's Commissioning Authority, and Owner's Project Manager of scheduled meeting dates.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Owner's Project Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: LEED goals for the project, Contractor's action plans, and discussion of targeted LEED Prerequisites and Credits.
3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits.

1.5 ACTION SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

1. Submit each LEED submittal simultaneously with applicable product submittal.

B. LEED Documentation Submittals:

1. General, LEED v4 Product Data Submittal Reporting Form: Project submittals must be accompanied by a completed LEED v4 Product Data Submittal Reporting Form, which follows this Section. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the LEED v4 Product Data Submittal Reporting Form.

    a. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

2. Construction and Demolition Waste Management: Comply with submittal requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
3. Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.
4. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.

    a. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
    b. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
    c. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.

5. Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.

a. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited to the following:

1) Manufacturer Inventory.
2) Health Product Declaration.
3) Cradle to Cradle certifications.
4) Declare product labels.
5) UL Product Lens certifications.
6) ANSI/BIFMA e3 Furniture Sustainability Standard.
7) Living Product Challenge.

6. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.

a. Reports showing a compliant material ingredient optimization report or action plan.

7. Indoor Air Quality: Comply with submittal requirements of Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
8. Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:

a. Paints and coatings.
b. Adhesives and sealants.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost and shop labor for materials used for Project. Costs exclude site labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Passive plumbing materials.
2. Passive mechanical (HVAC) materials.
3. Passive electrical materials.

4. Earthwork and exterior improvements, hard costs.

C. LEED Action Plan Components: Provide preliminary submittals within 21 days of date established for commencement of the Work indicating how the following requirements will be met:

1. Waste management plan, complying with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
2. Indoor air quality plan, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Waste reduction progress reports complying with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
2. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
3. Building Product Disclosure and Optimization, Sourcing of Raw Materials.

    a. General: Manufacturing locations.
    b. Option 2:

        1) Extended producer responsibility.
        2) Bio-based materials.
        3) Materials reuse.
        4) Recycled content.

4. Building Product Disclosure and Optimization, Material Ingredients.
5. Indoor air quality, during construction, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
6. Indoor air quality assessment, complying with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

1.7 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.

1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

B. Unauthorized Products: Materials and products required for work of this section shall not contain asbestos, lead, mercury, polychlorinated biphenyls (PCBs), or other hazardous materials identified by the Owner.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

A. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:

1. ISO 14044 Conforming LCA: Valued as one whole product.
2. Industry-Wide Type III EPD: Valued as one whole product.
3. Product-Specific Type III EPD (Internally Reviewed): Valued as one whole product.
4. Product-Specific Type III EPD (Externally Reviewed and Verified): Valued as 1-1/2 products.

B. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 2. Use products that have a compliant embodied carbon optimization report or action plan separate from the LCA or EPD. Use at least 5 permanently installed products sourced from at least three different manufacturers.

C. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices. Provide products that meet at least one of the responsible extraction criteria below for at least 15%, by cost, of the total value of permanently installed building products in the project:

1. Extended producer responsibility program.
2. Bio-based materials.
3. Recycled content.
    a. Exceptions: Do not include fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.

AND additionally, for any product meeting at least one of attributes 1-5 above:

4. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

D. Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.

1. Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
    a. Manufacturer Inventory.
    b. Health Product Declarations (HPDs).
    c. Cradle to Cradle (C2C) certifications.
    d. Declare product labels.
    e. UL Product Lens certifications.
    f. ANSI/BIFMA e3 Furniture Sustainability Standard.
    g. Living Product Challenge.

E. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.

1. Use at least 5 permanently installed products sourced from at least three different manufacturers that have a compliant material ingredient optimization report or action plan. Products are weighted as shown below.

a. Material Ingredient Screening and Optimization Action Plan (0.5 product) - action plan based on publicly available material Inventory to at least 1,000ppm prepared by the manufacturer and signed by a manufacturer executive.
b. Advanced Inventory and Assessment (1 product) - third-party verified Cradle to Cradle Certified, Material Health Certificate at Bronze Level or higher, Declare Label designated as Red List Free or LBC Red List Free, or Health Product Declaration (HPD) that Inventories Ingredients to at least 100ppm and no GreenScreen LT-1 hazards or GHS Category 1 hazards are present OR 75% by weight of the product Is assessed using GreenScreen and the remaining 25% has been Inventoried.
c. Material Ingredient Optimization (1.5 products) - third-party verified Cradle to Cradle Certified, Material Health Certificate at Silver Level or higher, Living Product Challenge certified with Imperative 09, or Health Product Declaration (HPD) that Inventories to at least 100ppm and 95% by weight of the product Is assessed using GreenScreen with no BM-1 hazards present and the remaining 5% has been Inventoried and screened using GreenScreen List Translator and no LT-1 hazards are present.

2. Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at twice their base contributing number of products, up to a maximum of 2 products.

2.3 LOW-EMITTING MATERIALS

A. Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.2-2017, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as follows:

1. 0.5mg/m3 or less,

2. between 0.5 and 5.0 mg/m3 or,
3. 0.50 mg/m3 or more.

Product Type:	Allowable VOC Content (g/L):
Flat coatings	50
Nonflat coatings	100
Nonflat - High gloss coatings	150
Aluminum roof coatings	400
Basement specialty coatings	400
Bond breakers	350
Concrete curing compounds	350
Concrete/Masonry sealers	100
Driveway sealers	50
Form-release compounds	250
Graphic arts coatings (sign paints)	500
Industrial maintenance coatings	250
Low solids coatings	120
Magnesite cement coatings	450
Mastic texture coatings	100
Metallic pigmented coatings	500
Multi-color coatings	250
Pre-treatment wash primers	420
Primers, sealers, and undercoaters	100

Reactive penetrating sealers	350
Recycled coatings	250
Rust preventative coatings	250
Specialty primers, sealers, and undercoaters	100
Traffic marking coatings	100
Zinc-rich primers	340

South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016:

Product Type:	Allowable VOC Content (g/L):
Bond breakers	350
Colorant - Architectural coatings, excluding IM coatings	50
Colorant - Solvent-based IM	600
Colorant - Waterborne IM	50
Concrete - Curing compounds	100
Concrete - Curing compounds for roadways and bridges	350
Concrete surface retarder	50
Driveway sealer	50
Flats	50
Form release compound	100
Graphic arts (sign) coatings	200
Industrial maintenance coatings	100
Industrial maintenance coatings - color indicating saftey coatings	480

Industrial maintenance coatings - High temperature IM coatings	420
Industrial maintenance coatings - Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings - Zinc-rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-Color coatings	250
Nonflat coatings	50
Pre-treatment wash primers	420
Primers, sealers, and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Rust preventative coatings	100
Specialty primers	100
Traffic coatings	100
Tub and tile refinish coatings	420
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Low solids coatings	120

B. Low-Emitting Materials, Adhesives and Sealants, General Emissions Requirement: For field applications that are inside the weatherproofing system, at least 75 percent of adhesives and sealants, measured by volume or surface area, shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. To comply with the General Emissions Requirement, products shall meet one of the following:

    a. UL Greenguard Gold Certified
    b. SCS Indoor Advantage Gold Certified
    c. MAS Certified Green
    d. Meet California Department of Public Health (CDHP), Standard Method v1.2-2017, using the applicable exposure scenario.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Environmental Tobacco Smoke Control: Smoking is prohibited on site.

1. Refer to Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Construction and Demolition Waste Management: Comply with Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Construction Indoor Air Quality Management Plan: Comply with Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

END OF SECTION

LEEDv4 BD+C: Schools (LEEDv4 SC)
Project Scorecard

Project: Hillcrest Elementary School
Address: 530 Daniels Farm Road Trumbull, CT 06611
Date: 5/13/26

The Green Engineer
Sustainable Design Consulting

LEED Goal	Gold
EUI Target	TBD (Net Zero)
Bldg Area	145,884 sf (Town website)
Parking	176 total, 10 EVCS
Site Area	xx sf
FTE	112 (Based on LEED CS defaults)
Visitors	TBD (Based on LEED CS defaults)
Students	826 (Actual from town website)

POINT TOTALS

Yes	M+	M-	No
64	8	10	26

	Yes	M+	M-	No						
					GENERAL PROJECT DOCUMENTATION		**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
D	Y				PIf1	Minimum Program Requirements	Req'd	Team	REQUIRED: Project must meet all MPRs to be eligible for LEED certification.
	Yes	M+	M-	No						
	1	0	0	0	**INTEGRATIVE PROCESS**		**1**	**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
D	1				IPc1	Integrative Process	1	Team	CREDIT: Perform energy and water-use analysis in early design through the use of a "simple box" model and development of a water budget, respectively.
	Yes	M+	M-	No						
	3	0	0	12	**LOCATION & TRANSPORTATION**		**15**	**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
D				N	*LTc1*	*LEED for Neighborhood Development Location*	*15*	*Team*		*CREDIT: Project located in a LEED ND development.*
D	1				LTc2	Sensitive Land Protection	1	Civil		CREDIT: Locate the development footprint on land that has been previously developed.
D	1			1	LTc3	High Priority Site	1-2	Env. Eng.		CREDIT: Option 1: Locate on an infill location in a historic district (1 pt) OR Option 2: Locate within a Federal Empowerment Zone, QCT, DDA, or other priority designation (1 pt) OR Option 3: Locate on a brownfield where soil or groundwater contamination has been identified, and where the local, state, or national authority (whichever has jurisdiction) requires its remediation (2 pts).
D				5	LTc4	Surrounding Density and Diverse Uses **v4.1**	1-5	TGE	*Project does not meet credit requirements*	**v4.1** CREDIT: Avg. surrounding density within 1/4 mile >22,000 sf (2pts) or >35,000 (3pts) and/or within 1/2 mile walking distance of at least 4-7 diverse uses (1pt) or >8 diverse uses (2pts). Physical education spaces that are part of the project site, such as playing fields and associated buildings used during sporting events only (e.g., concession stands) and playgrounds with play equipment, are excluded from the development density calculations.
D				4	*LTc5*	*Access to Quality Transit **v4.1***	*1-4*	*TGE*	*Project does not meet credit requirements*	**v4.1** CREDIT: 1pt - 72 wkdy & 30 wknd; 2 pts - 100 wkdy & 70 wknd; 3 pts - 144 wkdy & 108 wknd; 4 pts - 250 wkdy & 160 wknd trips; 5 pts - 360 wkdy & 216 wknd trips.
D				1	*LTc6*	*Bicycle Facilities **v4.1***	*1*	*Arch/LA*	*Project does not meet credit requirements*	**v4.1** CREDIT: Locate within 200-yd walking or bicycling distance of bicycle network. Provide long-term bike storage for at least 5% of all regular building occupants (excluding students grade 3 and younger). (4 spaces minimum.) Provide one shower for the first 100 regular building occupants and one additional for every 150 thereafter, exclude K-12 students from the regular building occupant count. Long-term bicycle storage must be within 300 feet walking distance of any functional entry.
D				1	*LTc7*	*Reduced Parking Footprint **v4.1***	*1*	*Arch/Civil*	*Project does not meet credit requirements*	**v4.1** CREDIT: Option 1 (1 pt): No off-street parking. Option 2 Reduced Parking (1 pt): Do not exceed the minimum local code requirements for parking capacity. Provide parking capacity that is a 30% reduction below the base ratios recommended by the Parking Consultants Council. Option 3 (1pt): Carshare: Provide at least one vehicle parking space for carshare vehicles for every 100 occupants. Option 4 Unbundled Parking: Sell parking separately from all property sales and leases at a daily parkking fee equal or greater than the cost of municipal public transit. For ALL projects: The
D	1				LTc8	Electric Vehicles **v4.1**	1	Arch/Civil		**v4.1** CREDIT: Install electrical vehicle supply equipment (EVSE) in 2% of all parking spaces used by the project.
	Yes	M+	M-	No						
	11	0	0	1	**SUSTAINABLE SITES**		**12**	**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
C	Y				SSpr1	Construction Activity Pollution Prevention	Req'd	Civil/CM		REQUIRED: Create/implement an ESC plan for all construction activities associated with the project. The plan must conform to the requirements of the 2012 U.S. EPA Construction General Permit (CGP).
D	Y				SSpr2	Environmental Site Assessment	Req'd	Env. Eng.		REQUIRED: Conduct a Phase I ESA. If contamination is suspected, perform a Phase II ESA. If contamination exists, remediate the site to meet local, state or national EPA standards.
D	1				SSc1	Site Assessment	1	Arch/Civil/LA		CREDIT: Complete and document a site assessment that includes: Topography, Hydrology, Climate, Vegetation, Soils, Human Use, Human health effects.
D	2				SSc2	Protect or Restore Habitat **v4.1**	1-2	LA	**› Credit points must be maintained for pathway to Gold** › Turf grass does not count as native or adapted vegetation for this credit; without this, only 17% of the site include compliant planting types › This credit is already considered 'yes' and needed to maintain a pathway to Gold	**v4.1** CREDIT: Preserve and protect from all development and construction activity 40% of the greenfield area on the site (if such areas exist) AND restore 15% (1 pt) or 25% (2 pts) of the previously developed site area with native & adaptive vegetation (including the building footprint).
D	1				SSc3	Open Space	1	LA	**› Credit point must be maintained for pathway to Gold** › Lawn is monoculture and doesn't count toward this credit. › 25% vegetated space is not met due to lawn; only ~20% compliant › This credit is already considered 'yes' for 1 points and is needed to maintain a pathway to Gold › Switch to diverse lawn mix	CREDIT: Provide outdoor space greater than or equal to 30% of the total site area (including building footprint). A minimum of 25% of that outdoor space must be vegetated (turf grass does not count as vegetation) or have overhead vegetated canopy. The outdoor space must be physically accessible.
D	3				SSc4	Rainwater Management **v4.1**	2-3	Civil		**v4.1** CREDIT: On site, manage the runoff from the developed site for the 80th percentile (1 pt) 85th percentile (2pts) or 90th percentile (3pts) of regional or local rainfall events using LID & GI strategies that best mimic natural site hydrology OR manage on site the annual increase in runoff volume from the natural land cover condition to the post developed condition.
D	2				SSc5	Heat Island Reduction	1-2	Arch/LA	Specify compliant roofing material	CREDIT: Use any combination of non-roof Measures, high-Reflectance roof, or vegetated roof to be equal to or greater than the total roof + hardscape area on-site AND/OR place a minimum of 75% of parking spaces under cover.

D	1				SSc6	Light Pollution Reduction	1	MEP/LA		CREDIT: Do not exceed allowable backlight, uplight or glare (BUG) ratings for all exterior lighting as determined by the project's lighting zone (LZ).
D				1	*SSc7*	*Site Master Plan*	*1*	*Owner*	*Project does not meet credit requirements*	CREDIT: Achieve at least four of the following six credits: LTc High Priority Site, SSc Protect or Restore Habitat, SSc Open Space, SSc Rainwater Management, SSc Heat Island Reduction, SSc Light Pollution Reduction. A site master plan must be developed in colloboration with school authorities. Projects where no future development is planned are not eligible for this credit.
D	1				SSc8	Joint Use of Facilities	*1*	Arch/Owner		CREDIT: Option 1 - Ensure 3 of the following are accessile and avialable for shared use by general public: auditorium, gymnasium, cafeteria, classroom(s), playing fields, parking. Option 2 - Contract with community or other organizations to provide at least two of the following spaces types in the building: commercial office, heath clinic, community service centers, police office, library or media center, parking lot, one or more commercial businesses. Option 2 - Ensure that two of the following space types that are owned by other organizations are accessible to students: auditorium, gymnasium, cafeteria, classroom(s), swimming pool, playing fields.

	Yes	M+	M-	No						
	6	0	0	6	**WATER EFFICIENCY**		12	Responsible	Comments to Team	[insert date + benchmark] Notes
D	Y				WEpr1	Outdoor Water Use Reduction	Req'd	LA		REQUIRED: Install landscape that does not require a permanent irrigation system beyond a maximum two-year establishment period OR reduce the project's landscape water requirement by at least 30% from the calculated baseline for the site's peak watering month.
D	Y				WEpr2	Indoor Water Use Reduction	Req'd	MEP		REQUIRED: Flush and flow fixtures must reduce aggregate water consumption by 20% from the baseline. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled.
D	Y				WEpr3	Building-level Water Metering	Req'd	Owner/MEP		REQUIRED: Install permanent water meters that measure the total potable water use for the building and associated grounds. Commit to sharing with USGBC the resulting whole-project water usage data for a five-year period.
D	2				WEc1	Outdoor Water Use Reduction	1-2	LA	**› Credit point must be maintained for pathway to Gold** › Permanent irrigation for turf grass will increase water needs; previously thought to not include permanent irrigation › Landscape to complete OWU calculator or remove permanent irrigation	CREDIT: Credit Reqs: Show that the landscape does not require a permanent irrigation system beyond a maximum two-year establishment period (2pts) OR reduce the project's landscape water requirement (LWR) by at least 50% (1pt) or 100% (2pts) from the calculated baseline for the site's peak watering month.
D	3			4	WEc2	Indoor Water Use Reduction	1-7	MEP	Meet commercial kitchen equipment requirements and/or reduce water closet flow rates	CREDIT: Further reduce fixture and fitting water use from the calculated baseline in WE Prerequisite Indoor Water Use Reduction and install equipment that meets the minimum requirements. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled.
D				2	*WEc3*	*Cooling Tower Water Use*	*1-2*	*MEP*	*Project does not meet credit requirements*	CREDIT: Conduct a one-time potable water analysis, measuring at least the five control parameters required. Calculate the number of cooling tower cycles by dividing the maximum allowed concentration level of each parameter by the actual concentration level of each parameter found in the potable makeup water. Limit cooling tower cycles to avoid exceeding maximum values for any of these parameters.
D	1				WEc4	Water Metering	1	MEP		CREDIT: Install permanent water meters for two or more of the following water subsystems: irrigation, indoor plumbing fixtures and fittings, domestic hot water, boiler, reclaimed water, and/or other process water.

	Yes	M+	M-	No						
	17	5	7	2	**ENERGY & ATMOSPHERE**		31	Responsible	Comments to Team	[insert date + benchmark] Notes
C	Y				EApr1	Fundamental Commissioning and Verification	Req'd	CxA		REQUIRED: A qualified CxA must be engaged by end of DD to perform Cx services for all base-building HVAC&R equipment serving the project. An OPR document, BoD, and Current Facilities Requirements and Operations and Maintenance Plan must be prepared with information necessary to keep the building operating efficiently.
D	Y				EApr2	Minimum Energy Performance **2024 Update**	Req'd	Team/Modeler		REQUIRED: Demonstrate an improvement of at least 10% in the proposed building performance rating compared with the ASHRAE 90.1–2010 baseline using a metric of energy cost, source energy, or greenhouse gas emissions.
D	Y				EApr3	Building-level Energy Metering	Req'd	MEP		REQUIRED: Install new or use existing base building-level energy meters, or submeters that can be aggregated to provide base building-level data representing total building energy consumption and commit to sharing whole-building energy-use data with USGBC for 5 years.
D	Y				EApr4	Fundamental Refrigerant Management	Req'd	MEP		REQUIRED: Do not use chlorofluorocarbon (CFC)-based refrigerants in new HVAC&R systems.
C	6				EAc1	Enhanced Commissioning	2-6	CxA		CREDIT: Perform Enhanced Cx services for all base-building HVAC&R equipment (3pts) AND/OR develop monitoring-based procedures and identify points to be measured and evaluated to assess performance of energy- and water-consuming systems (1pt) AND/OR complete all required Cx process activities for the building's thermal envelope (2pts).
D	8	4	4		EAc2	Optimize Energy Performance **2024 Update**	1-16	Team/Modeler		CREDIT: Demonstrate a percentage improvement in the proposed building performance rating compared with the ASHRAE 90.1–2010 baseline. Total points are awarded as the sum of energy cost or source energy reduction of at least 20% (1 pt) up to 60% (8 pts) and greenhouse gas emissions reduction of at least 20% (1 pt) up to 70% (8 pts).
D	1				EAc3	Advanced Energy Metering	1	MEP		CREDIT: Permanent advanced energy metering must be installed for all energy sources used by the base building as well as any individual energy end uses that represent 10% or more of the total annual consumption of the building. The advanced energy metering must be permanently installed, record at intervals of one hour or less, and transmit data to a remote location. Electricity meters must record both consumption and demand. Whole-building electricity meters should record the power factor, if appropriate.The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure.The system must be capable of storing all meter data for at least 36 months. The data must be remotely accessible. All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.
C				2	EAc4	Grid Harmonization **v4.1**	1-2	Owner/MEP	*Project does not meet credit requirements*	**v4.1** CREDIT: Option 1: Participate in an existing demand response (DR) program and design a system with the capability for real-time, fully-automated DR based on external initiation by a DR Program Provider (2 pts) OR Option 2: If a DR program is not available, provide infrastructure to take advantage of future demand response programs or dynamic, real-time pricing programs and develop a comprehensive plan for shedding at least 10% of building estimated peak electricity demand (1 pt) AND/OR Option 3: Implement one or more load flexibility and management strategies. Demonstrate through peak load optimization (1 pt) AND/OR on-site thermal/electricity storage (1 pt) reduce on-peak load by at least 10%.

D	2		3		EAc5	Renewable Energy **v4.1**	1-5	Owner	Generate at least 5% of the building's energy needs with on-site renewable energy or purchase Tier II RECs to offset at least 20%	CREDIT: Use renewable energy systems to offset building energy costs by 1% (1pt), 5% (2pts), or 10% (3pts). **v4.1** CREDIT: Use Tier 1 on-site renewable energy to offset at least 2% of total energy use (1 pt) up to 20% (5pts) AND/OR Use Tier 2 new off-site renewable energy to offset at least 10% of total energy use (1 pt) up to 50% (5 pts) AND/OR Use Tier 3 off-site renewable energy that is Green-e Energy certified to offset at least 35% of total energy use (1 pt) up to 100% (3 pts). Points achieved in each category may be added for a total of 5 points.
D		1			EAc6	Enhanced Refrigerant Management	1	MEP	CMTA to complete calculation in LEED Online	CREDIT: Credit Reqs: Select refrigerants that are used in HVAC&R equipment to minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change (1 pt).

Yes	M+	M-	No							
7	2	1	1	**MATERIALS & RESOURCES**		13	Responsible	**Comments to Team**	**[insert date + benchmark] Notes**
D	Y			MRpr1	Storage & Collection of Recyclables	Req'd	Owner/Arch.		REQUIRED: Provide dedicated areas for the collection and storage of recyclable materials for the entire building that includes mixed paper, corrugated cardboard, glass, plastics, and metals. Safe collection, storage, and disposal measures must also be provided for two of the following: batteries, mercury-containing lamps, and electronic waste.
C	Y			MRpr2	Construction & Demo Waste Management Plan	Req'd	CM		REQUIRED: Develop and implement a compliant construction and demolition waste management plan that establishes waste diversion goals for the project by identifying at least five materials targeted for diversion, approximate a percentage of the overall project waste that these materials represent, whether materials will be separated or commingled, descriptions of the diversion strategies planned, and describe where the material will be taken/how the recycling facility will process the material.
C	1	1	1		MRc1	Building Life-Cycle Impact Reduction **v4.1**	2-5	Arch	CMTA or other to complete LCA; show reductions in embodied carbon from baseline for additional points	**v4.1** CREDIT: Option 4. Path 1 (1 pt) - Conduct a life-cycle assessment of the project's structure and enclosure. Path 2 (2 pts) Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of 5% reduction, compared with a baseline building in at least three of the six impact categories listed below, one of which must be global warming potential. Path 3 (3 pts) 10% reduction. CREDIT: Option 1: Historic Building Reuse (5pts); Option 2: Renovation of Abondonded or Blighted Building (5pts); Option 3: Building and Material Reuse - 25% (2pt), 50 (3pt), 75% (4pt); Option 4: Whole-Building Life-Cycle Assessment (3pts).
C	2				MRc2	Building Product Disclosure & Optimization-EPD's **v4**	1-2	Arch/CM		**v4.1** CREDIT: Option 1: Provide EPDs for at least 20 different permanently-installed products (EP point 40 products) from 5 or more manufacturers (1pt) AND/OR Option 2: Use at least 5 products from 3 or more manufacturers with embodied carbon optimization reports of LCA actions plans (1 pt).
C		1		1	MRc3	BPDO-Sourcing of Raw Materials **v4.1**	1-2	Arch/CM		**v4.1** CREDIT: Responsible Sourcing of Raw Materials: Use products sourced from at least three different manufacturers that meet at least one of the responsible sourcing and extraction criteria for at least 15%, by cost, of the total value of permanently installed building products in the project (1 point). Five different manufacturers and 30% (2 points). 60% (1 EP point). Regional: 100 miles (160 km) of the project site.
C	2				MRc4	BPDO-Material Ingredients **v4.1**	1-2	Arch/CM		**v4.1** CREDIT: Option 1: Provide HPDs or C2C certification for at least 20 different permanently-installed products (EP point 40 products) from 5 or more manufacturers (1pt) AND/OR Option 2: Use at least 5 products from 3 or more manufacturers with material ingredient optimization reports or action plans (1 pt).
C	2				MRc5	Construction and Demo Waste Management **v4.1**	1-2	CM	Source separate all waste on site; include 4 waste streams and min. 75% diversion rate	**v4.1** CREDIT: Option 1: Divert at least 50% of the total construction and demolition material (1pt) OR Option 2: Divert at least 50% of demolition material AND do not generate more than 10 lbs of construction waste per square foot of the building's floor area (2 pts).

Yes	M+	M-	No							
11	1	1	3	**INDOOR ENVIRONMENTAL QUALITY**		16	Responsible	**Comments to Team**	**[insert date + benchmark] Notes**
D	Y			EQpr1	Minimum IAQ Performance	Req'd	MEP		REQUIRED: Comply with the requirements of ASHRAE 62.1-2010, Ventilation for Acceptable Indoor Air Quality.
D	Y			EQpr2	Environmental Tobacco Smoke (ETS) Control **v4.1**	Req'd	Owner		**v4.1** REQUIRED: Project must prohibit smoking inside the building and outside the building except in designated smoking areas located at least 25 feet from all entries, outdoor air intakes, and operable windows. Communicate the no-smoking policy to occupants. Have in place provisions for enforcement or no-smoking signage.
D	Y			EQpr3	Minimum Acoustical Performance	Req'd	Acoust. Eng.		REQUIRED: Meet LEED interior, HVAC background noise, exterior noise, and reverberation time requirements based on ANSI Standard S12.60–2010.
D	2			EQc1	Enhanced IAQ Strategies	1-2	Arch/MEP		CREDIT: Comply with the following requirements for 1pt: Entryway Systems, Interior Cross-Contamination Prevention, and Filtration. For an additional point, comply with the one of the following: Exterior Contamination Prevention, Increased Ventilation, Carbon Dioxide Monitoring, Additional Source Control, or Monitoring.
C	3			EQc2	Low-Emitting Materials **v4.1**	1-3	Arch/CM		**v4.1** CREDIT: Project must install compliant products that meet the (1) emissions testing requirements AND (2) VOC content standards for 2 (1pt), 3 (2pts), or 4 (3pts), 5 (3 points + EP) of the following categories: adhesives/sealants, paints/coatings, flooring, composite wood, ceilings, wall panels, insulation, and furniture. Meet 90% Threshold in 3 categories (1 EP point).
C	1			EQc3	Construction IAQ Management Plan	1	CM		CREDIT: Develop and implement an IAQ management plan that requires compliance with all applicable control measures of the SMACNA IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
C	1		1	EQc4	IAQ Assessment **v4.1**	1-2	Owner/CM	Complete pre- or post-occupancy building flush-out	**v4.1** CREDIT: Select one of the following two options to be implemented after construction ends and the building has been completely cleaned. All interior finishes must be finished. Option 1, Flush-Out: Path 1: Before Occupancy: Install new filtration media and perform a building flush-out. Path 2: During Occupancy: If occupancy is desired before the flush-out is completed, the space may be occupied only after delivery of a minimum of 3,500 cubic feet of outdoor air per square foot of gross floor area (1 pt) OR Option 2, Air Testing: Before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing for all occupied spaces testing for particulate matter and inorganic gases (1 pt) AND/OR volatile organic compounds (1 pt). For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants at the same sampling points. Repeat until all requirements are met (2 pts).
D	1			EQc5	Thermal Comfort	1	MEP		CREDIT: Provide individual thermal comfort controls for at least 50% of individual occupant spaces. Provide group thermal comfort controls for all shared multioccupant spaces. Thermal comfort controls allow occupants, whether in individual spaces or shared multioccupant spaces, to adjust at least one of the following in their local environment: air temperature, radiant temperature, air speed, and humidity. Design thermal comfort system to ASHRAE Standard 55-2010 or to Iso and Cen Standards: Design HVAC systems and the building envelope to meet the requirements of the applicable standard.

D	2				EQc6	Interior Lighting **v4.1**	1-2	Arch/MEP	Meet all 3 v4.1 credit options to earn 2 points; already assuming 1 for Option 3: Lighting Control	**v4.1** CREDIT: For regularly occupied spaces, comply with 1 of the following strategies for 1 pt OR 3 strategies for 2 pts. Option 1 Glare: use light fixtures with a luminance of less than 7,000 candela per square meter (cd/m2) between 45 and 90 degrees from nadir OR achieve a maximum Unified Glare Rating (UGR) rating of <19. Option 2 Color Rendering: use light sources that have a Color Rendering Index (CRI) of at least 90 OR have a Color Fidelity Index >78 and a gamut index between 97 and 110. Option 3 Lighting Control: for at least 90% of regularly occupied spaces, provide dimmable or multilevel lighting.
D	1	1		1	EQc7	Daylight **v4.1**	1-3	Arch		**v4.1** CREDIT: Option 1: Demonstrate through simulation that sDA of at least 40% (1pt), 55% (2pt), or 75% (3pts) is achieved. Option 2: Demonstrate through modeling that illuminance levels will be between 300 lux and 3,000 lux for 9 a.m. and 3 p.m., both on a clear-sky day at the equinox, for 55% (1pt). 75% (2 pts), or 90% (3pts) of the regularly occupied floor area. Option 3: With furniture, fixtures and equipment in place, conduct an on-site measurement that demonstrates the project achieves illuminace levels equal to Option 2 for 55% (1pt), 75% (2pts), or 90% (3pts) of the regularly occupied floor area.
D				1	EQc8	Quality Views **v4.1**	1	Arch	*Project does not meet credit requirements*	**v4.1** CREDIT: Achieve a direct line of sight to the outdoors via vision glazing, with a VLT above 40%, for at least 75% of all regularly occupied floor area that includes at least one of the following: nature, urban landmarks, or art; objects at least 25' from the exterior. Direct access must be within 3 times the head height of the glazing.
D				1	EQc9	Acoustic Performance **v4.1**	1	Acoust. Eng.	*Project does not meet credit requirements*	**v4.1** CREDIT: For all occupied spaces, meet the requirements, as applicable, for HVAC background noise, sound transmission, reverberation time, and sound reinforcement and masking.
	Yes	M+	M-	No						
	6	**0**	**0**	**0**	**INNOVATION**		**6**	**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
D	1				INc1.1	Innovation: Purchasing - Lamps	1	Team		
D	1				INc1.2	Innovation: Green Building Education or O&M Plan	1	Team		
D	1				INc1.3	Pilot: Integrative Analysis of Building Materials	1	Team		
C	1				INc1.4	EP: EPDs or Material Ingredients	1	Team		
C	1				INc1.5	EP: Optimize Energy Performance	1	Team		
C	1				INc2	LEED Accredited Professional	1	Team		
	Yes	M+	M-	No						
	2	**0**	**1**	**1**	**REGIONAL PRIORITY 00000 (underlined)**		**4**	**Responsible**	**Comments to Team**	**[insert date + benchmark] Notes**
D	1				RPc1	Regional: Optimize Energy Performance (8 pts)	1	-		
D	1				RPc2	Regional: Joint Use of Facilities (1 pt)	1	-		
D			1		RPc3	Regional: Building Lifecycle Impact Reduction (2 pts	1	-		
D				1	RPc4	Regional: Bicycle Facilities (1 pt)	1	-		
					RPcX	Regional: Surrounding Density and Diverse Use (2 p	1	-		
					RPcX	Regional: Access to Quality Transit	1	-		
	Yes	M+	M-	No						
	64	**8**	**10**	**26**	**PROJECT TOTALS (Certification Estimates)**		**110**			

Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points

SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, specifications and other general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Sections, apply to this Section.

B. Related Sections

1. Division 3 (ALL SECTIONS)
2. Division 4 (ALL SECTIONS)
3. Division 7 (ALL SECTIONS)
4. Division 8 (ALL SECTIONS)
5. Division 9 (ALL SECTIONS)
6. Division 21, Section 210500 Common Work Results for Fire Suppression
7. Division 22, Section 220500 Common Work Results for Plumbing
8. Division 23, Section 230500 Common Work Results for HVAC
9. Division 23, Section 230593 Testing, Adjusting and Balancing for HVAC
10. Division 23, Section 230900 Instrumentation and Control for HVAC
11. Division 26
12. Division 28

1.2 SUMMARY

A. This section includes requirements for Commissioning during the pre-design phase, design phase, construction phase and the building turnover phase. This section includes general Commissioning requirements for all specified and associated systems, sub systems and equipment. The intent of this section is to specify the Commissioning responsibilities of the Construction Manager / General and their subcontractors (referred to herein as the Contractor, Heating, Ventilation and Air Conditioning (HVAC) Subcontractor, Testing, Adjusting and Balancing (TAB) Subcontractor, Automated Temperature Controls (ATC) Subcontractor, etc.). The Contractor will assure participation and cooperation of their Subcontractors as required throughout the duration of the Commissioning process.

B. This project has been designed and will be Commissioned in accordance with the requirements of the High Performance Building Construction Standards (CT HPBS) for State Funded Buildings as outlined in RCSA Section 16a-38k-1 through 16a-38k-9 and further defined by the Connecticut Building Standard Guidelines Compliance Manual for High Performance Buildings September 2011 and the Capitol Projects High Performance Building Guidelines. The Commissioning Authority will coordinate with the Architect, Owner and Contractor throughout the integrated design and construction process.

C. This project has been designed and will be Commissioned in accordance with the requirements of the US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4.0 program even though the project will NOT be pursuing Certification at this time. This

Section includes all requirements of the LEED v4.0 program for Energy and Atmosphere Prerequisite Fundamental Commissioning and Verification.

D. This project has been designed and will be Commissioned in accordance with the requirements of the US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4.0 program. This Section includes all requirements of the LEED v4.0 program for Energy and Atmosphere Prerequisite Fundamental Commissioning and Verification.

E. This project has been designed and will be Commissioned in accordance with the requirements of the US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4.0 program. This Section includes all requirements of the LEED v4.0 program for Energy and Atmosphere Prerequisite Fundamental Commissioning and Verification and Energy and Atmosphere Enhanced Commissioning Option 1 /Path 1 (Enhanced Commissioning).

F. This project has been designed and will be Commissioned in accordance with the requirements of the US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4.0 program. This Section includes all requirements of the LEED v4.0 program for Energy and Atmosphere Prerequisite Fundamental Commissioning and Verification and Energy and Atmosphere Enhanced Commissioning Option 1 /Path 2 (Enhanced & Monitoring Based Commissioning).

G. This project has been designed and will be Commissioned in accordance with the requirements of the US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4.0 program. This Section includes all requirements of the LEED v4.0 program for Energy and Atmosphere Prerequisite Fundamental Commissioning and Verification and Energy and Atmosphere Enhanced Commissioning Option 2 (Envelope Commissioning).

PRODUCT DATA SHEET 1 -

1.3 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor.

B. Automated Temperature Controls (ATC): This term is inclusive of any and all automated controls, building management systems, energy management systems and their various networks, software and components.

C. Basis of Design (BOD): A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. Commissioning Authority (CxA): The individual or group engaged under separate contract to the Owner responsible for executing the Commissioning requirements.

E. Commissioning Plan: An informational document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning process.

F. Contractor: The prime contractor (Construction Manager or General Contractor) identified in the Contract for Construction between Owner and Contractor.

G. Statement of Completion: A certifying document issued by the CxA that is to be signed and notarized, confirming compliance with Connecticut High Performance Building Standards.

H. Engineer of Record: Includes the design Engineer(s) identified in the Contract for Construction between Owner and Contractor, responsible for design of HVAC, electrical, communications, controls for HVAC systems and other related building systems.

I. Packaged Controls: Controls provided by the equipment manufacturer that are not directly related to the Building Management System (BMS).

J. Owner's Project Requirements (OPR): A document that details the program requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

K. ATC Point to Point Report: A complete list and verification report of all analog and digital inputs/outputs tied to the building automation system.

L. Pre-Functional Checklists: These checklists are tools to help the Subcontractors verify that the installation complies with the Contract Documents and is complete and ready for functional performance testing.

M. Subcontractor: Installing contractors responsible to the Contractor for installation of systems and equipment. This term is inclusive of all trades (HVAC, electrical, plumbing, etc.).

N. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

O. Systems and Energy Management Manual: Collective documentation prepared in the form of a manual to allow easy navigation of its contents. Contents of the manual are defined by the Owner with the help of the CxA, and assembled by the Contractor at project close-out. Manual contents may incorporate other close-out documents (e.g. O&M's, emergency manuals, warranty documents, etc..).

P. Testing, Adjusting, and Balancing (TAB): Includes any and all testing, adjusting and balancing as performed by the TAB Subcontractor.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor and Subcontractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The Commissioning Team shall consist of, but not be limited to, representatives of the Contractor and of each Subcontractor, including project superintendents, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. The CxA: Owner has engaged the CxA under a separate contract.
2. Representatives of the Owner including facility users and operation and maintenance personnel.
3. Architect and Engineer of Record.
4. Sustainable Consultant

1.5 OWNER'S RESPONSIBILITIES

A. Owner shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in commissioning process activities including, but not limited to, the following:

1. Training in operation and maintenance of systems, subsystems, and equipment.
2. Participate, as needed, in the post-occupancy system performance review 10 months into the 12-month warranty period. (Enhanced Commissioning Path 1 & 2).
3. Provide, where applicable, any information and effort needed to support the development of the pre-occupancy commissioning report required per CT HPBS section 16a-38k-8, including but not limited to the statement of completion.
4. Provide, where applicable, any information and effort needed to support the development of the post-occupancy commissioning report required per CT HPBS section 16a-38k-8 sub. The report is to be provided within 180 days after one year of completion. Information needed includes, but is not limited to, the following:
   a. A description of any post-occupancy adjustments made to equipment or building operation and the reasons for which the changes were made.
   b. One-year worth of all energy use by source and water use.
5. Provide, where applicable, any information and effort needed to support the development of the CRF and O&M plan.

6. Provide full support of monitoring-based commissioning activities after occupancy (Option 1 / Path 2).

1.6 DESIGN TEAM'S RESPONSIBILITIES

B. Design Team shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in commissioning process activities including, but not limited to, the following:

1. Participate in functional performance testing / deferred or opposite season testing of systems to be commissioned (where applicable based on complexity of system or uniqueness of design).
2. Resolve issues identified during commissioning. Provide responses to open issues within two weeks of being posted via online web-based tracking database (SES Commissioning Portal).
3. Participate, as needed, in the post-occupancy system performance review 10 months into the 12-month warranty period.
4. Provide, where applicable, any information and effort needed to support the development of the pre-occupancy commissioning report required per CT HPBS section 16a-38k-8, including but not limited to the statement of completion.
5. Provide, where applicable, any information and effort needed to support the development of the Systems and Energy Management Manual.
6. Provide, where applicable, any information needed to support the development of the post-occupancy commissioning report required per CT HPBS section 16a-38k-8. The report is to be provided within 180 days after one year of completion.
7. Provide all information and documentation requested by the CxA for inclusion into the Systems Manual. This may include generating documents related to your responsibilities (reports, photometrics, insight, etc..) to meet LEED requirements.
8. Provide, where applicable, any information and effort needed to support the development of the CRF and O&M plan. This may include generating documents related to your responsibilities (reports, photometrics, insight, etc..) to meet LEED requirements
9. Provide full support of monitoring-based commissioning activities after occupancy (Option 1 / Path 2)

1.7 CONTRACTOR'S AND SUBCONTRACTOR’S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Provide the CxA with a detailed and accurate construction schedule. Coordinate scheduling of commissioning activities with the CxA and include them in the construction schedule.
3. Provide a submittal log, operation and maintenance data submittals, equipment start-up, and field quality reports.
4. Provide CxA with copies of all approved change orders, RFIs, ASIs or other modifications impacting construction when approved.
5. Participate in commissioning field observations.

6. Confirm accurate and successful completion of construction checkout documents (pre-functional checklists) for all systems to be commissioned prior to verification site visits and functional testing by the CxA. One complete pre-functional checklist shall be submitted for each piece of equipment or as directed by the CxA.
7. Certify readiness of systems to be commissioned prior to functional performance testing.
8. Participate in functional performance testing of systems to be commissioned.
9. Provide field quality control testing and inspection reports for all systems including envelope systems where called for in individual sections.
10. Resolving issues identified during commissioning and coordinating correction of deficiencies. Provide responses to open issues within two weeks of being posted via online web-based tracking database (SES Commissioning Portal).
11. Participate in operation and maintenance planning and verification.
12. Participate in operation and maintenance training sessions.
13. Participate in final review at the 10-month post occupancy meeting.
14. Coordinate Subcontractor participation in commissioning activities.
15. Assemble Systems and Energy Management Manual at project close-out in accordance with the approved Systems and Energy Management Manual Outline. If required, convene meeting with Owner to understand requirements of manual assembly.
16. Assist in coordinating the Subcontractors, as needed, to perform testing of systems and equipment as it relates to project phasing.
17. Assist in coordinating the Subcontractors, as needed, to perform deferred or opposite seasonal testing of systems and equipment. Assist in coordinating the Subcontractors to resolve issues discovered as a result.
18. Coordinate the Subcontractors to resolve issues discovered during the system performance review 10 months into the 12-month warranty period.
19. Provide, where applicable, any information and effort needed to support the development of the pre-occupancy commissioning report required per CT HPBS section 16a-38k-8, including but not limited to the statement of completion.
20. Provide, where applicable, any information needed to support the development of the post-occupancy commissioning report required per CT HPBS section 16a-38k-8. The report is to be provided within 180 days after one year of completion.

B. Subcontractor(s) shall assign representatives with the expertise and the authority to act on behalf of the entity responsible for installation of systems to be commissioned who shall participate in and perform commissioning team activities including, but not limited to, the following:

1. Provide a submittal log, operation and maintenance data submittals, equipment start-up, and field quality reports.
2. Provide information to the CxA including, but not limited to:
    a. Schedule as mentioned above
    b. Equipment submittals
    c. Operation and maintenance information submittals
3. Confirm accurate and successful completion of construction checkout documents (pre-functional checklists) for all systems to be commissioned prior to verification site visits and functional testing by the CxA. One complete pre-functional checklist shall be submitted for each piece of equipment or as directed by the CxA.
4. Certify readiness of systems to be commissioned prior to functional performance testing. Provide any available support documentation (start-up reports, pressure test reports, etc.).
5. Participate in functional performance testing of systems to be commissioned.

6. Participate in Commissioning meetings.
7. Provide technicians who are familiar with the construction and operation of the installed systems, are trained in the use of required testing instruments and procedures to participate in testing of installed systems, subsystems and equipment.
8. Resolving issues identified during commissioning and coordinating correction of deficiencies. Provide responses to open issues within two weeks of being posted via online web-based tracking database (SES Commissioning Portal).
9. Participate in training sessions for Owner's operation and maintenance personnel.
10. Participate, as needed, in performing deferred or opposite seasonal testing of systems and equipment.
11. Participate, as needed, in resolving warranty related issues discovered during the system performance review 10 months into the 12-month warranty period.
12. Provide, where applicable, any information and effort needed to support the development of the pre-occupancy commissioning report required per CT HPBS section 16a-38k-8.
13. Provide, where applicable, any information needed to support the development of the post-occupancy commissioning report required per CT HPBS section 16a-38k-8. The report is to be provided within 180 days after one year of completion.
14. Provide all information and documentation requested by the CxA for inclusion into the Systems Manual. This may include generating documents related to your trade (reports, line diagrams, as-builts, etc..) to meet LEED requirements.
15. Provide, where applicable, any information and effort needed to support the development of the CRF and O&M plan. This may include generating documents related to your trade (reports, line diagrams, as-builts, etc..) to meet LEED requirements.
16. Provide full support of monitoring-based commissioning activities after occupancy (Option 1 / Path 2)
17. Provide on-site support, as needed, from equipment manufacturers for testing packaged controls

1.8 COMMISSIONING DOCUMENTATION

A. Commissioning plan: An informational document, prepared by the CxA, that outlines the schedule, allocation of resources and documentation requirements of the commissioning process, including:

1. Plan for delivery and review of submittals, Systems and Energy Management Manual and other documents and reports. Identification of the relationship of these documents to other functions and a description of submittals that are required to support the commissioning processes.
2. Overview of the organization, layout and content of commissioning documentation and a description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
5. Description of responsibilities of commissioning team members.
6. Description of requirements for operation and maintenance training, including required training materials.
7. Description of expected performance for systems, subsystems, equipment and controls.
8. Requirements for documenting changes on a continuous basis to appear in the project record documents.

9. Process and schedule for completing construction checklists for systems to be commissioned.
10. Step by step procedures for testing systems, subsystems and equipment with descriptions for methods of verifying relevant data, recording the results obtained and listing parties involved in performing and verifying tests.

B. Pre-functional Checklists: CxA shall develop pre-functional checklists for each system to be commissioned including all interfaces and interlocks. Separate entries will be provided for each item to be checked. Pre-functional checklists will be completed by the installing Subcontractor and verified by the Contractor and CxA. Space will be provided for sign off of installing Subcontractor, Contractor and CxA. The successful completion of the pre-functional checklists for systems and equipment is mandatory prior to any functional testing being performed. One complete pre-functional checklist shall be submitted for each piece of equipment or as directed by the CxA. The successful completion of these checklists without outstanding issues indicates the equipment/systems full readiness for successful functional testing. **Falsely indicating successful completion of the checklists and resulting failures of functional testing will result in the responsible contractor being responsible for the cost of retesting.**

C. Field Observation Reports: The CxA will issues periodic field observation reports resulting from site visits made throughout construction. The reports will be submitted to the Owner and the Contractor for distribution to the Subcontractor and include, but are not limited to, the following:
1. Witnessing systems, assemblies, equipment, and component startup.
2. Cleanliness and proper storage of construction materials like duct work, refrigerant piping, etc.
3. Observed installation deficiencies and/or deviations from the Contract Documents.

D. Certificate of Readiness: Certificate of Readiness shall be signed by the Contractor, Subcontractor(s), and Installer(s) certifying that systems, subsystems, equipment, and associated controls are ready for functional performance testing and that all relevant information including submittals and installation data has been submitted. Completed pre-functional checklists signed by the responsible parties shall accompany this certificate. **Falsely indicating readiness and resulting failures of functional testing will result in the responsible contractor being responsible for the cost of retesting.**

E. Functional Performance Test Procedures: The CxA shall develop functional performance test sheets for each system to be commissioned including interfaces and interlocks. Separate entries will be provided for each item to be tested. CxA shall prepare separate tests for each mode of operation and provide space to indicate whether the mode under test responded as required. All information gathered will be documented by the CxA. Each test will include, but not limited to, the following:

1. Name and identification of each item being checked.
2. Date of test.
3. Indication of whether the record is for a first test or retest following correction of a problem or issue.
4. List of deficiencies.
5. Verifying the Calibration of sensors and sensor function.
6. Testing conditions under which test was conducted, including (where applicable) ambient conditions, setpoints, override conditions, and status and operating conditions that impact the results of the test.

7. Control sequences for mechanical and electrical systems.
8. Verification of control signals for each setpoint at specified conditions.
9. Responses to control signal at specified conditions (where applicable).
10. Sequence of responses to control signals at specified conditions.
11. Electrical demand or power input at specified conditions (where applicable).
12. Expected performance of systems, subsystems and equipment at each step of the tests. Narrative description of observed performance of systems, subsystems and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
13. Interaction with ancillary equipment.

F. Systems Manual (Enhanced Cx)

1. The CxA shall develop the Systems Manual in accordance with the requirements identified in Divisions 01, and LEED v4.0 guideline (option 1 / path 1) with the help of the contractor and design team. Materials below shall be provided to the CxA as requested for the assembly of this manual.
    a. Executive Summary
    b. OPR
    c. BOD
    d. System single lie diagrams
    e. Construction & Record Documents
    f. Approved submittals
    g. As-built drawings
    h. As-built Sequence of Operations
    i. Original Setpoints for all systems commissioned
    j. Recommended schedule for recommissioning
    k. Recommended schedule for sensor re-calibration
    l. O&M manuals
    m. Equipment preventative maintenance manuals
    n. Confirmation of completed training for the owner and occupants
    o. Ongoing system optimization procedures
    p. Final Cx report

G. Current Facilities Requirements (CFR) and Operations & Maintenance (O&M) plan. Shall be prepared by the CxA and shall incorporate requirements from the OPR, BOD, and functional testsheets. Information may also be extracted from product submittals and equipment operations and maintenance manuals. The plan will include the following information;

1. Sequence of operations

2. Building Occupancy Schedule

3. Equipment runtime schedules

4. Setpoints for all HVAC equipment

5. Lighting Levels throughout the building

6. Minimum OA requirements

7. Seasonal changes to schedules or setpoints

8. System narrative describing mechanical and electrical equipment

9. Cx program that includes periodic Cx requirements, ongoing Cx tasks, and continuous tasks for critical facilities

H. Systems & Energy Management Manual: To be prepared by the Contractor and shall incorporate the requirements listed in the Systems & Energy Management Manual Outline. The Systems & Energy Management Manual shall be easy to navigate with a Table of Contents for each volume, and may require other close-out documents to be incorporated (e.g., O&M's, training documentation, warranty contracts). Format for final delivery shall be electronic, unprotected, bookmarked and searchable.

I. Commissioning Issues Log: The CxA will document any and all deficiencies and corrective actions taken for systems and equipment that fail initial functional performance tests including required modifications to systems and equipment and revisions to functional performance test procedures. Re-tests and final results will also be documented.
   1. Commissioning Notice: CxA prepares and maintains an issue log that describes design, installation and performance issues that are at variance with the OPR, BOD and Contract Documents. Identification and tracking of issues as they are encountered, documenting the status of unresolved and resolved issues. The issues log is shared with members of the Commissioning team via an interactive web-based portal which is maintained by the CxA.
      a. SES Commissioning Portal: The interactive web-based portal is an on-line database maintained by Sustainable Engineering Solutions, LLC. The portal is used by the CxA to track issues and assign responsibility for corrective action. All parties will use the SES online portal for reviewing, tracking and responding to all commissioning related issues.
      b. All members of the Commissioning Team will be given access to the portal as required to respond to issues or deficiencies.
      c. Issues status will begin as "Open" until the responsible Contractor or Subcontractor addresses the issue stating that corrective action has been performed.
      d. Once the Contractor / Subcontractor have addressed the issue stating that corrective action has been performed the issue status will be changed to "Pending Verification" as the issue awaits re-verification by the CxA.
      e. After the CxA has confirmed that the corrective action has taken place, as stated by the responsible Contractor or Subcontractor, the issue status will be indexed to "Closed" but remain visible for record purposes.

1.9 SUBMITTALS BY CONTRACTOR

A. Information listed below shall be submitted with the product and system literature and shop drawing submittals for review and approval by the Owner, Architect, Engineer of Record and the CxA. This information will be used to confirm the product compliance with the Contract Documents and to establish detailed commissioning requirements and procedures. The information shall be specific to each system to be commissioned and shall be inclusive of all related systems, equipment and components.

B. Systems and Energy Management Manual

1. The Contractor shall coordinate with the CxA to develop the Systems and Energy Management Manual in accordance with the requirements identified in Divisions 01, the specific requirements identified in each Section and per the Connecticut High Performance Standards.

2. The Systems and Energy Management Manual shall contain all required information under a single cover unless otherwise indicated and shall include, but not be limited to the following:

SYSTEMS & ENERGY MANAGEMENT MANUAL OUTLINE:

a. Executive Summary (Description of manual contents and intention)
b. Basis of Design (BOD, provided by the Design Team)
c. Construction Record Documents (As-builts, TAB final report, ATC as-built, warranties, approved submittals)
d. Project Operations and Maintenance Manuals (as specified)

3. The Systems and Energy Management Manual documentation shall be provided in digital and hard copy format (at owner's discretion) and structured with a table of contents per the sections indicated above.

C. The Contractor shall provide the product and equipment submittals in accordance with the requirements identified in Divisions 1and the specific requirements identified in each Section.

1.

a. Manufacturer's detailed installation and start-up requirements including equipment checklists for each piece of equipment/assembly.
b. Operation instructions.
c. Manufacturer's recommended maintenance and troubleshooting procedures.
d. Warranty and owners' obligations to maintain warranty.
e. Detailed product data for each piece of equipment including part load capacities, electrical components and requirements, etc. (As appropriate)
f. Performance curves for each piece of equipment being submitted. (As appropriate)
g. Coordination and Record Drawings.
h. Logic flow diagrams for control systems sequences of operation. Include detailed sections of the Sequence of Operations for related function groups.
i. Indicate initial setpoints, reset schedules, sensor locations, etc.
j. Detailed test reports resulting from testing of any exterior enclosure (window, door, curtain wall, etc.) mock-ups performed by the installing contractor or third-party entity prior to construction.

D. Operation and Maintenance Manuals

D. As-Built Documents

E. Training materials

F. Start-up & field-testing reports

G. Product, equipment, and materials warranties

F. The Contractor shall develop the Operation and Maintenance manuals in accordance with the requirements identified in Divisions 1and the specific requirements identified in each Section.

1.10 COORDINATION

A. Coordination Meetings: The CxA shall conduct periodic coordination meetings with the Commissioning Team to review progress on the commissioning plan, to discuss scheduling conflicts and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: The CxA shall conduct pretest meetings with the Commissioning Team prior to the start of the functional performance testing to review start-up reports, pretest verification results, testing procedures, testing personnel and instrumentation requirements and manufacturer's authorized service representative services for each system, subsystem, equipment and component to be tested.

C. Field Observations: The CxA shall conduct periodic field observations during construction. The Contractor must notify the CxA at least one week prior to completion of key milestones, assemblies and sub-system components installation and functional testing so that site visits can be coordinated while access is available to witness.

D. Coordination During Functional Performance Testing: The CxA shall coordinate sequence of testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and verification.

E. Manufacturer's Field Services: The Subcontractor(s) shall be responsible for coordinating services from the manufacturer's representative, technicians or vendors as needed to assist in the functional performance testing. The CxA will coordinate when these services are required and notify the Subcontractor(s) at least one week prior to scheduled functional performance testing.

1.11 ENVELOPE COMMISSIONING (Enhanced Option 2)

A. Intent: The CxA will work closely with the Owner, design team, and the installing contractors to help establish a level of quality for the envelope systems on the project.

B. The statement above is accomplished through a review of submittals, project details, manufacturer guidelines and contractor coordination meetings. Once that level of quality is established, the CxA will provide periodic observations of systems throughout construction to help assure ongoing quality. The CxA shall not be considered an inspector nor be responsible to observe every section or application of these systems.

C. Where deficiencies are observed and reported by the CxA, it is the responsibility of the contractor to not only correct the area of the system reported, but to assure these deficiencies are corrected throughout, prior to being enclosed with the exterior façade or interior finishes. The contractor is responsible for installing systems and materials in compliance with the project documents and with manufacturers practices.

D. If the CxA is not notified prior to final assembly then finished sections may have to be disassembled for review at no cost to the owner. Any costs associated with dissembling and re-assembling components shall be borne solely by the contractor.

E. See section 3.8 for testing requirements.

1.12 SYSTEMS TO BE COMMISSIONED

A. The following systems, subsystems, equipment and components will be commissioned and will be referred to collectively herein as the Systems to be Commissioned:

1. Mechanical, including HVAC&R equipment & controls
2. Electrical including service, distribution, lighting, lighting controls, daylighting
3. Plumbing including domestic hot water systems, pumps, controls
4. Renewable energy systems
5. Building envelope

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. All standard and non-standard testing equipment required to perform start-up, initial checkout and functional performance testing shall be provided by the Division contractor for the equipment being tested. This includes any equipment, such as ladders or man lifts, necessary to gain access to systems or equipment to be commissioned.

B. The ATC sub-contractors will be responsible for providing any available software to interface with the automated temperature control system for functional performance testing purposes. If necessary due to licensing restrictions the ATC contractor will be responsible for providing a computer as well to operate the software.

C. The mechanical/electrical/plumbing contractor shall provide all required tools and factory support to complete the functional testing of equipment containing packaged controls, and/or packaged/BMS integrated controls.

D. The ATC sub contractor will be responsible for securing access to any available networks (wireless or local) for use with web-based control systems. The ATC contractor will be responsible for providing user access to the web-based control system for the CxA to facilitate functional performance testing.

E. The electrical contractor or information technology contractor (the installing contractor) will be responsible for providing optical loss test sets (OLTS) for testing of fiber optic cable where commissioning of telephone or data systems has been included as part of the commissioning scope of work in section 1.11 above.

F. The electrical contractor or information technology contractor (the installing contractor) will be responsible for providing cable analysis meters for testing of copper where commissioning of telephone or data systems has been included as part of the commissioning scope of work in section 1.11 above.

G. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in applicable Divisions. The Subcontractor’s instrumentation shall meet the following standards:

1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required to determine adequate performance.
2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout the duration of use on this project.

PART 3 - EXECUTION

3.1 FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS

A. The requirements identified in this section are applicable to the functional performance testing of all system and equipment to be commissioned.

B. The objective of functional performance testing is to demonstrate that each system is operating in accordance with the performance identified in the OPR, BOD and Contract Documents through systematic testing and documentation. The intent is to bring the systems from a state of substantial completion to full dynamic operation and documenting the performance. Additionally, during the functional performance testing process, areas of deficient performance are identified and corrected, improving the operation and function of the systems.

C. The CxA shall achieve this objective by developing individual systems testing procedures which, when executed systematically by the Subcontractor(s), will allow the CxA to observe operation, evaluate performance, identify deficiencies, recommend modifications, adjust, and document the systems and systems equipment performance over a range of load and functional levels.

D. In general, each system to be commissioned shall be made to operate through all modes of operation where there is a specified system response. Verifying each sequence identified in the Contract Documents is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no air or water flow, equipment general failure, etc. shall be tested.

3.2 COORDINATION AND SCHEDULING OF FUNCTIONAL PERFORMANCE TESTING

A. Scheduling of the Subcontractor(s) and personnel required to execute the functional performance testing is the responsibility of the Contractor.

1. Commissioning activities shall be scheduled by the CxA and forwarded to the Contractor for distribution to the Subcontractors.
2. The Contractor shall be responsible for integrating functional performance testing and commissioning requirements into the master activity schedule.

B. The Subcontractor(s) shall provide sufficient notice to the CxA regarding their completion schedule for the pre-functional checklists and system start-up of all equipment and systems to be commissioned.

1. Subcontractors are responsible for execution of all tests.

C. Functional performance testing is conducted after pre-functional checklists and start-up procedures have been satisfactorily completed and documentation has been submitted and approved.

D. The Contractor shall verify completeness of the exterior enclosure to facilitate the functional performance testing of the various systems and sub system assemblies.

E. The Contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation and control of HVAC, Plumbing and Electrical equipment and systems.

F. The testing, adjusting and balancing of both air and hydronic systems shall be completed and any noted issues addressed before functional performance testing of air and water related equipment or systems. A preliminary report of the TAB Subcontractor's findings shall be submitted prior to the start of functional performance testing.

3.3 SYSTEM START-UP

A. The Contractor shall confirm that all start-up procedures take place and are documented in accordance with the requirements identified in Divisions 1 and the specific requirements identified in each Section.

B. The contractor shall confirm that all packaged controls integration has been completed during the start-up process. This will require coordination between the ATC contractor and the equipment manufacturer.

C. A start-up plan shall be developed and submitted by the Contractor to the CxA for review. The Contractor shall be responsible for coordinating the Subcontractor(s), manufacturer's representatives and certified start-up technicians. The Contractor shall commence with system start-up after approval has been given to the start-up plan and after initial inspections by the Subcontractor(s) have been completed. The CxA shall be notified via a system start-up schedule for witness of system start-up on selected systems to be commissioned.

1. The Subcontractor(s) shall be responsible for submitting system start-up documentation in accordance with the requirements identified in Division 1 and the specific requirements identified in each Section.

2. The Contractor shall take corrective action on all system deficiencies noted in the start-up report and demonstrate to the CxA suitable system operation can be maintained.

3.4 PREREQUISITE FUNCTIONAL TESTING VERIFICATION

A. The Contractor shall certify that systems to be commissioned have been completed, calibrated and start-up procedures have been completed. The Contractor shall verify that the systems to be commissioned are operating according to the Contract Documents and the Certificates of Readiness are signed and submitted.

B. The Contractor shall certify that instrumentation and automated temperature controls associated with the systems to be commissioned have been completed and calibrated and are operating according to the Contract Documents and that preset set points have been recorded. A copy of the

ATC point-to-point report and sequence verification documents, resulting from the ATC sub contractor start-up, shall be provided to the CxA for review.

C. The Contractor shall coordinate division 22, 23, and 26 requirements for equipment sequence of operations with unit manufacturer, for all equipment containing packaged controls. Adjustments shall be made in accordance with these specified requirements prior to Cx testing and recorded for record of final settings.

D. The Contractor shall certify that the TAB procedures have been completed and that TAB preliminary reports have been submitted, discrepancies corrected, and corrective work approved. The Contractor shall confirm that the equipment interface with monitoring and control system and TAB criteria, and where specified, the calibration of sensors and control devices is fully completed.

E. The Contractor shall certify that all safety cutouts, alarms and interlocks with smoke control and life safety systems during each mode of operation have been tested, discrepancies corrected and corrective work approved.

F. The Contractor shall confirm that all pre-functional check lists have been completed.

3.5 FUNCTIONAL PERFORMANCE TESTING

A. The responsible Subcontractor will execute the functional performance testing under the direction of the CxA. The CxA shall observe the functional performance test procedures for all of the sub systems, equipment and components associated with the systems to be commissioned.

B. Functional performance procedures may be executed by manual adjustment (i.e. manually manipulating the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system’s graphic trend log capabilities.

C. Functional performance test procedures shall be performed using design conditions whenever possible to confirm design performance.

1. If design conditions are not available then the functional performance test procedures shall be performed under conditions that simulate actual conditions to the closest practical approximation.

D. The Subcontractor executing the functional performance test procedure shall provide all necessary materials, system modifications, etc. to produce the flows, pressures, temperatures, etc. necessary to execute the test under specified conditions.

E. At completion of the functional performance testing, the Subcontractor executing the functional performance test procedure shall return all affected building equipment and systems to their normal operating condition. Contractor to release any overrides.

F. The functional test procedures are meant to allow the CxA to observe, evaluate, identify deficiencies, recommend modifications and document the systems and systems equipment performance over a range of load and functional levels. Below is a general list of support topics that may be requested of the contractor/subcontractor to support the Commissioning testing efforts. See section 1.12 for a list of systems to be commissioned, to better clarify expectations.

During the construction phase of the project, the CxA will generate functional performance test sheets that will define actual testing measures and rigor of testing:

1. Air & Water Distribution and Exhaust Systems:
   a. The CxA will require the TAB contractor to spot check air and hydronic systems for reported accuracy and/or as relates to the CxA scope of systems. This may include, but will not be limited to readings at registers, diffusers, traverses, pumps, coils, lab systems, building/space pressures, fans, etc.
   b. The CxA may require the TAB contractor to confirm calibration of ATC/HVAC/Plumbing devices which may include, but will not be limited to; Air flow stations, water flow devices, static pressure devices, temperature sensors, pressure devices, fume hood face velocity monitors, etc.

2. Automated Temperature Controls (inclusive of all applicable systems):

   a. The ATC Subcontractor shall demonstrate the proper operation of the specified and/or approved temperature control sequences for each system, sub systems, equipment and components serving the systems to be commissioned.
   b. In addition to sequence verification, The ATC subcontractor shall demonstrate, but not limited to, the following:

      1) Proper display of all ATC graphics.
      2) Point-to-point verification and calibration of controls devices (flow stations, thermostats, glycol refractometers, etc.)
      3) Point-to-point verification of dampers, actuators, valves, etc.
      4) Demonstrate systems reaction and operation when operating on emergency power.
      5) Integration with equipment packaged controls

3. Mechanical Systems:

   a. The mechanical subcontractor shall provide support as requested by the CxA to demonstrate proper operation and control of, but not limited to the air handling equipment, exhaust fans, VRF, FCU, UH, CUH, chilled beams, radiation, convection, cooling & heating plant, heat exchangers, pumps, DX, geothermal, or other systems that relate to or integrate with the systems being commissioned.

4. Plumbing Systems:

   a. The plumbing subcontractor shall provide support as requested by the CxA to demonstrate proper operation and control of, but not limited to the domestic water systems, emergency shower/eye wash stations, mixing valves, lab gas, compressed air, or other systems that relate to or integrate with the systems being commissioned.

5. Electrical Power Systems:

   a. The electrical subcontractor shall provide support as requested by the CxA to demonstrate proper operation and control of, but not limited to emergency power, photovoltaic, day lighting, lighting controls, thermal imaging of electrical

equipment, switching, or other systems that relate to or integrate with the systems being commissioned.

6. Communications (voice, data, video, etc.) Systems:

   a. The communication subcontractor shall provide support as requested by the CxA to demonstrate proper operation and control of, but not limited to communication devices, timeclocks, paging systems, public address systems, networking, or other systems that relate to or integrate with the systems being commissioned.
   b. The communication contractor shall notify the CxA of communication system testing that may be required by division section, or by equipment manufacturer showing integrity of the installed system.

7. Building Envelope Systems:
   a. The various trades that relate to the building envelope (may include but not limited to, division 3, division 7 & division 8) shall provide support as requested by the CxA to review and confirm proper installation of their materials or systems. Systems typically observed, but not limited to roofing, skylights, parapet assembly, air & vapor barrier systems, waterproofing, sealants, glazing, curtain walls, exterior doors, rain screens, flashing, etc.
   b. The CxA shall be notified for potential witness when system or material testing is specified in division sections is specified (ASTM, AAMA, etc.).

8. Life Safety Systems:

   a. The life safety subcontractor shall provide support as requested by the CxA to demonstrate proper operation and control of, but not limited to fire alarm devices and panels, fire protection temper/flow/pumping devices, security devices, device ring-in and mapping, smoke detection or smoke related systems, or other systems that relate to or integrate with the systems being commissioned

9. Envelope Testing

   a. The various trades that relate to the building envelope (may include but not limited to, division 3, division 7 & division 8) shall provide support as requested by the CxA to review and confirm proper installation of their materials or systems.

   b. Testing requirements are outlined in individual sections by the design team, with the help of the CxA and the owner.

   c. All performance testing of the envelope systems is the responsibility of the division contractor unless otherwise specified. Testing procedures per specified standard (ASTM, AMAA, etc.) shall be presented to the CxA for review 2 weeks prior to testing being scheduled.

10. Problem Solving

    a. The CxA may recommend solutions to problems found, however the burden of responsibilities to solve, correct and retest problems rests with the Contractor, Subcontractor, Architect and Engineering of Record.

11. Trend Logs:

    a. ATC contractor to provide trend logs as requested by the CxA in any format we deem necessary.

3.6 OPPOSITE SEASON/DEFERRED FUNCTIONAL PERFORMANCE TESTING

A. The purpose of opposite seasonal functional testing is to evaluate the performance of selected equipment during design weather conditions that may not have been available during the initial functional testing. Ideally cooling equipment needs to be functionally tested under hot, humid summer conditions to review proper operation in accordance with design specifications. The same is true for heating hot water, steam system and humidification systems which require colder, drier, winter climates.

B. The purpose of deferred functional performance testing is to evaluate the performance of a selected system that may have been partially complete during the initial functional performance testing of the system's components. Ideally systems need to be functionally tested once completed but, due to project phasing, may be completed at the component level before being completed at the system level.

C. The functional performance testing performed during seasonal/deferred testing will adhere to the guidelines listed above in section 3.6 in its entirety of this Section.

D. The documentation and resolution of any noted deficiencies will be performed in accordance with section 1.8 sub section H and section 3.7 in its entirety of this Section.

3.7 DOCUMENTATION OF COMPLIANCE AND NON-COMPLIANCE

A. Documentation:

1. The CxA will witness and document the results of the functional performance tests using the specific procedural forms (i.e. functional performance test sheets) developed for that purpose.
2. Recorded information will include measured performance data, visual observations and a comprehensive summary describing the operation of systems at the time of testing.
3. All functional performance test sheets, procedural forms, etc. used to document compliant and non-compliant performance will remain the property of the CxA until the end of the project at which point they will become the property of the Owner.

B. Compliance

1. The CxA will record the results of the functional performance testing on each specific procedural form. Tests found to be compliant with the testing criteria stated in the procedural form will be identified as such and submitted to the Owner for approval.
2. Where applicable, additional performance information may be recorded for future use or reference by the CxA when developing additional project documentation.

C. Non- Compliance

1. The CxA will record the results of the functional performance testing on each specific procedural form. Tests found to be non-compliant with the testing criteria stated in the procedural form will be identified as such.
2. Corrections of minor deficiencies identified may be made during the functional performance testing at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form for record.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
4. Should a deficiency be identified that cannot be readily corrected during the functional performance testing the CxA will notify the installing Contractor or Subcontractor. If there is no dispute regarding the nature of said deficiency then the installing Contractor or Subcontractor accepts the responsibility to correct it.
    a. The CxA will document the deficiency, the Contractor or Subcontractor's response and their intentions and proceed to the next functional performance test.
5. If functional performance tests cannot be completed because of a deficiency outside the scope of the Contractor or Subcontractor responsible for installation of the system or equipment to be commissioned then the deficiency shall be documented and reported to the Owner.
    a. The CxA will document the deficiency, the responsible Contractor or Subcontractor's response and their intentions and proceed to the next functional performance test.
6. After completion of the functional performance testing the CxA will publish all deficiencies through the web-based interactive commissioning database. At this point the deficiencies will be assigned a tag, responsibility and status and be known as "commissioning issues".
7. If there is any dispute regarding a specific commissioning issue or issues in general; whether the assigned responsibility or the nature of the issue are being disputed then the dispute will be documented and a copy given to the Contractor, Design Team and Owner for evaluation and resolution.
8. The intent is to make resolutions at the lowest management level possible. Other parties are brought into the discussions as needed. The Owner maintains the final interpretive authority.
9. Once the interpretation and resolution have been agreed upon by all parties, the appropriate party addresses the commissioning issue and updates the web-based interactive commissioning database indicating corrective action has taken place. The CxA will reschedule the functional performance test and the test will be repeated until satisfactory performance is achieved.
10. If it is determined that the system is constructed according to the Contract Documents the Owner will decide whether modifications required to bring the performance of the system to the OPR and BOD documents shall be implemented or if the noted performance will be accepted as submitted. If additional work is performed outside of the original project scope then the Owner will decide if functional performance testing shall be repeated and a revised functional performance test sheet submitted.

D. Cost(s) of Re-testing Non-Compliant System or Equipment

1. The cost for the Contractor or Subcontractor to perform re-testing, if they are responsible for the deficiency preventing a successful initial functional performance test, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the Owner.
2. The cost associated with the time used by the CxA to direct any re-testing required because a specific pre-functional checklist, start-up or commissioning notice issue, reported to have been successfully completed, but determined during functional performance testing to be incomplete, will be back-charged to the Contractor, who may choose to recover costs from the party responsible.
3. Packaged controls will be tested once by the CxA for conformance with the contract documents. The cost for the CxA to direct any re-testing of the packaged controls because the contractor or manufacturer is not prepared to manipulate the equipment to confirm compliance with the contract documents, or because the packaged controls fails to meet the project design documents or approved submittals, shall be back charged to the contractor.

E. Failure Due to Manufacturing Defect

1. If 10% or a total of three (3), whichever is greater, of pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance, all identical units may be considered unacceptable by the CxA. In such case, the responsible Contractor or Subcontractor shall provide the Owner with the following:
    a. Within one week of original notification the Contractor or Subcontractor shall coordinate with the vendor and/or manufacturer's representative and shall examine all other identical units making a record of the findings.
    b. Within two weeks of the original notification, the Contractor, Subcontractor vendor and manufacturer's representative shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals, training, warranty, etc.
    c. The proposed solution shall significantly exceed the specified requirements of the original installation and meet or exceed the performance identified in the Contract Documents.
    d. The Owner will determine whether a replacement of all identical units or a repair is acceptable.
    e. Two (2) examples of the proposed solution will be provided by the Contractor or Subcontractor and all parties will be allowed to test and review the performance for up to one week, upon which the Owner will decide whether to accept the proposed solution.
    f. Upon acceptance of the proposed solution by the Owner, the responsible party shall replace or repair all identical units, at their expense and extend the warranty accordingly, if the original equipment warranty had already begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when replacement parts or units can be obtained.

F. Cost(s) of Re-testing System or Equipment due to Manufacturing Defect

1. The cost for the Contractor or Subcontractor to perform re-testing, if they are responsible for providing the defective equipment, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the Owner.
2. The cost associated with the time used by the CxA to direct any re-testing required because of defective equipment, will be back-charged to the Contractor.

3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. The Contractor and Subcontractors shall be responsible for coordinating, scheduling and completing operations and maintenance training for the Owners designated personnel on all systems and equipment to be commissioned.

1. All training materials (agenda, hand-outs, etc.) shall be submitted to the CxA for review and approval at least two weeks in advance of scheduled training.
2. Equipment training shall be provided by a factory authorized technical representatives, experienced in training, operation and maintenance procedures for installed systems, subsystems and equipment.
3. All qualifications and certifications of the individual performing the training shall be submitted to the CxA for review and approval at least two weeks in advance of scheduled training.
4. Each Subcontractor responsible for training will submit a written training plan to the CxA for review and approval at least two weeks in advance of scheduled training. The plan will include field orientation during installation, classroom instruction and field training after the completion of installation and cover the following elements:
    a. Equipment (to be included in training must include all systems to be commissioned).
    b. Intended audience (list titles or names)
    c. Location of training
    d. Objectives
    e. Subjects to be covered (i.e. description, special methods, etc.)
    f. Duration of training on each subject.
    g. Tracking method to ensure all training is provided.
    h. Methods of instruction (i.e. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
    i. Instructor and qualifications
5. For all major systems and equipment, the ATC subcontractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others in addition to formal ATC training on work station operation, graphics, etc.
6. Subcontractors shall provide all qualified personnel, including manufacturer representatives, vendors, technicians, installing personnel, etc. for equipment and system training.

B. The CxA will oversee the training of Owner personnel for systems to be commissioned.

1. Training rigor: to be established by Owner and CxA.
2. In addition to these general requirements, the specific training requirements for Owner personnel are specified in Divisions 1 and the specific requirements identified in each Section.

C. All training shall meet the requirements per the following outline as follows:

1. List of those who should receive operational training (by position or name).
2. List of systems that require operator training.
3. Level of instruction required for each system.
4. Determination of whether the training provided by the equipment manufacturer is acceptable.
5. Tracking method to ensure that all persons receive training.

D. Training Planning Meeting: Before operation and maintenance training, CxA shall convene a training planning meeting to include Owner's operation and maintenance personnel, the Contractor, and the Subcontractors. In addition to requirements specified in other Divisions, the following will be reviewed with all in attendance:

1. Review of the and BOD.
2. Review installed systems, subsystems, and equipment.
3. Review instructor qualifications
4. Review instructional methods and procedures.
5. Review training module outlines and contents.
6. Review course materials (including operation and maintenance manuals.
7. Verify and discuss locations and other facilities required for instruction.
8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

3.9 EXCLUSIONS

A. The CxA is not responsible for the following: facilitating construction means or methods, regulating job site safety or providing any other unrelated management function.

B. The CxA is not responsible for providing Design Engineering services.

C. The CxA is not responsible for providing installation technician services requiring tools or the use of tools to functionally test, adjust or otherwise bring equipment into a fully operational state. The CxA shall observe technicians as they complete testing and but shall not perform installation or technician services. The Contractor and/or appropriate Subcontractor are responsible for providing all installation technician, vendor or manufacturer representative services as needed to meet the CxA's needs.

END OF SECTION 019113

SECTION 020100 – PROTECTION OF EXISTING UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 - Earthwork

C. Section 312333 - Trench Excavation and Backfill for Utilities

D. Section 312316 - Excavation, Backfill and Subgrade Preparation for Pavement

E. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. Identification and field mark out of all on-site utility lines to remain in operation during construction.

B. Identification and field markout of all off-site utility lines within construction work areas.

C. Submission of procedures to be used to ensure the safety of the utility.

D. Conduct test pit excavation at all proposed utility crossings prior to construction.

E. Repair of any damage during construction operations.

F. Relocate utilities that are indicated as such.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities and utility lines encountered during construction.

B. Accurately record actual locations and elevations of existing utilities at proposed utility crossings prior to utility and storm sewer construction. Submit recorded data to Owner's Engineer for verification of proposed design.

1.5 REGULATORY REQUIREMENTS

A. Contractor shall notify all affected utility companies, agencies, authorities, owners, etc. at least 48 hours prior to the commencement of work or as required by each agency and shall comply with their requirements.

B. Contractor shall contact the "Call Before You Dig" service for an official utility mark out.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Prior to commencement of work, contractor shall locate all existing utilities which are to remain in service and/or require relocating during construction as shown on the Contract Drawings. Contractor shall record location, depth from existing grade, size and type of existing utility. If existing utilities are in conflict with proposed improvements shown on the contract drawings, it shall be the responsibility of the contractor to inform the Owner and Owner's Engineer prior to commencement of work to determine alternate resolutions of conflict. Contractor shall take responsibility of utility relocation in the absence of such coordination prior to commencement of work.

3.2 PROTECTION

A. Flag, barricade or suitably protect existing utilities during construction operations and equipment movement. Install shoring and bracing as required.

B. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

3.3 LATERAL DISCONNECTION

A. Where a utility line is to be disconnected from portions to remain, the lateral pipes shall be cut and suitably plugged/capped in accordance with the Contract Drawings and applicable utility or agency requirements.

3.4 REPAIRS

A. Any damage to existing, operational utilities by the Contractor or his subcontractors during the on-going construction operation shall be immediately repaired to operational standards at the Contractor's expense. If the repairs are not immediately addressed by the Contractor, the utility owner and/or the Owner shall have the right to contract for the repair at the Contractor's expense.

3.5 RELOCATIONS

A. Where utility lines are designated to be relocated, construct new utilities as shown and in accordance with these specifications and then remove former service to minimize disruption to the best extent practical. This operation shall be coordinated with the appropriate Authorities, as necessary.

B. Coordinate with the Owner for necessary shut-offs or temporary disruption to existing services.

END OF SECTION

SECTION 022113 - PROJECT SURVEYING AND LAYOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 – Earthwork

C. Section 321216 – Asphaltic Concrete Pavement

D. Section 321613 – Curbs and Sidewalks

E. Section 101453 – Traffic Control Signage

F. Section 265600 – Site Lighting

G. Section 334100 – Storm Sewer System

H. Section 333000 – Site Sanitary Sewer

I. Section 337100 – Utilities

J. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. The Contractor shall employ a Connecticut Licensed Land Surveyor to do all necessary surveying required to construct all elements of the Project as shown on the Contract Drawings and specified herein.

B. Once survey items are laid out, it is the contractors' responsibility to ensure that all survey stakes are protected and that data remains in good usable condition. Should the survey marks or data need to be replaced, additional survey work will be the responsibility of the contractor, and will be performed at no additional cost to the Owner.

C. All surveys shall be signed and sealed by the Contractor's Land Surveyor, licensed to practice in the State of Connecticut.

D. All project installations improperly constructed as a result of Contractor error shall be properly relocated by the Contractor at no cost to the Owner.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. In accordance with local rules and regulations.

1.5 QUALITY ASSURANCE

A. All construction layout work shall be performed under the direction of a Professional Land Surveyor.

B. The survey crew will discuss all layout procedures with the Contractor's supervisor prior to commencing work.

C. The survey crew daily report shall be filled out and signed by the Contractor's supervisor at the end of that day's layout.

D. Copies of sketches, cut sheets, etc. shall be provided to the Contractor by the end of the next workday.

E. All costs related to re-staking due to construction or Contractor's work resulting in destruction or movement of stakes shall be paid for by the Contractor and at no additional expense to the Owner.

F. Building dimensions to be coordinated with approved architectural plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all instruments, equipment, stakes, monuments, marking paints and other materials necessary to perform the work satisfactorily.

PART 3 - EXECUTION

3.1 GENERAL

A. Qualified personnel and adequate equipment shall be made available by the Contractor to maintain control points and layout all lines and grades throughout the duration of the Contract.

B. The exact position of all work points shall be established from control points, base line transit points and/or other points of similar nature based upon information provided in Contract Documents.

C. The Contractor shall establish, re-establish when necessary and maintain control points throughout the life of the Contract to permit the Engineer to make the necessary preliminary, interim and final measurements and to check the Contractor's layout.

D. The Contractor shall be responsible for the preservation of all control points. If control points are damaged, lost or moved, they shall be reset at no additional expense to the Owner. Control points outside as well as inside the Contract Limits shall be used for construction.

E. The Contractor shall provide and maintain offset stakes for each base line, at each station, and out of the limits of grading and construction. Each stake shall be identified and marked to show the offset distance from the base line and the Contractor shall furnish sheets showing cuts and fills to the finished profile and cross section lines.

F. Any error, apparent discrepancy or absence of data shown or required for accurately accomplishing the survey work shall be referred to the Owner’s Engineer for interpretation or furnishing when such is observed or required.

G. The Owner’s Engineer may check all or any portion of the survey work or notes made by the Contractor. Any necessary correction to the work shall be made immediately by the Contractor. Such verification by the Owner’s Engineer shall not relieve the Contractor of any responsibilities for the accuracy and completeness of his work.

H. The Contractor shall keep a survey transit and level with tripod and survey rod on the project at all times to be used for checking inverts, surveyor’s stakes, etc.

I. The Contractor shall submit all survey data for daily checks, to the office of the Owner’s Engineer after the data is obtained.

J. The Contractor shall submit cut sheets for the Owner’s Engineers approval prior to any construction activity, for the purpose of verifying the construction layout. Cut sheets for any particular item of work shall be submitted prior to the need for approval. All cut sheets shall be prepared by a Licensed Land Surveyor and shall bear his seal and signature.

K. In cases where extra excavation is required, before and after cut sheets shall be submitted for determination of quantities for excavation and backfill and extra bedding.

L. All project installation improperly constructed or located as a result of inadequate or erroneous survey layout shall be relocated or reconstructed, after demolition and/or removal of the improper work as necessary, by the Contractor at no charge to the Owner.

3.2 LAYOUT

A. Building Layout – Set a minimum of 6 corners with 2 offsets per corner. Also included will be a finished floor elevation and/or benchmark within close proximity to the proposed building.

B. Curb Layout – Stakes will be located at 50-ft stationing and also at the point of curvature, points of tangency and radius points with 4-ft offsets to the face of the curb. Cut sheets shall be provided to the Contractor by the Surveyor.

C. Storm drainage and sanitary sewer lines (including manholes and catch basins) – Stakes will be located at 50-ft stationing along the centerline of the utility at 15-ft offsets. Manholes and catch basins will have 2 offsets per structure. Cut sheets shall be provided to the Contractor by the Surveyor.

D. Water Layout – Offset stakes will be located at deflections and at hydrant locations. Hydrant elevations will be to grade ring.

E. Grade Stakes – Stakes will be located @ 50 ft. stationing along the centerline of the roadway at finished grade elevations. Off roadway areas will be at a 50 ft. grid at finished grade elevations. Cut sheets shall be provided to the contractor.

F. Lighting Layout – Centerline of lighting structure with 5-ft offsets and finished grade elevations.

G. Allowable tolerances for the project shall be generally as follows:

1. Structural work, site furnishings: horizontal location 0.1 feet; vertical elevation 0.01 feet.
2. Paving, fine grading: vertical elevation 0.1 feet.
3. Utility lines and structures: vertical elevation 0.1 feet
4. Light Poles: horizontal location 0.1 feet; vertical elevation 0.1 feet
5. Trees: horizontal location 0.5 feet.

END OF SECTION

SECTION 024113 – SITE DEMOLITION

PART 1 GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Contract Drawings and all other specification sections along with all provisions included within this contract package, instructions to bidders, and other general conditions apply to this section. The Contractor must accept the site as is and shall be deemed to have inspected the site and reviewed all Contract Documents prior to submitting a bid.

C. Section 020100 - Protection of Existing Utilities

D. Section 312500 - Soil Erosion and Sediment Control

E. Section 312333 - Trench Excavation and Backfill for Utilities

F. Section 329300 - Landscape Planting

G. Construction Drawings

1.2 SCOPE OF WORK

A. Overall work under this Contract shall include all labor, materials, equipment, supervision, coordination efforts, permitting costs, certificate costs, services, filing fees, testing costs, security, insurance and all other associated or related items specified herein that are necessary and are required to complete the Work. Work includes all demolition required to complete the project regardless of whether the demolition is specifically indicated on the drawings. Elements shall include, but not be limited to the following:

1. Demolition and removal of all existing site structures not indicated to remain including, but not limited, to modular buildings, fencing, gates, walls, railings, and free-standing items (e.g. bollards, signs, sign posts, light poles, light pole bases, canopies, benches, etc.)
2. Demolition, removal, and/or disposal of all excess topsoil, stumps, roots and organic materials, removal of existing sidewalks, drives, curbs, pavement, infield surfacing, etc.
3. Removal/Abandonment of existing above-ground and underground utilities and associated structures, including septic fields, tanks, sanitary pump station, roof leaders, other utility appurtenances and irrigation. It shall be the responsibility of the Contractor to accurately locate all facilities and to determine their extent. If such facilities obstruct the progress of the work and are not indicated to be removed or relocated, they shall be removed or relocated only as directed by the Owner.

4. Installation and maintenance of soil erosion and sediment control measures.
5. Removal from site and disposal of all excess and unusable material in accordance with applicable regulations.
6. Transportation and disposal in an appropriately licensed landfill of all demolition debris not recycled or reused on-site.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. National Association of Demolition Contractors (NADC) - Demolition Safety Manual, latest edition.

B. All applicable OSHA requirements and other Federal, State, and local codes, laws, ordinances, regulations, and guidelines for demolition and related work.

C. International Building Code, latest edition.

1.5 QUALITY ASSURANCE

A. The Contractor shall provide and maintain a capable and experienced field person representing the Contractor to oversee all demolition operations. The representative shall be on site during all operating hours of the project and shall prepare field reports documenting the progress of the demolition.

B. The Contractor shall obtain and pay for any permits, bonds, licenses, etc., required for demolition work.

C. The Contractor shall conduct any work within street or highway right-of-ways in accordance with the requirements of the governmental agencies having jurisdiction and shall not begin until these governing authorities have been notified. The Contractor shall restore to their present conditions any public right-of-way that is disturbed by the work under this section. All pavement restoration work in public rights-of-way shall be performed to the proper satisfaction of the governmental agencies having jurisdiction.

D. The Contractor shall dispose all construction debris in accordance with all jurisdictional agencies.

1.6 SUBMITTALS

A. PERMITS

1. Prior to the commencement of work, the Contractor shall submit to the Owner record copies of all required permits and certificates obtained for the work in this section. The Contractor shall incur all fees and other requirements associated with obtaining the required permits and certificates.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Noise-producing activities shall be held to a minimum. Internal combustion engines and compressors, etc., shall be equipped with mufflers to reduce noise to a minimum. The Contractor shall comply with all noise abatement ordinances.

B. The work areas shall be sufficiently dampened to prevent dust from rising during demolition activities.

C. The Contractor shall see to it that trucks leaving the site shall use construction entrances only, as indicated on the project soil erosion and sediment control documents and do so in such a manner that mud and earth will not be deposited on adjacent street pavements. Any mud or earth deposited on street pavements shall be promptly removed by the Contractor.

D. Trucks exiting the site shall be appropriately covered.

1.8 TEMPORARY SHORING AND PROTECTION

A. Any damage done by the Contractor to existing pipe lines, utilities, etc., to remain shall be repaired by the Contractor and at his expense in a manner acceptable to the Owner of the damaged property. The Contractor shall report any existing damage prior to his beginning work.

B. The Contractor shall provide necessary temporary shoring, bracing, etc., and maintenance thereto required in accordance with all applicable OSHA Standards for the completion of demolition work. The contractor shall submit copies of all temporary excavation bracing designs intended for use onsite, signed and sealed by a Professional Engineer licensed in the state of Connecticut to the Owners Site Engineer for review prior to constructing the bracing onsite.

C. The Contractor shall insure the provisions of adequate bracing, shoring, lamps, fencing, warning signs, and flags as required by agencies having jurisdiction and as directed by the Owner. Remove same when necessity for protection ceases.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials are as specified on the Contract Drawings. See related sections for additional product specifications.

PART 3 - METHOD OF CONSTRUCTION

3.1 GENERAL

A. The Contractor is responsible for the demolition of existing buildings, concrete slabs, retaining walls, walks and curb, asphalt pavement, utilities, signs and miscellaneous items encountered. All demolition debris shall be disposed off-site in accordance with all applicable Federal, State, and Local codes and regulation governing legal transportation and disposal of work.

B. The general scope of demolition work is shown on the Contract Drawings. The Contractor shall include for all demolition work necessary to accomplish the construction project.

3.2 SITE VISIT

A. The Contractor shall visit the site and verify the location of all pertinent items prior to submitting a bid so that the difficulties associated with execution of the contract are fully understood. No additional compensation will be allowed for failure to be so informed.

3.3 UTILITIES

A. GENERAL:

1. Existing utilities service shall not be interrupted unless authorized in writing by authorities having jurisdiction and the Owner of the utility. Any temporary interruption necessary shall be directly coordinated and supervised by utility company personnel. The Contractor shall provide temporary services during interruptions to existing utilities, as acceptable to governing authorities and the affected utility companies and users.

B. MAINTENANCE:

1. The Contractor shall maintain and protect from damage all existing above and below ground utilities that are to remain. Other utilities to remain include, but are not necessarily limited to, above ground utility lines and transformers within the public right-of-ways. The Contractor shall immediately repair or have repaired by the appropriate utility company any damage incurred by utilities during demolition work at no cost to the Owner or municipality. The Contractor shall be responsible for notifying and coordinating with the appropriate utility companies the shut-off of utilities that are to be abandoned as part of this Contract.

C. ABANDONMENT/REMOVAL:

1. The Contractor shall disconnect and cap/terminate all services including but not limited to water, storm and sanitary sewers, gas, electric, telephone, cable TV, etc. prior to demolition. The Contractor shall determine if utility laterals to be demolished are direct and exclusive to a building before disconnection is performed.

2. Prior to removal, all utilities and sewers shall be properly purged and evacuated of all residual gases, oils, etc. or de-energized in the case of electric, telephone or other communications services. All purging and testing shall be approved by local utility or sewer companies and governing authorities having jurisdiction.

3. All utility disconnections shall be performed no later than 15 days prior to the scheduled start of demolition and must precede the demolition permit application procedure.

D. RESTORATION:

1. All underground utility lateral removals shall be properly backfilled and all disturbed pavements within the public right-of-way shall be restored to their pre-demolition (existing) condition. This includes the restoration of concrete pavement, concrete curbing, and asphalt pavement within the public right-of-way. All pavement and curbing shall be saw-cut prior to excavation in order to produce a clean and neat edge. Replacement pavement and curbing shall be equal in design performance to the existing condition and as directed by the Consultant and/or the local authority having jurisdiction. All restoration work shall be performed immediately following utility removal and backfill completion.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. GENERAL:

1. The Contractor shall remove from the site all debris, rubbish and other materials resulting from demolition and shall safely and legally dispose of all these items in accordance with applicable Federal, State and local codes and regulations.

B. REMOVAL:

1. The Contractor shall legally and safely transport and dispose off-site all demolished materials in accordance with local, State and Federal regulations governing such operations.

2. The Contractor shall be responsible for locating and making arrangements for the safe, legal disposal of demolition material off-site during the entire course of the Contract.

END OF SECTION

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARYs

A. The Work of this Section Includes:

1. Demolition and removal of buildings or structures.
2. Demolition and removal of site improvements.
3. Removing below-grade construction.
4. Disconnecting, capping or sealing, and removing site utilities.
5. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.

2. Section 017400 “Construction Waste Management” for disposal of construction debris.

3. Section 018110 “Sustainable Design Requirements” for LEED compliance requirements.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements that are not part of building demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and finalize protection requirements.
4. Review procedures for dust control.
5. Review storage, protection, and accounting for items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.

B. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services. Indicate how long services will be interrupted.
3. Coordination for shutoff and capping of utility services.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials:

1. Hazardous materials are present in buildings and structures to be demolished.

a. Hazardous material remediation is specified in Section 028213 "Asbestos Abatement", Section 028313 “Lead Paint Activity”, and Section 028433 “Removal and Disposal of PCBs”.

E. On-site sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged. Photograph or video conditions that might be misconstrued as damage caused by removal.

2. Photograph or video existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations or removal of items for salvage.

3.2 PREPARATION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

D. Existing Utilities to Remain: Maintain utility services to remain and protect against damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

E. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
1. Arrange to shut off utilities with utility companies.
2. Cut off pipe or conduit a minimum of 24 inches below grade at or outside the building or structure to be demolished and cap, valve, or plug and seal remaining portion of pipe or conduit in accordance with requirements of authorities having jurisdiction.
3. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing by authorities having jurisdiction.

F. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least one hour after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.4 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction:

1. Demolish foundation systems and other below-grade construction.

a. Remove below-grade construction, including basements, foundation systems, and footings, completely.

D. Existing Utilities:

1. Demolish and remove existing utilities and below-grade utility structures.

3.5 SITE RESTORATION

A. Below-Grade Areas:

1. Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them in accordance with Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 028200 - SELECTIVE HAZARDOUS BUILDING MATERIALS ABATEMENT DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide selective demolition to remove existing carpeting/multiple layers of flooring/ wood/concrete and demolish ceilings **(INCLUDING METAL CEILINGS THROUGHOUT)**/walls/floors/doors/millwork/shelving/countertops/ window systems/door systems/concrete/boilers/chases/mechanical systems/ductwork/piping/ roofing/ masonry/stone/brick/wall and ceiling systems/raised flooring/wall materials (bulletin/chalk/white /etc. boards, mirrors), non-moveable objects, etc. as necessary to access all asbestos/PCB/other hazardous containing materials as specified herein, and as required for complete and proper abatement.

B. The hazardous building materials contractor (contractor) will be responsible for performing selective interior and exterior demolition throughout the building that is scheduled for demolition (assume selective demolition of walls, non-movable objects, floors, ceilings **(INCLUDING METAL CEILINGS THROUGHOUT)** is required in every room/area). Contractor shall open up walls, chases and ceilings to check for hidden piping and ductwork (as required for entire building in areas of work) as well as demolishing millwork, cabinetry, all non-moveable objects, walls, chases etc. to located potential asbestos containing flooring materials and other suspect asbestos containing materials that may be hidden, buried, inaccessible.

C. The contractor(s) will be responsible for hiring an engineer and other appropriate personnel to ensure that all required selective demolition and demolition activities are safe to perform for all personnel on site. The contractor(s) will be financially responsible for any damage that may occur to the site, on-site personnel, fines, penalties, etc. They will also be responsible for paying/reimbursing all legal fees/costs for all parties involved with the project should selective demolition or demolition activities cause injury or death to any persons on site.

D. Please note there are several layers of flooring, ceilings, walls, chases, non-moveable objects requiring demolition to access all asbestos containing materials, some of which are contaminated with asbestos/PCBs and require disposal as such.

E. Required permits shall be obtained by the Contractor at no additional cost to the Owner.

F. Notes: Contractor is responsible for removing all asbestos containing materials (behind walls, ceilings, windows, chases, doors, windows, concrete, brick, non-moveable objects, etc.) in selective demolition/demolition areas as noted by the architect's specifications and drawings.

G. The contractor will be required to remove carpeting and other flooring, wood floors, classroom wall and ceiling structures, raised flooring, multiple layers of mixed flooring to gain access to the asbestos flooring and/or mastic and carpet adhesives in all areas. There are more than one layer

of flooring in most locations. All layers of floor tile, leveling materials, mastic, concrete, wood, thinset, sheet flooring, rubber, rolled or poured flooring, carpet adhesives, etc. are included in the base work, no extra change will be accepted. Demolition or moving typical non-movable objects by the abatement contractor is required to gain access to all flooring materials to be removed. SD sheets for chemicals to be used during the project must be submitted to the owners' representative prior to site delivery.

H. The contractor will be required to remove roofing, window and door systems, mechanical systems, flooring, walls, ceilings, wall applications/masonry, brick, concrete, glazed block, millwork, shelving and cabinetry to access all asbestos containing materials for abatement/remediation and packaging for recycling/removal/abatement and disposal.

I. Related Sections:

1. Section 028213 – Asbestos Abatement
2. Section 028313 – Lead-Based Paint Awareness
3. Section 028416 – Universal Waste Removal and Recycling
4. Section 028432 – PCB Remediation
5. HBM – 01– Hazardous Building Materials Abatement Drawing

1.2 PROJECT CONDITIONS

A . Occupancy:

1. Areas of the buildings in which selective demolition/demolition will occur will be unoccupied during work.

B. Existing Conditions:

1. After the project is begun, the Contractor is responsible for the condition of the structures to be selectively demolished.
2. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate and fully submit an accurate, detailed, written report to the office of the Consultant. While awaiting a response, reschedule operations if necessary to avoid delay of overall project.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and sealed.

B. Insofar as is practicable, arrange operations to reveal unknown or concealed conditions for examination and verification before removal or demolition.

C. Verify actual conditions to determine, in advance, whether removal or demolition of any element will result in structural deficiency, overloading, failure, or unplanned collapse.

1. Demolish and remove connections to all electrical gas, and plumbing fixtures required to remove asbestos containing materials.

3.2 PREPARATION

A. Traffic: Do not obstruct walks or public ways without the written permission of governing authorities and of the Owner. Where routes are permitted to be closed, provide alternate routes if required.

B. Protection:

1. Provide for the protection of persons passing around or through the area of demolition.
2. Perform demolition so as to prevent damage to adjacent improvements and facilities to remain.
3. Protect walls, floors, and other new or existing work from damage during demolition operations.

C. Damages: Without cost to the Owner and without delay, repair any damage caused to facilities to remain.

3.3 POLLUTION CONTROLS

A. Control as much as practicable the spread of dust and dirt.

B. Observe environmental regulations.

C. Do not allow water usage resulting in freezing or flooding.

D. Do not allow adjacent improvements to remain to become soiled by demolition operations.

3.4 DEMOLITION - GENERAL

A. Remove: Items indicated to be removed shall be removed by the Contractor.

B. Existing to Remain: Construction or items indicated to remain shall be protected against damage during demolition operations. Where practical, and with the Owner's permission, the Contractor may elect to remove items to a suitable storage location during demolition and then properly clean and reinstall the items.

C. Perform work in a systematic manner.

D. Demolish and remove existing construction only to the extent required, as indicated in the Contract Documents.

E. Perform selective demolition using methods that are least likely to damage work to remain and which will provide proper surfaces for patching.

F. Remove debris daily.

G. Use any methods permitted by governing regulations and the requirements of the Contract Documents.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of materials resulting from demolition operations. Non-contaminated material (materials not containing residue asbestos, lead, PCB or other hazardous, regulated or special waste) may be disposed of as construction waste. Do not allow materials to accumulate on site.

B. All rubbish and waste material from the Work shall be neatly stacked or kept in suitable containers and removed from the premises daily. The premises shall be kept clean and in an orderly condition at all times to the satisfaction of the Owner and the Consultant.

C. Transport materials resulting from demolition operations and legally dispose of off-site.

D. Off-site disposal location shall not be within one-half mile of any portion of the project site or within sight of the project site.

E. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

3.6 CLEANING

A. Throughout the construction period, the Contractor shall maintain the building and site free of rubbish, debris, surplus materials, and other items not required for the Work.

B. Remove such material from the site daily to prevent accumulations.

C. Remove all construction debris from work areas, and remove all hazardous waste and asbestos waste as required by the most current federal, state, and local regulations and the requirements of the specifications.

END OF SECTION

SECTION 028213 - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028313 – Lead-Based Paint Awareness
3. Section 028416 – Universal Waste Removal and Recycling
4. Section 028432 – PCB Remediation
5. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 CONSULTANT

A. The Owner shall retain Langan for the purposes of project management and monitoring during Asbestos Abatement. The Consultant will represent the Owner in all phases of the abatement project at the discretion of the Owner. The Asbestos Abatement Contractor will regard the Consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items. The State of Connecticut licensed Asbestos Consultant — Project Designer is Matthew Myers (license no. 000058).

1.3 USE OF THE CONTRACT DOCUMENTS

A. It shall be incumbent upon the Contractor to visit the Site and determine what exists, its condition, and what will be required to accomplish the Work intended by the Contract Documents. No increase in the Contract Sum will be permitted as a result of the Contractor's failure to visit the Site and understand the existing conditions.

B. All work shall comply with the Contract Documents and with applicable Codes, laws, regulations, and ordinances wherever applicable. The most stringent of all the foregoing shall govern.

C. It is not intended that the Specifications show every detail of the Work, but the Contractor shall be required to furnish within the Contract Sum all material and labor necessary for the completion of the Work in accordance with the intent of the Specifications.

D. In case of ambiguity among the Contract documents, the more stringent requirement as determined by the Consultant shall prevail.

E. The Work of this Contract includes making modifications as necessary, subject to approval by Owner in consultation with the Consultant, to correct any conflicts.

F. All items, not specifically mentioned in the Specifications but implied by trade practices to complete the work, shall be included.

G. This specification and drawings cover the proper and legal removal and disposal of all asbestos-containing materials (ACM) and asbestos contaminated waste from the Hillcrest Middle School demolition project site located in Trumbull, Connecticut. The abatement activities shall comply with all aspects of the contract documents and Federal, State and local requirements.

H. Whenever there is a conflict or overlap within these specifications and between applicable codes and regulations, the most stringent provision specified shall apply.

1.4 EXAMINATION OF THE SITE

A. It is understood that the Contractor has examined the Site and made his own estimates of the facilities and difficulties attending the execution of the Work, and has based his price thereon.

B. Except for unforeseeable concealed conditions as determined by the Consultant, the Contractor shall make no claim for additional cost due to the existing conditions at the Site.

1.5 CONTRACTOR QUALIFICATIONS

A. All bidders shall submit a record of prior experience in asbestos abatement projects, listing no less than three (3) completed jobs in the past year, with all projects of similar size and scope. The Contractor shall list the experience and training of the project foremen and all on-site personnel. The information that should be included is as follows:

1. Project Name and Address
2. Owner's Name and Address
3. Architect/Consultant
4. Contract Amount
5. Date of Completion
6. Extras and Changes

B. The Contractor selected must appear on the approved list of Asbestos Abatement contractors on file at the State of Connecticut Department of Public Health (CT DPH) and hold a valid license for asbestos abatement within the State of Connecticut.

C. Submit a written statement regarding whether the Contractor has ever been found out-of-compliance with federal or state asbestos and/or lead regulations pertaining to worker protection, removal, transport, or disposal.

D. The Contractor shall be responsible for obtaining all necessary or required permits from the Federal, State and local agencies having jurisdiction over this asbestos abatement project. Failure on behalf of the Contractor to obtain these permits shall not result in any extension for the timely results of completion of the work set forth in the Contract. The Contractor shall be responsible and shall be required to pay any administrative penalties imposed on the owner for actions taken or lack thereof by the Contractor.

E. Work includes any and all selective demolition and protective measures required to access and remove ACM and maintain a safe working environment.

F. Upon completion of asbestos removal, the contractor shall provide completed, signed and notarized statements indicating that all asbestos-containing materials identified in the scope of work and project description (Section 1.08 and 1.09) were properly removed and disposed of in accordance with applicable Federal, State, and local regulations.

G. All contractors submitting a bid for this work shall visit the work site, attend a pre-bid meeting and walk-through, to be scheduled by the Owner, and be familiar with the work in its entirety. The contractors pre-meeting attendance and bid submission affirms his/her acceptance of the work, site, and building conditions as is.

H. All Contractor personnel involved with asbestos removal work must be thoroughly familiar with the standard operating procedures of the Contractor for removal work as well as all applicable Federal and State regulations governing asbestos removal work.

I. The Supervisor and Asbestos Abatement workers shall be accredited in accordance with EPA regulation 40 CFR Part 763, subpart E, Appendix C; and CT DPH regulations as outlined in Section 19a-332a-1 through 19a-332a-16 (Standards for Asbestos Abatement), and Section 20-440-1 through 20-440-9 (Licensure and Training Requirements for Persons Engaged in Asbestos Abatement and Consulting Services).

J. The Contractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the Contractor of its obligation to furnish all labor and materials necessary to perform the work. Any discrepancies noted shall be brought to the attention of the Owner and Engineer prior to bidding the project. No claims for extras shall be made during construction/abatement /demolition.

K. Work includes necessary selective demolition and protective measures required to access and remove ACM and maintain a safe working environment. Asbestos containing materials that would be impacted by selective demolition of wall, ceiling and floor cavities shall be performed within negative pressure enclosure.

L. It is the sole responsibility of the Contractor to determine what, if any patents are applicable to the Project. The Contractor will pay all royalties and/or license fees, and will defend all suits or claims for infringement of any patent rights and save the Owner, Architect, Asbestos Safety Control Monitor, Design Sub-Consultant, and Construction Manager harmless from loss, including attorney's fees, on account thereof.

M. The Contractor shall coordinate with the Consultant and maintain the project schedule.

N. The abatement contractor shall hold and document daily pre-abatement safety tool box meeting to review safe work practices and emergency communication program for the project. The abatement contractor's supervisor and the consultant's project monitor must also ensure that proper fire extinguishing equipment is present. The supervisor shall be knowledgeable in use of fire extinguishing equipment, and emergency exit plans.

1.6 TESTING LABORATORY SERVICES

A. The Contractor shall submit to the Consultant the name; address and qualifications of proposed laboratories intended to be utilized for sample analysis as required by this section and the laboratories must be approved by CT DPH.

1.7 ADDITIONAL GENERAL REQUIREMENTS

A. The Asbestos Abatement Contractor shall employ a competent Asbestos Abatement Supervisor with at least three (3) years' experience on projects of similar scope and magnitude who shall be responsible for all work involving asbestos abatement as described in the specifications and defined in applicable regulations, and have full time daily supervision of the same. The Supervisor shall be the competent person as defined by OSHA regulations.

B. The Contractor shall allow the work of this contract to be inspected if required by local, state, federal, and any other authorities having jurisdiction over such work. The Contractor shall immediately notify the Owner and Consultant and shall maintain written evidence of such inspection for review by the Owner and Consultant.

C. The Contractor shall incur the cost of all fines resulting from regulatory non-compliance as issued by federal, state, and local agencies. The Contractor shall incur the cost of all work requirements mandated by federal, state, and local agencies as a result of regulatory non-compliance or negligence.

D. The Contractor shall immediately notify the Owner and Consultant of the delivery of all permits, licenses, certificates of inspection, of approval, or occupancy, etc., and any other such instruments required under codes by authorities having jurisdiction, regardless of who issued, and shall cause them to be displayed to the Owner and Consultant for verification and recording.

1.8 SCOPE OF WORK

A. This specification and drawing HBM – 01 cover the proper and legal removal and disposal of all asbestos-containing materials (ACM) and asbestos contaminated waste to be impacted by demolition activities from the Hillcrest Middle School project site located in Trumbull, Connecticut. The abatement activities shall comply with all aspects of the contract documents and Federal, State and local requirements. There is interior friable and non-friable asbestos containing materials (thermal system insulation and miscellaneous materials) identified on the site. Lead-based paint was identified on the interior metal ladder in custodial office. Sealant compounds throughout the building, are assumed to contain greater than 50 ppm PCB (bulk product waste). Universal wastes are located throughout the building that is slated for demolition.

1.9 PROJECT DESCRIPTION

A. Trumbull Hillcrest Middle School was constructed in 1966. The school is a one-story building with classrooms, offices, auditorium/cafeteria, kitchen, media center, gymnasium, pool, planetarium, greenhouse, toilet rooms, storage rooms, and boiler/

mechanical rooms and is approximately 119,000 square feet. A new school will be constructed on site and the existing building will be abated and demolished.

B. The base bid includes the removal and disposal of all asbestos containing materials as identified herein, and on the architects drawings by workers meeting requirements of OSHA 1926.1101 for Class 1 and 2 work. The base bid will include the cost for removal and disposal of asbestos-containing clock/speaker tar, transite tabletops and tabletop adhesives, laboratory sink caulking compound, transite laboratory hood and box, laboratory test tube rack and adhesive, laboratory countertops, electrical insulation, light backing paper, black tar on concrete block, black duct paper/tar, duct insulation pin adhesive, dark red fire penetration sealant, older 9”x9” and 12”x12” floor tiles and black mastic, black mastic underneath 12”x12” floor tiles, ceramic wall and floor tile grouts and mud beds, rock wall damp-proofing tar/paper, damp-proofing tar/paper behind brick walls, transite board and damp-proofing tar/paper behind stone paneling, display case, wall, ceiling, ceramic wall, door, door/window wall, window, door window, sill, foundation, wall, vent, rock wall and wall expansion caulking and glazing compounds, conduit putty, and roofing materials. Work includes filing and permitting all necessary applications, notifications, requirements and fees; insurance; necessary design services; providing skilled, licensed and certified labor; materials; and equipment necessary for proper preparation, handling, removal and legal disposal of all asbestos-containing materials and asbestos contaminated waste from the subject building in accordance with all requirements of applicable federal, state and local regulations, these specifications and the contract drawings. The following materials and amounts are included in the base bid work.

Material	Location	Estimated Quantity of ACM
Clock/Speaker Tar (Black) – Miscellaneous Material	Throughout Building	ALL – 80 Clock/Speaker Units
Transite Tabletops and Tabletop Adhesive (Black) – Miscellaneous Materials (Substrates Contaminated)	Classrooms C1, C5 and C5 Computer Room	ALL -165 Square Feet (SF)
Laboratory Sink Caulking Compound – Miscellaneous Material (Substrates Contaminated) (Assumed PCB Bulk Product Waste Also)	Classrooms A12, A13 and A14, A17 and A17 Prep Room	34 Sinks
Transite Laboratory Hood and Box – Miscellaneous Materials	Classroom A17 and A17 Storage Room	ALL - 82 SF
Laboratory Test Tube Rack and Adhesive – Miscellaneous Materials (Substrates Contaminated)	Classroom A17	ALL - 16 SF

Material	Location	Estimated Quantity of ACM
Laboratory Countertops and Adhesives – Miscellaneous Materials	Classrooms A17, A17 Prep Room and A12 – Student, Teacher and Perimeter, Classrooms A13 and A14 – Teacher and Perimeter and Classroom C5 Computer Room	ALL – 1,300 SF
Electrical Insulation – Miscellaneous Materials	Auditorium/Cafeteria and Stage	ALL - 11 Spotlights and Eight Light Trays (80 Linear Feet (LF))
Light Backing Paper – Miscellaneous Material	Gymnasium Storage Room 1	ALL - One Light Fixture Visible
Black Tar on Concrete Block/Wall Materials – Miscellaneous Material (Substrates Contaminated)	Main Office Areas/Wing	ALL – 20 SF May Exist in Additional Hidden Locations - Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%
Black Duct Paper/Tar – Miscellaneous Material (Substrates Contaminated)	Main Office Areas/Wing	ALL – 40 SF May Exist in Additional Hidden Locations - Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%

Material	Location	Estimated Quantity of ACM
Duct Insulation Pin Adhesive – Miscellaneous Material (Substrates/Adjacent Materials Contaminated)	Auditorium/Cafeteria Stage, Gymnasium, Gymnasium Storage Closets 1 and 2 and Planetarium Closet	ALL - 1,050 SF May Exist in Additional Hidden Locations - Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%
Dark Red Fire Penetration Sealant – Miscellaneous Material (Substrates Contaminated)	Throughout Building	ALL
Pipe Fitting and Roof Drain Insulation – Thermal System Insulation (Substrates/Adjacent Materials Contaminated)	Throughout Building – Visible in Some Locations and Assumed Inside Pipe Chases, Behind Fixed Ceilings (Metal Deck and Other Ceilings), Etc. (Throughout All Rooms/Areas) (Requires select demolition throughout walls/ceilings/etc.)	ALL - Unknown – Estimate 3,000 SF/Fittings (one fitting/one roof drain equals one SF) Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%

Material	Location	Estimated Quantity of ACM
Older 9”x9” and 12”x12” Floor Tiles and/or Black Mastic and Black Mastic Underneath Newer 12”x12” Floor Tiles – Miscellaneous Materials (Substrates/Adjacent Materials Contaminated) (Assume Multiple Layers)	Planetarium Closet/Mechanical Room, Weight Room, Toilet Room Adjacent Classroom C11 and Throughout Building Underneath Millwork/Cabinetry/Fixed Object/Gypsum Walls – Older Floor Tiles/Mastic Throughout Building – Black Mastic Underneath Newer Floor Tiles/Flooring	ALL -70,000 SF Assume Containments Are Required for Each Room/Area For Hidden Flooring Materials (and other materials listed in specifications) Non-Moveable Objects to be Demolished Throughout Building Prior to Abatement Containment Construction Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%
Ceramic Wall and Floor Tile Grouts and Mud Beds – Miscellaneous Materials (Substrates/Adjacent Materials Contaminated)	Throughout Inside of Pool	ALL – 5,800 SF
Rock Wall Damp-Proofing Tar/Paper – Miscellaneous Material (Substrates/Adjacent Materials Contaminated)	Exterior Classrooms D4, Media Center, Planetarium, Main Entrance, Auditorium/Cafeteria and Courtyards (Did Not Find Damp-Proofing Behind Interior Rock Walls Investigated in Multiple Locations)	ALL – 8,000 SF Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%

Material	Location	Estimated Quantity of ACM
Damp-Proofing Tar/Paper Behind Brick Walls/Walls (including at foundation) – Miscellaneous Materials (Substrates/Adjacent Materials Contaminated)	Throughout Exterior	ALL – 35,000 SF Negotiated Unit Pricing will be used to add or deduct to the estimated asbestos quantity if the amount removed is different by less/more than 20%
Transite Board and Damp-Proofing Tar/Paper Behind Stone Wall/Window Paneling – Miscellaneous Materials (Substrates/Adjacent Materials Contaminated)	Throughout Exterior	ALL – 6,700 SF
Interior Display Case, Wall, Ceiling, Ceramic Wall, Door, Door/Window Wall, Door Window, Window Caulking and Glazing Compounds – Miscellaneous Materials (Substrates Contaminated) (Assumed PCB Bulk Product Waste Also)	Throughout Building Interior and Greenhouse – All Areas/Rooms/Corridors/Etc.	ALL
Exterior Window, Sill (Including Underneath Sills), Wall, Foundation, Door, Door Window, Door/Window Wall, Vent, Rock Wall, Wall Expansion and Other Caulking and Glazing Compounds – Miscellaneous Materials (Substrates Contaminated) (Assumed PCB Bulk Product Waste Also)	Throughout Exterior (Including Greenhouse)	ALL

Material	Location	Estimated Quantity of ACM
Conduit (Electrical and Other) Putty – Miscellaneous Material (Substrates Contaminated)	Throughout Exterior	ALL
Roof Dome Black Paper Material Underneath Metal/Outer Roofing – Miscellaneous Material (Substrates/Adjacent Materials Contaminated)	Planetarium Exterior	ALL
Roof Field and Flashing Materials (Black Middle Layer(s)) – Miscellaneous Materials (Substrates/Adjacent Materials Contaminated – All Layers)	Pool and Media Center Exterior (Curved Roofs)	ALL
Roof Penetration Flashing Materials – Miscellaneous Materials (All Layers) (Substrates/Adjacent Materials Contaminated)	Exterior Roofs Throughout	ALL

C. Abatement and Remediation in all areas will start with removing materials at the ceiling level and end with the materials at the flooring level. The hazardous building materials contractor will coordinate and perform enough selective demolition/demolition to access all materials to be removed/abated/remediated. Contractor shall open walls and ceilings to check for hidden piping, ductwork, etc. (as required for entire building in areas of work) as well as demolishing millwork, cabinetry, desktops, flooring, all non-moveable objects, walls, chases etc. to locate potential asbestos containing flooring materials and other suspect asbestos containing materials that may be hidden, buried, inaccessible (only demolish materials scheduled for selective demolition /demolition). Exterior abatement/remediation will be either removed in containment (interior) or the abatement/remediation contractor will install polyethylene sheeting on the interior of the building and remove materials from the exterior. All ground and roof surfaces must also be protected with tarps, plywood and two layers 10-mil reinforced polyethylene sheeting. This ground protection must extend at least 20 feet away from the building foundation (or farther - enough to prevent building materials from touching unprotected ground and floor surfaces). The contractor will pay for all contamination/remediation/ abatement of interior and exterior surfaces, including ground surfaces if Langan deems they have contaminated these surfaces.

D. The hazardous building materials contractor will be required to perform multiple mobilizations for the abatement/remediation work.

E. Additional materials as discovered outside of those listed will be covered by unit prices if all is not listed as the quantity. Quantities are estimates only and should be verified by the Contractor. Safety data sheets for chemicals to be used during the project must be submitted to the Owner's Representative prior to site delivery. The contractor is responsible for providing temporary water, power, and heat as needed at the site. Temporary lighting/Blast Trac machines/Negative air units within the work areas must be connected to Ground Fault Circuit Interrupter (GFCI) Power Panels installed by a State of Connecticut licensed electrician and located outside of the work areas.

F. The contractor shall be responsible for paying the utility bills for the use of power and water (unless owner agrees to supply at no cost to contractor). However, if any such temporary facilities cannot be provided, it shall be the contractor's responsibility to provide all fixed and temporary connections and hook-ups as well as obtaining permits and paying all fees for making such services available for his work as is necessary. If necessary, the Contractor shall provide temporary services as specified herein, and as required or as necessary to carry out the work. This may include such items as portable generators, water tank trucks, pumps and necessary accessories or the means and equipment and services necessary to temporarily connect to and maintain such services from adjacent utility systems. The use of portable generators will require 24 hour a day, 7 day a week continuous operation if negative air machines in containments are powered by them. This continuous operation must remain in place from the time the pre-abatement visual is completed up until clearance re-occupancy sampling results have passed. The contractor will pay the owner a $2,500 penalty should the power found to not be running the negative air machines in active abatement containments. This penalty will apply daily and the contractor is also responsible for paying all CT DPH fines that may be imposed on the contractor and owner. The contractor shall also comply with any local permits that may be required as well as local noise ordinances.

G. The general/abatement contractors shall only use heavy equipment operators that have proper asbestos and/or HAZWOPER training when disturbing/removing/moving and packing asbestos, lead-based paint and PCB containing materials. Acceptable training for asbestos can be 32 or 40 hour asbestos worker/supervisor with annual refresher training. 40 hour HAZWOPER training and annual refresher training is required for operators handling lead and/or PCB containing/contaminated materials. All operators must also have current medicals, fit test data and wear respirators during work.

H. The remediation/asbestos abatement contractor, their subcontractors, waste transporters and/or landfill(s) do not have permission to take/analyze building materials for PCB content/ concentrations without written permission from the building owner prior to such sampling. Should the contractor or other parties listed above take/analyze PCB samples without the owner’s permission and PCB’s are found to be >1 ppm, the hazardous materials/remediation contractor will be responsible for **all costs** associated with the abatement/ remediation/replacement of all the interior/exterior building materials and adjacent surfaces, including soil/asphalt/concrete/etc. as well as all costs associated with project delays, attorney fees for all parties affected and all costs resulting from CT DEEP/EPA requirements that may occur as a result.

I. The remediation/asbestos abatement contractor, their subcontractors, waste transporters must submit landfill information to Langan and the owner prior to the shipment of any waste. The contractor(s)/hauler(s) cannot ship waste until Langan and the owner have

approved the landfill the contractor/hauler is/are proposing to ship the waste to. PCB TCLP sampling of the waste may be required by the landfills permits and this testing must be performed by the contractor (if testing is approved by Langan and the owner), with Langan present during sampling, and the results made available to Langan and the owner prior to waste shipment. If Langan is not present during the sampling, Langan may perform additional PCB TCLP sampling to confirm the contractor's results and these results will supersede the contractors sample results.

J. The contractor(s) will be responsible for hiring an engineer and other appropriate personnel to ensure that all required selective demolition and demolition activities are safe to perform for all personnel on site. The contractor(s) will be financially responsible for any damage that may occur to the site, on-site personnel, fines, penalties, etc. They will also be responsible for paying/reimbursing all legal fees/costs for all parties involved with the project should selective demolition or demolition activities cause injury or death to any persons on site.

K. The Owner shall retain a Consultant for the purposes of project management and monitoring during asbestos abatement. The Consultant will represent the Owner in all phases of the abatement project at the discretion of the Owner. The asbestos abatement contractor will regard the consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items. The State of Connecticut licensed Asbestos Consultant — Project Designer is Matthew Myers (license no. 000058).

1.10 DEFINITIONS

A. The following definitions relative to asbestos abatement apply:

1. Abatement - Procedures to control fiber release from asbestos-containing materials; includes removal, encapsulation, and enclosure.
2. Air Monitoring - The process of measuring the fiber concentration of an area or of a person.
3. Amended Water - Water to which a surfactant has been added.
4. Asbestos - The name given to a number of naturally occurring fibrous silicates. This includes the serpentine forms and the amphiboles and includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, or any of these forms, which have been chemically altered.
5. Asbestos Felt - a product made by saturating felted asbestos with asphalt or other suitable bindery, such as a synthetic elastomer.
6. Asbestos Fibers - Those particles with a length greater than five (5) microns and a length to diameter ratio of 3:1 or greater.
7. Asbestos Work Area - a regulated area as defined by OSHA 29 CFR 1926.1101 where asbestos abatement operations are performed which is isolated by physical barriers to prevent the spread of asbestos dust, fibers, or debris. The regulated area shall comply with requirements of regulated area for demarcation, access, respirators, prohibited activities, competent persons and exposure assessments and monitoring.

8. Asphalt Shingles, Composition Shingles or Strip Slates: (Pitched Roof Shingle) - a roofing material manufactured by saturating a dry felt with asphalt then coating the saturated felt with a harder asphalt mixed with a fine mineral, glass fiber, asbestos or organic stabilizer. All or part of the weather side may be covered with mineral granules, or with powdered talc or mica.
9. Base Flashing (roof) - the flashing provided by upturned edges of a water tight membrane on a roof. May contain metal and associated waterproofing material or combination of roofing felts and waterproofing at the joint between a roofing surface and a vertical surface such as a wall or parapet. Also base flashing may be present at perimeter of completely flat roof.
10. Built-Up Roofing (Composition Roofing, Felt and Gravel Roofing, Gravel Roofing) - a continuous roof covering made up of laminations or plies of saturated or coated roofing felts, alternated with layers of asphalt or coal-tar pitch and surfaced with gravel, paint or finish coat.
11. Caulking - resilient mastic compound often having a silicone bituminous or rubber base; used to seal cracks, fill joints, and prevent leakage. Typical applications: around windows, and doors. Caulking is at joints between two dissimilar materials. (i.e. masonry to wood, masonry to steel)
12. Clean Room - An uncontaminated area or room, which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.
13. Clearance Sampling - Final air sampling performed aggressively after the completion of the abatement project in a regulated area.
    Air samples collected by the air sampling professional having a fiber concentration of less than 0.01 fibers/cc of air in each of five (5) samples collected inside the containment will denote acceptable clearance sampling by Phase Contrast Microscopy.
    or
    Five air samples collected inside the containment by the air sampling professional having an average asbestos concentration of less than 70 structures per square millimeter of air will denote acceptable clearance sampling for Transmission Electron Microscopy.
14. Competent Person - As defined by 29 CFR 1926.1101, a representative of the Abatement Contractor who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure. Who has authority to take prompt corrective measures to eliminate such hazards during asbestos removal. Competent person shall be properly trained in accordance with EPA's Model Accreditation Plan.
15. Curtained Doorway - A device to allow ingress and egress from one area to another while permitting minimal air movement between the areas. Two curtained doorways spaced a minimum of six feet apart can form an airlock.
16. Damp Proofing - application of a water impervious material to surface such as wall to prevent penetration of moisture, typically at foundation or below grade surface.
17. Decontamination Enclosure System - A series of connected areas, with curtained doorways between any two adjacent areas, for the decontamination of workers and equipment. A decontamination enclosure system always contains at least one airlock and is adjacent and connected to the regulated area, where possible.
18. Encapsulant - A liquid material which can be applied to asbestos-containing materials which controls the possible release of asbestos fibers from the materials

either by creating a membrane over the surface (bridging encapsulant) or penetrating the material and binding its components together (penetrating encapsulant).

19. Equipment Room - Any contaminated area or a room that is part of the worker decontamination enclosure with provisions for storage of contaminated clothing and equipment.
20. Fixed Object - Unit of equipment or furniture in the work areas that cannot be removed from the work area.
21. Friable Asbestos Materials - Any material that contains more than 1% asbestos by weight, that can be crumbled, pulverized or reduced to powder by hand pressure.
22. Glazing Compound - any compound used to hold window glass in place, also referred to as putty, or glazier's putty, is not field applied, usually installed during manufacture of windows.
23. HEPA Filter - High Efficiency Particulate Air (HEPA) filter in compliance with ANSI Z9.2-1979.
24. HEPA Vacuum Equipment - Vacuum equipment equipped with an HEPA filter system for filtering the effluent air from the unit.
25. Movable Object - Unit of equipment of furniture in the work area that can be removed from the work area.
26. Negative Air Pressure Equipment - A portable local exhaust system equipped with HEPA filtration used to create negative pressure in a regulated area (negative with respect to adjacent unregulated areas) and capable of maintaining a constant, low velocity air flow into regulated areas from adjacent unregulated areas.
27. NESHAPS - National Emissions Standard for Hazardous Air Pollutants regulations enforced by the EPA.
28. Permissible Exposure Level (PEL) - The maximum airborne concentration of asbestos fibers to which an employee is allowed to be exposed. The new level established by OSHA 29 CFR 1926.1101 is 0.1 fibers per cubic centimeter of air as an eight (8) hour time weighted average and 1.0 fibers /cc averaged over a sampling period of 30 minutes as an Excursion Limit. The Contractor is responsible for maintaining work areas in a manner that this standard is not exceeded.
29. Project Monitor - A professional capable of conducting air monitoring and analysis of schemes. This individual should be an industrial hygienist, an environmental scientist, or an engineer with experience in asbestos air monitoring and worker protection equipment and procedures. This individual should have demonstrated proficiency in conducting air sample collection in accordance with 29 CFR 1910.1001 and 29 CFR 1926.1101.
30. Regulated Area - An area established by the employer to demarcate where Class I, II, and III asbestos work is conducted and any adjoining area where debris and waste from such asbestos work accumulate, and a work area within which airborne concentrations of asbestos exceed or there is a reasonable possibility that they may exceed the PEL.
31. Shower Room - A room between the clean room and the equipment room in the work decontamination enclosure with hot and cold running water and suitably arranged for employee showering during decontamination. The shower room is located in an airlock between the contaminated area and the clean area.
32. Waterproofing - material, usually a membrane or applied compound (tar/mastic), used to make a surface impervious to water, includes concealed conditions

(applications around doors, windows, and in wall cavities). Sometimes combined with felts.

1.11 SUBMITTALS

A. Pre-Work Submittals: Within 7 days prior to the pre-construction conference, the Contractor shall submit 3 copies of the documents listed below to the Owner and Engineer for review:

1. Valid Contractor's Asbestos Removal license issued by the Connecticut Department of Public Health (CT DPH).
2. Certificate of insurance covering work of this Contract.
3. Name, experience of supervisors, and copies of valid Asbestos Supervisor permits issued by the CT DPH.
4. Citations/Violations/Legal Proceedings: Submit a statement describing:

    a. Any citations, violations, criminal charges, or legal proceedings undertaken or issued within the past two years by any law enforcement, regulatory agency, or consultant concerning performance on previous abatement contracts. Briefly describe the circumstances citing the Project and involved persons and agencies as well as the outcome of any actions.
    b. Any litigation or arbitration proceedings arising out of performance on past Projects.

5. Work Schedule:

    a. Show the complete sequence of abatement activities and the sequencing of work within each building section.
    b. Show the dates for the beginning and completion of each major element of work including substantial completion dates for each work area, building, or phase.
    c. Show projected percentage of completion for each item, as of the first day of each month.
    d. Show final inspection dates.

6. Project Notifications: As required by Federal, State, and local regulatory agencies together with proof of transmittal (i.e. certified mail return receipt). The contractor shall notify the Connecticut Department of Public Health and US EPA Region 1 at least ten (10) days prior to the start of asbestos abatement, as required by the Regulations of Connecticut State Agencies, Section 19a-332a-3 and EPA.
7. Abatement Work Plan: The Contractor shall design, prepare and submit to the Authority for review and approval, a detailed asbestos removal plan for the project in accordance with the applicable regulations and these specifications. The plan shall, at minimum, show limits of containment and work areas, methods of removal, location of decontamination units, number and location of negative air units, waste routes, waste storage location, entrance and exits, emergency exits, and any necessary details. Work shall not commence until the Authority has reviewed, commented and approved the contractor's asbestos removal plan. Provide plans which clearly indicate the following:

a. All Work Areas/containment numbered sequentially.
b. Locations and types of all decontamination enclosures.
c. Entrances and exits to the Work Areas/containment.
d. Type of abatement activity/technique for each Work Area/containment.
e. Number and location of negative air units and exhaust. Also provide calculations for determining number of negative air pressure units.
f. Proposed location and construction of storage facilities and field office.
g. Location of water and electrical connections to building services.
h. Waste transport routes through the building to the waste storage container.

8. Contingency plan.
9. Name, location, and applicable licenses for primary and secondary landfill for disposal of asbestos-containing material and asbestos contaminated waste.
10. Summary of proposed materials, and equipment to be used.
11. Certification that vacuums, temporary ventilation equipment, and other equipment to be used meet the ANSI 29.2-79 requirement for airborne fiber filtration.
12. If rental equipment is to be used in work area or to transport asbestos contaminated waste, provide notice to rental agency stating intended use of equipment, with copy to the Authority.
13. Summary of the Contractor's workforce by disciplines. Include a notarized statement signed by the Contractor documenting that all proposed workers, by name, have received all required medical examinations and have been properly trained and certified in asbestos removal work, respirator use, to appropriate EPA and OSHA standards for asbestos removal. Include on statement Contractor's compliance with OSHA medical surveillance requirements.
14. The Contractor shall submit his/her Health and Safety Plan and Standard Operating Procedures for this project for use in complying with the requirements of these Specifications and applicable regulations. The Plan shall include, but shall not be limited to: distribution and use of amended water, the sequencing of asbestos work, detailed schedules and dates, shift times, and work activities during that shift, the interface of other trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the Site, security of the work areas, and a detailed description of the methods to be employed to control airborne fiber concentrations.
15. Written description of emergency procedures to be followed in case of injury or fire. This section must also include evacuation procedures, sources of medical assistance and procedures for access by medical personnel.
16. Level of respiratory protection intended for each operation for the project.

B. Project Closeout Submittals: Submit the following to Owner and Consultant at the close out of the Project (no later than 15 days subsequent to site demobilization):

1. Originals of all waste disposal manifests, seals, and disposal logs.
2. OSHA compliance air monitoring records conducted during the work.
3. Daily progress log.

a. A list of all workers used in the performance of the Project, including name, social security number, and CT DPH certification number.
b. For each worker used in the performance of the project, submit required employee statements including Medical Examination Statement, Worker's

Acknowledgment Statement, Respirator Fit Test, and Employee Training Statement.

c. Certification for the laboratory that analyzed the OSHA personnel air samples.

d. A notarized “Release of Liens” in a form acceptable to the owner. Such notarized release of liens shall certify that all sub-contractors, labor suppliers, etc. have been paid their pro rate share of all payments to date for the project, that the contractor has no basis for further claims, and will not make further claims for payment in any account after the first payment is made to him.

1.12 MEDICAL REQUIREMENTS

A. Prior to potential exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1910.1001, and 29 CFR 1926.1101.

1. This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1910.1001, and 29 CFR 1926.1101 within the past year.
2. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within thirty (30) calendar days before or after the termination of employment in such occupations.

B. As required by 29 CFR 1910.1001, and 29 CFR 1926.1101 maintain complete and accurate records of employees' medical examinations for a period of thirty (30) years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either of them, and an employee’s physician upon the request of the employee or former employee.

C. The Contractor shall furnish the Owner evidence of its firm's medical surveillance program required under 29 CFR 1910.1001, and 29 CFR 1926.1101.

1.13 REGULATIONS AND STANDARDS

Regulatory compliance includes but is not necessarily limited to applicable requirements set forth by:

A. Federal Regulations:

1. 29 CFR 1910 and 1926 – Construction and General Industry Standards
2. 29 CFR 1910.1001, "Asbestos" (OSHA)
3. 29 CFR 1910.1200, "Hazard Communication" (OSHA)
4. 29 CFR 1910.134, "Respiratory Protection" (OSHA)
5. 29 CFR 1910.145, "Specification for Accident Prevention Signs and Tags" (OSHA)
6. 29 CFR 1910.146, “Permit Required Confined Spaces” (OSHA)
7. 29 CFR 1926, "Construction Industry" (OSHA)

8. 29 CFR 1926.1101, "Asbestos, Tremolite, Anthophyllite, and Actinolite" (OSHA)
9. 29 CFR 1926.500 "Guardrails, Handrails and Covers" (OSHA)
10. 40 CFR 61, Subpart A, "General Provisions" (EPA)
11. 40 CFR 61, Subpart M, "National Emission Standards for Hazardous Air Pollutants (NESHAP)" (EPA)
12. 40 CFR 763 Subpart E, “Asbestos in Schools Regulations” (EPA)
13. 49 CFR 171-172, Transportation Standards (DOT)

B. Connecticut Regulations:
State requirements which govern asbestos abatement work and hauling and disposal of asbestos waste materials include but are not necessarily limited to the following:

1. Connecticut Department of Energy and Environmental Protection (Solid Waste Management Regulations).
2. Connecticut Department of Public Health (CT DPH) regulations outlined in Section 19a-332a-1 through 19a-332a-16 “Standards for Asbestos Abatement”
3. CT DPH regulations outlined in Section 20-440-1 through 20-440-9 “Licensure and Training Requirements for Persons Engaged in Asbestos Abatement and Consulting Services”
4. Connecticut Department of Labor (CT DOL)
5. Connecticut Department of Transportation (CT DOT)

C. Local Regulations:
Local agencies which may govern or have certain requirements regarding asbestos abatement work or hauling and disposal of asbestos waste materials include but are not necessarily limited to the following:

1. Building Department
2. Health Department
3. Fire Department

D. Standards and Guidance Documents:

1. American National Standard Institute (ANSI) Z88.2-80, Practices for Respiratory Protection
2. ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems
3. EPA 560/585-024, Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
4. EPA 530-SW-85-007, Asbestos Waste Management Guidance

1.14 EXEMPTIONS

A. Any deviations from these specifications require the written approval and authorization from the Owner and Consultant.

B. Any modifications from the standard work practices identified in the CT DPH Standards for Asbestos Abatement, Sections 19a-332a-1 to 19a-332a-16 must be requested in writing, and approved in writing from the CT DPH.

1.15 FINAL AIR CLEARANCE

A. Following the completion of the encapsulation phase of the work, the Consultant shall collect final air clearance samples inside the work area per AHERA regulation 40 CFR Part 763 and in compliance with CT DPH regulations. The Owner of the facility shall be responsible for payment of the sampling and analysis of the initial final air clearance samples only. The contractor shall be responsible for payment of all costs associated with the collection and analysis of additional final air clearance samples if the first set of samples fail to satisfy the clearance criteria.

1.16 NOTIFICATIONS, POSTINGS, SUBMITTALS, AND PERMITS

A. The contractor shall make the following notifications, and provide the submittals to the following agencies prior to the commencement of removal work. This notification is required ten (10) calendar days prior to the start of the abatement project:

1. U.S. EPA, Region 1
   5 Post Office Square, Suite 100 (OES05-4)
   Boston, MA 02109-3912

2. Connecticut Department of Public Health
   410 Capital Avenue MS #12 AIR
   P.O. Box 340308
   Hartford, CT 06134

B. The minimum information included in the notification to these agencies includes:

1. Name and address of building Owner/Operator
2. Building location
3. Building size, age, and use
4. Amount of friable asbestos
5. Work schedule, including proposed start and completion date
6. Asbestos removal procedures to be used
7. Name and location of disposal site for generated asbestos waste, residue, and debris
8. If landfill opens in Connecticut to accept ACM waste, Consultant will notify CT DEEP prior to utilizing said landfill.

1.17 WORK SITE SAFETY PLAN

A. The contractor shall establish a set of emergency procedures and shall post them in a conspicuous place at the work site. The safety plan should include provisions for the following:

1. Evacuation of injured workers.
2. Emergency and fire exit routes from all work areas.
3. Emergency first aid treatment
4. Local telephone numbers for emergency services including ambulance, fire, and police.

5. A method to notify occupants of the building in the event of a fire or other emergency requiring evacuation of the building.

B. The contractor is responsible for training all workers in these procedures.

1.18 INDEPENDENT AIR SAMPLING AND ASBESTOS ABATEMENT MONITORING

A. This section describes independent air sampling work being performed on behalf of the Owner. This work is not in the Contract Sum. This section describes air monitoring carried out by the Owner's Consultant to verify that the building beyond the work area and the outside environment remains uncontaminated. (Personal air monitoring required by OSHA is work to be performed by the Contractor and is within the Contract Sum.)

B. The purpose of the Owner's Consultant's air monitoring is to detect faults in the work are isolation such as:

1. Contamination of the building outside of the work area by airborne asbestos fibers.
2. Failure of filtration or rupture in the differential pressure system.
3. Contamination of air outside the building envelope by airborne asbestos fibers.

Should any of the above occur the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Do not recommence work until authorized by the Owner's Consultant.

C. The Owner's Consultant will monitor airborne fiber counts in the Work Area. The purpose of this air monitoring will be to detect airborne asbestos concentrations, which may challenge the ability of the Work Area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

D. To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Consultant will sample and analyze air in accordance with clearance air sampling requirements.

E. The Owner's Consultant will perform on-site monitoring throughout the course of the project, as follows:

1. All work procedures shall be continuously monitored by the Consultant to assure that areas outside the designated work locations in the buildings will not be contaminated.
2. Prior to work on any given day, the Contractor's designated "competent person" shall discuss the day's work schedule with the Consultant to evaluate job tasks with respect to safety procedures and requirements specified to prevent contamination of the building or the employees. This includes a visual survey of the work area and the decontamination of the building or the employees. This includes a visual survey of the work area and the decontamination enclosure systems.

1.19 CONTRACTOR’S AIR SAMPLING RESPONSIBILITY

A. The contractor shall independently retain a CT licensed asbestos project monitor to monitor airborne asbestos concentrations in the workers' breathing zone and to establish

conditions and work procedures for maintaining compliance with OSHA Regulations 29 CFR 1910.1001 and 1926.1101.

B. The Contractor's project monitor shall document all air sampling results and provide a report to the Consultant within 24 hours after sample collection.

C. All air sampling shall be conducted in accordance with methods described in OSHA Standards 29 CFR 1910.1001 and 1926.1101 and the OSHA Respiratory Protection Standard 29 CFR 1910.134.

D. A minimum of 20% of all workers in each working category (i.e., gross removal, final clearance, etc.) must be monitored each day of asbestos removal activities.

E. Phase Contrast Microscopy may be used to analyze personal air samples. The Contractor shall arrange and pay for all costs of the testing. Laboratories used shall be currently enrolled in the American Industrial Hygiene Association Proficiency Analytical Testing Program or an equivalent recognized program and approved by CT DPH.

1.20 PROPER WORKER PROTECTION

A. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

B. All workers are to be accredited as abatement workers as required by the AHERA regulation 40 CFR 763 Appendix C to Subpart E, February 3, 1994.

C. The contractor is required to be certified and accredited as required by the State of Connecticut Department of Public Health Services.

D. In accordance with 29 CFR 1926 and 20-440-7 RCSA, all workers shall receive a training course covering the dangers inherent in handling asbestos, the dangers of breathing asbestos dust, proper work procedures, and proper worker protective measures. This course must include but is not limited to the following:

1. Methods of recognizing asbestos
2. Health effects associated with asbestos
3. Relationship between smoking and asbestos in producing lung cancer
4. Nature of operations that could result in exposure to asbestos
5. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

    a. Engineering controls
    b. Work Practices
    c. Respirators
    d. Housekeeping procedures
    e. Hygiene facilities
    f. Protective clothing
    g. Decontamination procedures
    h. Emergency procedures

6. Waste disposal procedures
7. Purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR 1910.134
8. Appropriate work practices for the work
9. Requirements of medical surveillance program
10. Review of 29 CFR 1926
11. Pressure Differential Systems
12. Work practices including hands on or on-job training
13. Personal Decontamination procedures
14. Air monitoring, personal and area

E. The Contractor shall provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8-hour Time Weighted Average and/or enter regulated areas. In the absence of specific airborne fiber data provide medical examinations for all workers who will enter the Work Area for any reason. Examination shall, at a minimum, meet OSHA requirements as set forth in 29 CFR 1926 In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

F. Submit the following to the consultant for review. The contractor shall not start work until these submittals are returned with consultant action stamp indicating that they are approved.

1. Submit copies of certificates from an EPA-approved AHERA abatement workers course for each worker as evidence that each asbestos abatement worker is accredited as required by the AHERA Regulation 40 CFR 763 Appendix C to Subpart E, February 3, 1994.
2. Submit evidence that the contractor is certified to perform asbestos abatement work by the State of Connecticut Department of Public Health services.
3. Submit documents verifying that each worker has had a medical examination within the last 12 months as part of compliance with OSHA medical surveillance requirements. Submit, at a minimum, for each worker the following:

    a. Name and Social Security Number
    b. Physicians Written Opinion from examining physician including at a minimum the following:

4. Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.
5. Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.
6. Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.
7. Copy of information that was provided to physician in compliance with 29 CFR 1926
8. Statement that worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.

9. Submit copies of certificates for the site supervisor and the workers issued by CT DPH.

G. Submit certification signed by an officer of the abatement-contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.

H. The Contractor shall maintain control of and be responsible for access to all work areas to ensure the following requirements:

1. Non-essential personnel are prohibited from entering the area.
2. All authorized personnel entering the work area shall read the "Worker Protection Procedures" which are posted at the entry points to the enclosure system, and shall be equipped with properly fitted respirators and protective clothing.
3. All personnel who are exiting from the decontamination enclosure system shall be properly decontaminated.
4. Asbestos waste that is taken out of the work area must be properly bagged and labeled in accordance with these specifications. The surface of the bags shall be decontaminated. Asbestos leaving the enclosure system must be immediately transported off-site or immediately placed in locked, posted temporary storage on-site, and removed within 24 hours of the project conclusion.
5. Any material, equipment, or supplies that are brought out of the decontamination enclosure system shall be cleaned and decontaminated by wet cleaning and/or HEPA vacuuming of all surfaces.

1.21 ALTERNATE WORK PRACTICES

A. The contractor and/or consultant may obtain services of a CT DPH certified asbestos project designer and submit application for variances to the CT DPH, as applicable for any alterations, modifications or non-conforming methods intended of asbestos removal. Methods requiring variances include but are not necessarily limited to glove-bagging, use of tent procedures, remote decons, etc. The alternative procedures shall be submitted in writing and hand delivered or post marked at least ten (10) days before the project start date. CT DPH may approve an alternative procedure for an asbestos abatement project with certain conditions that would provide equivalent or a greater measure of asbestos emission control than the conventional work practices. The alternate work practice request form shall be signed and sealed by a Licensed Designer. Any fees associated with the application shall be paid by the Contractor. All alternative work practices (AWPs) must be approved and accepted by Langan’s project designer regardless if they have been approved by CT DPH. The abatement contractor will be required to propose a credit to the building owner/client/consultant that must be reviewed and accepted prior to AWP submission to CT DPH.

1.22 POST-PROJECT CLOSEOUT

A. The contractor shall provide all required documentation as required by this specification once his/her work is complete, final clearances passed and asbestos waste disposed of. This should include but not be limited to: bound copy of the daily log containing log of daily work activities, all supervisor and worker certificates of training and Connecticut licenses, certificates of insurance, daily sign in sheets, containment entry/exit logs, copy of recording manometer charts, waste shipment records, personal air monitoring laboratory reports and chain-of-custody documentation, and project completion certificate. Final payment shall not be made to the contractor until all required documentation is submitted and verified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name and product technical description.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with asbestos shall be decontaminated or disposed of as asbestos waste.

C. Polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to the job site with factory label indicating 4 or 6 mil.

D. Polyethylene disposable bags shall be six (6) mil with pertinent pre-printed label. Tie wraps for bags shall be plastic, five (5) inches long (minimum), pointed and looped to secure filled plastic bags.

E. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

F. Surfactant (wetting agent), shall consist of fifty (50) percent polyoxyethylene ether and fifty (50) percent polyoxyethylene ester, or equivalent, and shall be mixed with water to provide a concentration of one (1) ounce surfactant to five (5) gallons of water or as directed by manufacturer.

G. Removal encapsulant shall be non-flammable factory prepared penetrating chemical encapsulant found acceptable to Consultant. Usage shall be in accordance with manufacturer's printed technical data.

H. The contractor shall have available spray equipment capable of mixing wetting agent with water and capable of generating sufficient pressure and volume and having sufficient hose length to reach all areas with asbestos.

I. Impermeable containers are to be used to received and retain any asbestos-containing or contaminated materials until disposal at an acceptable disposal site. The containers shall be labeled in accordance with OSHA Standard 29 CFR 1926.1101. Containers must be both air and watertight.

J. Labels and signs, as required by OSHA Standard 29 CFR 1926.1101, will be used.

K. Encapsulant shall be bridging or penetrating type which has been found acceptable to the consultant. Usage shall be in accordance with manufacturer's printed technical data.

L. HEPA filtered local exhaust ventilation shall be utilized during the installation of enclosures and supports where asbestos-containing materials may be disturbed.

2.2 TOOLS AND EQUIPMENT

A. The contractor shall provide all tools and equipment necessary for asbestos removal, encapsulation and enclosure.

B. The contractor's air monitoring professional shall have air-monitoring equipment of type and quantity to monitor operations and conduct personnel exposure surveillance per OSHA requirements.

C. The contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, polyethylene sheeting of proper size and thickness, tape and air filters.

D. The contractor shall provide (as needed) temporary electrical power panels, electrical power cables, and electrical power sources (such as generators). Any electrical connection work affecting the building electrical power system shall be performed by a State of Connecticut licensed electrician and the contractor shall obtain all necessary local permits.

E. The contractor shall have available shower stalls and plumbing to support same to include sufficient hose length and drain system or an acceptable alternate.

F. Exhaust air filtration system units shall contain HEPA filter(s) capable of sufficient air exhaust to create negative pressure of -0.02 inches of water within enclosure with respect to outside area. Equipment shall be checked for proper operation by smoke tubes or differential pressure gauge before the start of each shift and at least twice during the shift. Adequate exhaust air shall be provided for a minimum of four (4) air changes per hour within the enclosure. No air movement system or air filtering equipment shall discharge unfiltered air outside.

G. Vacuum units, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

H. The contractor will have reserve units so that systems will operate continuously.

2.3 RESPIRATORY PROTECTION

A. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

B. Respirators shall be individually fit-tested to personnel under the direction of an Industrial Hygienist on a yearly basis. Fit-tested respirators shall be permanently marked to identify the individual fitted, and use shall be limited to that individual. Fit-test records shall be maintained on-site for each employee.

C. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators (PAPR) are the minimum allowable respiratory protection permitted to be utilized during gross removal operations. The Contractor shall use supplied air respirator for confined space requirements. PAPR's are the minimal respiratory protection required for all thermal system insulation and surfacing asbestos abatement.

D. No respirators shall be issued to personnel without such personnel participating in a respirator training program.

E. High Efficiency Particulate Air (HEPA) respirator filters shall be approved by NIOSH and shall conform to the OSHA requirements in 29 CFR 1910.134 and 29 CFR 1926.1101.

F. A storage area for respirators shall be provided by the contractor in the clean room side of the personnel decontamination enclosure where they will be kept in a clean environment.

G. The contractor shall provide and make available a sufficient quantity of respirator filters so that filter changes can be made as necessary during the work day. Filters will be removed and discarded during the decontamination process. Filters cannot be reused. Filters must be changed if breathing becomes difficult.

H. Filters used with negative pressure air purifying respirators shall not be used any longer than one eight (8) hour work day.

I. Any authorized visitor, worker, or supervisor found in the work area not wearing the required respiratory protection shall be removed from the project site and not be permitted to return.

J. The contractor shall have at least two (2) Powered Air Purifying Respirators stored on-site designated for authorized visitors use. Appropriate respirator filters for authorized visitors shall be made available by the contractor.

K. Establish a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134, and 29 CFR 1926.1101. Provide respirator training and fit-testing.

2.4 PROTECTIVE CLOTHING

A. Provide personnel utilized during the Project with disposable protective whole body clothing, head coverings, gloves and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may also be worn. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape, or provide disposable coverings with elastic wrists or tops.

B. Provide sufficient quantities of protective clothing to assure a minimum of four (4) complete disposable outfits per day for each individual performing abatement Work.

C. Eye protection and hard hats shall be provided and made available for all personnel entering any work area.

D. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear whenever they enter the work area.

PART 3 - EXECUTION

3.1 PRE-ABATEMENT MEETING

A. At least one week prior to the start of work a Pre-Construction Meeting will be scheduled and must be attended by the contractor and any sub-contractors. The assigned contractor site supervisor is also required to attend this meeting.

B. The contractor shall present a detailed project schedule and project submittals at the Pre-Construction Meeting. Variations, amendments, and corrections to the presented schedule will be discussed, and the Owner and consultant will inform the contractor of any scheduling adjustments for this project.

C. Following the Pre-Construction Meeting, the contractor shall submit a revised schedule (if needed) no later than one week after the meeting.

3.2 WORK AREA PREPARATION

A. Where necessary, shut down electrical power, including receptacles and light fixtures. Under no circumstances during the decontamination procedures will lighting fixtures be permitted to be operating when the spraying of amended water may contact the fixture. Provide GFCI devices, temporary power, and temporary lighting installed in compliance with the applicable electrical codes. All installations are to be made by a State of Connecticut licensed electrician.

B. Shut down and/or isolate heating, cooling, and ventilation air systems or zones to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents within the work area shall be "criticalled" with duct tape and polyethylene sheeting.

C. The contractor shall be responsible for removing furniture from the work areas. The contractor shall pre-clean moveable objects within the proposed work areas using HEPA vacuum equipment and/or wet cleaning methods as appropriate and remove such objects

from work areas to a temporary location. For example, cabinets to gain access to floor tile and associated mastic.

D. Seal off all openings, including, but not limited to, windows, corridors, doorways, skylights, ducts, grills, diffusers, and any other penetration of the work areas, with polyethylene sheeting a minimum of six (6) mils thick, sealed with duct tape. This includes doorways and corridors that will not be used for passage during work areas and occupied areas.

E. Pre-clean fixed objects within the work areas, using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and enclose with a minimum six (6) mil plastic sheeting sealed with duct tape.

F. Clean the proposed work areas using HEPA vacuum equipment or wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

G. After HEPA vacuum cleaning, cover fixed walls with two (2) layers of four (4) mil polyethylene sheeting to the floor level. Where fixed walls are not used, two layers of six (6) mil polyethylene sheeting will be applied to a rigid framework of wood, metal, or PVC. Where floor tile/mastic is not being abated, cover the floor with two (2) layers of six-mil polyethylene sheeting. All overlaps shall be sealed with tape or spray adhesive.

H. Maintain emergency and fire exits from the work areas, or establish alternate exits satisfactory to fire officials.

I. Clean and remove ceiling mounted objects, such as lights and other items not sealed off, which interfere with asbestos abatement. Use hand-held amended water spraying or HEPA vacuuming equipment during fixture removal to reduce settled fiber dispersal.

J. Create pressure differential between work areas and uncontaminated areas by the use of acceptable negative air pressure equipment sufficient to provide four (4) air changes per hour and create negative pressure of -0.02 inches of water within enclosure with respect to outside area as measured on a water gauge.

3.3 DECONTAMINATION SYSTEM

A. The following requirements shall be followed for the worker decontamination unit:

1. At all asbestos abatement projects, work areas shall be equipped with decontamination facilities consisting of: a clean room, a shower room, and an equipment room attached to each containment.
2. The decontamination enclosure system chambers shall be constructed to meet the criteria of the Specification. The decontamination enclosure shall be installed watertight to prevent water leaks. The interior shall be lined with two layers of 6-mil fire-retardant plastic sheeting, with a minimum overlap of 16 inches at seams and sealed (airtight) by tape and adhesive. The interior floor shall be sheathed with (2) layers of reinforced fire retardant plastic sheeting with a minimum overlap on the wall of sixteen (16) inches. The contractor shall

ensure compliance with local building codes and other regulations governing temporary structures.

3. Curtained Doorways: Three overlapping sheets of 6-mil polyethylene shall be placed over a framed doorway and secured along the top of the doorway. Secure the vertical edge of the outer sheets along one vertical side of the doorway and the vertical edge of the center sheet along the opposite vertical side of the doorway. The sheets shall be weighted so that they close quickly after being released.
4. Air Locks: Air locks shall consist of two curtained doorways placed a minimum of three feet apart.

    a. Clean Room: In this room, persons remove and leave all street clothes and put on clean disposable coveralls. Approved respiratory protection equipment is stored in this area. The floor of the clean room must be kept dry at all times. At the end of each shift, the room must be cleaned using wet rags. Also, a lockable door may be installed. No asbestos-containing materials are allowed in this room. The clean room shall be equipped with suitable hooks, lockers, shelves, etc. for workers to store personal articles and clothing. THIS IS NOT A CONTAMINATED AREA.
    b. Shower Room: Provide a completely watertight operational shower to be used by cleanly dressed workers heading for the Work area from the clean room or for showering workers headed out of the Work Area after dressing in the Equipment Room. Shower must be constructed so that water leakage is minimized. The shower shall have one shower per six full shift abatement people, calculated on the basis of the largest shift. Any leaking water must be cleaned immediately. Showers must be equipped with hot and cold running water, soap and sufficient disposable towels for the number of workers at the job site. Arrange water shut off and drain pump operation controls, so that a single individual can shower without assistance from either inside or outside the work area. THIS IS A CONTAMINATED AREA.

        Pump wastewater into a polyethylene lined 55-gallon drum located in the work area to be added to the asbestos waste. If the water is allowed by the work treatment workers to be pumped into a drain, provide 20 micron and 5 micron waste water filters in line to drain. Change filters at a minimum of once a day. Locate filters inside the shower unit, so that the shower pan catches the water lost during filter change.
    c. Equipment Room: Work equipment, footwear, and all other contaminated work clothing are to be left here upon exiting work area. A walk-off pan filled with water shall be located in the work area just outside the equipment room for workers to clean foot coverings while exiting the work area. This is a change and transit area for workers. Provide a drop cloth layer of sheet plastic on the floor of the Equipment Room for every shift change. Roll drop cloth layer in upon itself at the end of each shift and dispose of as contaminated waste. THIS IS A CONTAMINATED AREA.

        Each room shall be separated from the other and from the work area by airlocks such as will prevent the free passage of air or asbestos fibers and shall be accessible through doorways protected with three (3) overlapping 6 mil polyethylene sheets which shall be weighed, so as to fall into place when

people pass through the area. The shower room shall be contiguous to the clean room and equipment room. All personnel entering or leaving the work area shall pass through the shower room. The number of showers provided shall satisfy the requirements of OSHA 29 CFR 1910.141. Hot and cold water shall be supplied to the showers. The equipment room (dirty room) shall be situated between the shower room and the work area and separated from both by means of suitable barriers or overlapping flaps such as will prevent the free passage of air or asbestos fibers.

Decontamination chamber doors shall be of sufficient height and width to enable replacement of equipment, which may fall, and to safely stretcher or carry an injured worker from the site without destruction of the chamber or unnecessary risk to the integrity of the work area. Such doors must be at least four (4) feet wide, and the distance between sets of doors must be at least four (4) feet.

5. No person or equipment shall leave the asbestos abatement project work area unless first decontaminated by showering, wet washing or HEPA vacuuming to remove all asbestos debris. No asbestos contaminated materials or persons shall enter the clean room.
6. Where feasible, decontamination systems shall abut the work area. In situations where it is not possible, due to unusual conditions, to establish decontamination systems contiguous to the work area, personnel shall be directed to remove visible asbestos debris from their persons by HEPA-filtered vacuuming prior to donning clean disposable coveralls while still in the work area, and proceeding directly to a remote decontamination system to shower and change clothes to follow work area exit procedures.
7. In specific situations where the asbestos contractor determines that it is not feasible to establish a contiguous decontamination system at a work site, the asbestos contractor shall utilize a remote decontamination system if approved by Langan. Such systems must be operated in conformance with 29 CFR 1926.1101, Appendix F.

B. Remote Decontamination Facility:

For exterior work on the roof, glove bag or tent procedures, when full containment enclosure is not feasible, the Contractor shall provide remote personnel decontamination enclosure system if approved by the Consultant - Langan.

C. Occupied areas and/or building space not within the work areas shall be separated from asbestos abatement work areas by means of airtight barriers.

D. Construct the decontamination system with wood or metal framing, 3/8" sheathing and cover both sides with a double layer of six (6) mil polyethylene sheeting, spray glued or taped at the joints. Caulk joints watertight at floor, walls, and ceiling.

E. The contractor and the consultant shall visually inspect barrier several times daily to assure effective seal and the contractor shall repair defects immediately

F. Waste/Equipment Decontamination Enclosure System:
This system is located adjacent to the work area. The equipment decontamination

enclosure system, consisting of two totally enclosed spaces, shall be constructed as follows:

1. Equipment Washroom: An equipment washroom shall have two air locks: one adjacent to the work area and one common air lock which separate it from the holding area. The washroom shall have facilities for washing material containers and equipment. Gross removal of dust and debris from contaminated material containers and equipment shall be accomplished in the work area, prior to moving to the washroom.
2. Holding Area: A holding area shall share a common air lock with the equipment washroom and shall have a curtained doorway to outside areas. A hinged, lockable door shall be placed at the holding area entrance to prevent unauthorized access into the work area.
3. Remote Decontamination Facility: For exterior work on the roof, glove bag or tent procedures, when full containment enclosure is not required, the contractor shall provide remote Waste/Equipment decontamination enclosure system as specified.

3.4 ABATEMENT REMOVAL PROCEDURES

A. Regulatory compliance will include, but is not necessarily limited to, applicable requirements set forth by the Federal Environmental Protection Agency (EPA), Connecticut Departments of Public Health (CT DPH), Connecticut Department of Environmental Protection, and Trumbull/local Health and Building Departments.

B. The following procedures shall be followed while performing the abatement activities:

1. No asbestos abatement work, including preparation, shall be performed or continued without having proper notification and a certified supervisor at the work area. The contractor shall have a designated "competent person" on the job at all times to ensure establishment of a proper enclosure system and proper work practices throughout the project.
2. Abatement work will not commence until authorized by the consultant.
3. Provide and display danger signs at every entrance to the work areas in clearly visible locations indicating that asbestos removal work is being conducted and unauthorized and not protected persons should not enter.
   Signs must use the following legend:

   DANGER
   ASBESTOS
   MAY CAUSE CANCER
   CAUSES DAMAGE TO LUNGS
   AUTHORIZED PERSONNEL ONLY
   WEAR RESPIRATORY PROTECTION AND
   PROTECTIVE CLOTHING IN THIS AREA

   Signs shall be posted which meet the specifications set forth in 29 CFR 1926.1101 at all approaches to the work area. Signs shall be posted a sufficient distance from the work area to permit a person to read the sign and take precautionary measures to avoid exposure to asbestos.

4. The worker decontamination enclosure system shall be installed or constructed prior to plasticizing the work area or before disturbing ACM. The waste decontamination enclosure system shall be installed or constructed prior to commencement of gross removal work.
5. All asbestos handlers shall wear disposable suits, including gloves, hood and footwear, and appropriate respiratory equipment, after removing street clothes in the clean room.
6. Abatement of asbestos-containing materials shall be done by wet methods only.
7. ACM shall be sprayed with amended water in sufficient frequency and quantity for enhanced penetration. Sufficient time shall be allowed for penetration to occur prior to removal action or other disturbance-taking place. Dry removal of asbestos materials is prohibited.
8. In order to maintain indoor asbestos concentrations to the minimum, the wet asbestos must be removed in manageable sections. Material drop shall not exceed eight (8) feet. For heights up to 15 feet, provide inclined chutes or scaffolding to intercept drop.
9. Remove asbestos containing materials as appropriate by standard methods. Fill disposal containers as removal proceeds; seal filled containers and clean containers before removal to equipment decontamination system. Wet clean each container thoroughly, double bag and apply caution label. Ensure that workers do not exit the work area thorough the equipment decontamination enclosure.
10. After completion of stripping work, all surfaces from which asbestos has been removed shall be wet brushed, using a nylon brush, wet wiped, and sponged or cleaned by an equivalent method to remove all visible material (wire brushes are not permitted). During this work, the surfaces being cleaned shall be kept wet.
11. Remove and containerize all visible accumulations of asbestos-containing and/or asbestos-contaminated debris. During cleanup, utilize brooms, rubber dustpan, and rubber squeegees to minimize damage to floor covering.
12. Retrieve all free water in contaminated areas and place in plastic lined leak-tight drums.
13. Sealed disposal containers, and all equipment used in the work area, shall be included in the cleanup and shall be removed from work areas via the equipment decontamination enclosure at an appropriate time in the cleaning sequence. All asbestos waste in 6-mil polyethylene disposal bags shall be double bagged in the equipment decontamination enclosure before removal from the Site.
14. At any time during asbestos removal, should the consultant suspect contamination of areas outside the work area(s), he shall cause all abatement work to stop until the contractor takes steps to decontaminate these areas and eliminate the causes of such contamination. Unprotected individuals shall be prohibited from entering suspected contaminated areas until air sampling and visual inspections certify decontamination.
15. After completion of the initial final cleaning procedure including removal of the inner layers of polyethylene sheeting, but prior to encapsulation, a pre-sealant inspection shall be conducted by the consultant. The pre-sealant inspection shall verify that ACM and residual dust has been removed from the work area.
16. After the work area has been inspected by the Engineer and rendered free of visible debris, a thin coat of a pigmented (non-transparent) encapsulating agent

shall be applied to all surfaces in the work area from which ACM was removed, to lockdown nonvisible fibers.

17. Removal of asbestos containing materials shall be done under negative pressure containment. All OSHA Class I, Class III, and interior Class II asbestos abatement projects shall employ HEPA negative air pressure equipment ventilation. The negative air pressure equipment shall operate continuously, twenty-four (24) hours a day, from startup of negative air pressure equipment, through the cleanup operations. A negative air pressure, relative to areas outside of the enclosure, shall be maintained at all times in the regulated abatement work area during the asbestos abatement project to ensure that contaminated air in the regulated abatement work area does not escape back to an uncontaminated area. A manometer shall be used to document the pressure differential for all OSHA Class I Large and Small size asbestos project regulated abatement work areas. A minimum of -0.02 column inches of water pressure differential, relative to pressure outside the regulated abatement work area, shall be maintained within the regulated abatement work area, as evidenced by manometric measurements.

3.5 CONSULTANT

A. The Owner has retained Langan Engineering (Langan) as the Hazardous Materials Consultant for the purpose of project design, construction administration, and project monitoring during Asbestos Abatement. Mr. Matthew Myers (License #000058) of Langan is the DPH-approved Asbestos Project Designer for this project. The Consultant will represent the Owner in all tasks of the abatement project at the discretion of the Owner. The Asbestos Abatement Contractor will regard the Consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items.

3.6 CONSULTANT'S RESPONSIBILITIES

A. Air sampling shall be conducted by the consultant to ascertain the integrity of controls that protect the building from asbestos contamination. Independently, the contractor shall monitor air quality within the work area to ascertain the protection of employees and to comply with OSHA regulations.

B. The consultant's CT DPH licensed asbestos project monitor shall collect and analyze air samples during two time periods:

1. Abatement Period: If required, the consultant's project monitor shall collect samples on a daily basis during the work period. A sufficient number of area samples shall be taken outside of the work area, at the exhaust of the negative pressure system, and outside of the building to judge the degree of cleanliness or contamination of the building during removal. Additional samples may be taken inside the work area and decontamination enclosure system, at the discretion of the project monitor.
2. Post-Abatement Period: The consultant's project monitor shall conduct air sampling following the final cleanup phase of the project, once the "no visible residue" criterion, as established by the project monitor, has been met. Five (5)

samples shall be collected inside the work area utilizing aggressive methods to comply with the State of Connecticut Department of Public Health Standards for Asbestos Abatement, sections 19a-332a-12. Analysis of the samples to determine airborne concentrations of asbestos shall be conducted by Transmission Electron Microscopy (TEM) method with an average limit of 70.0 structures per square millimeter of filter surface or by Phase Contrast Microscopy (PCM) with a limit of 0.010 fibers per cubic centimeters of air in accordance with the above Connecticut regulation sections.

C. The consultant's project monitor shall provide continual evaluation of the air quality of the building during removal, using his/her best professional judgment in respect to the State of Connecticut Department of Public Health guideline of 0.010 fibers/cc and the background air quality established during the pre-abatement period.

D. If the project monitor determines that the building air quality has become contaminated from the project, he/she shall immediately inform the contractor to cease all removal operations and implement a work stoppage clean up procedure. The contractor shall conduct a thorough cleanup of the areas of the building designated by the consultant. No further removal work can take place until the project monitor has assessed that the building air has been decontaminated.

E. Pre-abatement and abatement air samples shall be collected as required to obtain a volume of 1,200 liters. Samples shall be analyzed by Phase Contrast Microscopy (PCM) methodology using the NIOSH 7400 protocol.

3.7 CONSULTANT'S INSPECTION RESPONSIBILITIES

A. The consultant shall conduct inspection throughout the progress of the abatement project. Inspections shall be conducted in order to document the progress of the abatement work as well as the procedures and practices employed by the abatement contractor.

B. The consultant shall perform the following inspections during the course of abatement activities:

1. Pre-commencement Inspection: Pre-commencement inspections shall be performed at the time requested by the abatement contractor. The consultant shall be informed 12 hours prior to the time the inspection is needed. If, during the course of the pre-commencement inspection, deficiencies are found, the contractor shall perform the necessary adjustments in order to obtain compliance.
2. Work Area Inspections: Work area inspections shall be conducted on a daily basis at the discretion of the consultant. During the course of the work inspections, the consultant shall observe the contractor's removal procedures, verify barrier integrity, monitor negative air filtration devices, assess project progress, and inform the abatement contractor of specific remedial activities if deficiencies are noted.
3. Pre-encapsulation/Final Visual Inspection: The consultant, upon the request of the abatement Contractor, shall conduct a pre-sealant inspection. The consultant shall be informed 24 hours prior the time that the inspection is needed. The pre-encapsulation inspection shall be conducted after completion of the all cleaning procedures, but prior to encapsulation. The pre-encapsulation inspection shall

verify that all ACM and residual debris have been removed from the work area. If, during the course of the pre-encapsulation inspection, the consultant identifies residual dust or debris, the contractor shall comply with the request of the consultant in order to render the area "dust free."

3.8 CLEARANCE AIR TESTING

A. After the visual inspection is completed and all surfaces in the abatement area have dried, final air clearance sampling shall be performed by the consultant. Aggressive air monitoring will be used. Selection of location and samples shall be the responsibility of the consultant. Air monitoring volumes shall be sufficient to provide a detection limit of 0.010 f/cc using NIOSH-approved method for PCM analysis. For air clearance by Transmission Electron Microscopy, air-monitoring volumes shall be sufficient to provide a detection limit of 0.005 f/cc using the AHERA Level II Yamate Method.

B. Areas which do not comply with the Standard for Cleaning for Initial Clearance shall continue to be cleaned by and at the contractor's expense until the specified Standard of Cleaning is achieved as evidenced by results of air testing as previously specified.

3.9 ASBESTOS WASTE DISPOSAL

A. The contractor shall package, label, and remove all asbestos waste from the work area in accordance with Connecticut DEEP and DPH regulations, all other applicable regulations, and as specified below. Packaging shall be accomplished in a manner that minimizes waste volume, but insures waste containers shall not tear or break. All waste shall be transported in leak tight containers.

B. Asbestos wastes may include building materials, insulation, disposable clothing and protective equipment, plastic sheeting and tape, exhaust systems or vacuum filters, contractor equipment, or other materials designated by state or local authorities which have been potentially contaminated with asbestos and have not been fully cleaned.

C. Waste Labeling

1. Warning labels, having waterproof print and permanent adhesive in compliance with OSHA, EPA, CT DEEP/DOT and CT DPH requirements, shall be affixed to or printed on the sides of all waste bags or transfer containers. Warning labels shall be conspicuous and legible, and contain the following words:

   DANGER
   CONTAINS ASBESTOS FIBERS
   MAY CAUSE CANCER
   CAUSES DAMAGE TO LUNGS
   DO NOT BREATHE DUST
   AVOID CREATING DUST

2. In compliance with NESHAP, 40 CFR, Part 61.150, all waste containers or bags shall be labeled with the following generator information:

a. Name of waste generator
b. Location of where waste was generated

D. Wetting of Waste: A fine water spray shall be used to keep the top layers of waste in containers thoroughly wet at all times. When a waste bag is full, air within the bags shall be evacuated with a HEPA equipped vacuum and be securely sealed with tape or other secure fastener.

E. Use and Decontamination of Fiber Drums: The Contractor's use and decontamination of fiber drums shall be in accordance with CT DPH, EPA and DOT requirements. The drums shall be lined with a minimum of two layers of 6-mil asbestos waste bags. The waste will be appropriately labeled and sealed. The drums shall be sealed with an airtight lid and shall be decontaminated and/or additionally bagged if the drums are filled inside the containment and visible debris/contamination is observed on the exterior of the drums. All waste shall be labeled as previously described. The drums and waste will be re-containerized should their integrity be compromised and/or liquid is visibly passing through or staining the container.

F. Waste Container Storage: The container used for the storage of bagged contaminated waste shall be an enclosed dumpster. The dumpster shall have a solid metal roof and a solid metal door with padlock. At a minimum, line the cargo area with two layers of a 6-mil polyethylene sheeting to prevent contamination from damaged or leaking containers. Floor sheeting shall be installed first and shall extend up the sidewalls 24 inches minimum. Wall sheeting shall be overlapped and taped securely into place. No un-bagged contaminated waste or non-asbestos waste shall be stored in these dumpsters. Ensure that bags placed in dumpsters are undamaged. Warning signs shall be posted on the dumpster in accordance with Sections 29 CFR 1926.1101 of the OSHA regulations.

G. Waste Removal Scheduling: All waste containers shall be decontaminated and removed from the Site before final cleanup is started and isolation barriers are taken down.

H. Waste Transportation and Disposal

1. It is the responsibility of the contractor to determine and insure that the contractor and his/her subcontractor are complying with: 1) current waste handling regulations; and 2) the current regulations for transporting and disposing waste at the ultimate disposal landfill. The contractor must comply fully with these regulations, and with all U.S. Department of Transportation, State, local, and EPA requirements.
2. The contractor's waste hauler and disposal contractor shall maintain a valid hazardous waste transporter's permit and identification number; and obtain complete, and fully comply with any other local hazardous waste manifesting requirements.
3. Exercise care before and during transport to ensure that no unauthorized persons have access to the containerized ACW.
4. Do not transport ACW on open trucks. Treat and dispose of drums that have been contaminated as asbestos-containing waste.
5. A copy of ACW manifest forms shall be sent to the Owner after each disposal is completed and all required data and signatures have been inserted.

6. The contractor shall return the original Disposal Certificate (landfill receipt) to the Owner within 10 working days of waste shipment from the Site.

END OF SECTION

SECTION 028313 – LEAD-BASED PAINT AWARENESS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Refer to all drawings and/or other Sections of these specifications to determine the type and extent of work therein affecting the work of this Section, whether or not such work is specifically mentioned herein.

C. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028213 – Asbestos Abatement
3. Section 028416 – Universal Waste Removal and Recycling
4. Section 028432 – PCB Remediation
5. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 SUMMARY OF WORK

A. Work of this Section includes requirements for worker protection and waste disposal related to the demolition work involving components and surfaces containing lead at the Hillcrest Middle School project site located in Trumbull, Connecticut. All materials should be considered to contain some amounts of lead. XRF screening identified lead-based paint on interior metal ladder (yellow) in custodial office. The contractor must have proper training (RRP or CT DPH licensed lead abatement contractor) and follow lead-safe work practices (including protection of ground surfaces to prevent possible contamination and proper disposal of lead hazardous waste).

B. The procedures referenced herein shall be utilized during required demolition work specified elsewhere in the Architect's Specification that might impact lead.

C. Demolition activities may result in dust and debris exposing workers to levels of lead above the OSHA Action Level. Worker protection, training, and engineering controls referenced herein shall be strictly adhered to, until completion of exposure assessment with results indicating exposures below the "Action Level". This section does not involve lead abatement by CT DPH regulation, but identified worker protection requirements for trades involved in the demolition and disposal procedures if lead is involved in the waste stream.

1.3 DEFINITIONS

A. The following definitions relative to lead paint as used in this Section are offered:

1. Action Level (AL): The allowable employee exposure, without regard to use of respiratory protection, to an airborne concentration of lead over an eight (8) hour time weighted average (TWA), as defined by OSHA. The current action level is thirty micrograms per cubic meter of air (30 $\mu g/m^3$).

2. Area Monitoring: The sampling of lead concentrations, which is representative of the airborne lead concentrations that may reach the breathing zone of personnel potentially exposed to lead.
3. Biological Monitoring: The analysis of a person's blood and/or urine, to determine the level of lead concentration in the body.
4. Change Room: An area provided with separate facilities for clean protective work clothing and equipment and for street clothes, which prevents cross-contamination.
5. Competent Person: A person employed by the Contractor who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions, and who has authorization to take prompt corrective measures to eliminate them as defined by OSHA.
6. Exposure Assessment: An assessment conducted by an employer to determine if any employee may be exposed to lead at or above the action level.
7. "High Efficiency Particulate Air" (HEPA): A type of filtering system capable of filtering out particles of 0.3 microns diameter from a body of air at 99.97% efficiency or greater.
8. Lead: Refers to metallic lead, inorganic lead compounds and organic lead soaps. Excluded from this definition are other organic lead compounds.
9. Lead Work Area: An area enclosed in a manner to prevent the spread of lead dust, paint chips, or debris resulting from lead-containing paint disturbance.
10. Lead Paint: Refers to paints, glazes and other surface coverings containing a toxic level of lead.
11. Permissible Exposure Limit (PEL): The maximum allowable limit of exposure to an airborne concentration of lead over an eight (8) hour time weighted average (TWA), as defined by OSHA. The current PEL is fifty micrograms per cubic meter of air (50 $\mu g/m^3$). Extended workdays lower the PEL by the formula: PEL equals 400 divided by the number of hours of work.
12. Personal Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62 and 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a sphere with a radius of 18 inches and centered at the nose or mouth of an employee.
13. Resource Conservation Recovery Act (RCRA): RCRA establishes regulatory levels of hazardous chemicals. There are eight (8) heavy metals of concern for disposal: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Six (6) of the metals are typically found in paints, excluding selenium and silver.
14. Toxic Level Of Lead: A level of lead, when present in dried paint or plaster, contains more than 0.50% lead by dry weight as measured by atomic absorption spectrophotometry (AAS) or 1.0 mg/cm^2 as measured by on-site testing utilizing an x-ray fluorescence analyzer. (Term is specific to State of CT regulations and HUD guidelines only)
15. Toxicity Characteristic Leachate Procedure (TCLP): The U.S. Environmental Protection Agency (US EPA) required sample preparation and analysis for determining the hazard characteristics of a waste material.

1.4 REGULATIONS AND STANDARDS

A. The following regulations, standards, and ordinances of federal, state, and local agencies are applicable and made a part of this specification by reference:

1. American National Standards Institute (ANSI) ANSI 288.2 - 1980 Respiratory Protection
2. Code of Federal Regulation (CFR)

a. 29 CFR 1910.134 - Respiratory Protection
b. 29 CFR 1910.1025 - Lead
c. 29 CFR 1926.62 - Lead in Construction Interim Final Rule
d. 29 CFR 1910.1200 - Hazard Communication
e. 29 CFR 1926.59 - Hazard Communication in Construction
f. 29 CFR 1926.55 - Gases, Vapors, Fumes, Dusts, and Mists
g. 29 CFR 1926.57 - Ventilation
h. 40 CFR 260 - Hazardous Waste Management Systems: General

3. 40 CFR 261 - Identification and Listing of Hazardous Waste
4. 40 CFR 262 - Generators of Hazardous Waste
5. 40 CFR 263 - Transporters of Hazardous Waste
6 40 CFR 264 - Owner and Operators of Hazardous Waste Treatment, Storage, and
7. Disposal Facilities

a. 40 CFR 265 - Interim Statutes for Owner and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
b. 40 CFR 268 - Lead Disposal Restrictions
c. 40 CFR 172 - Hazardous Materials Tables and Communication Regulations
d. 40 CFR 178 - Shipping Container Specifications
e. 40 CFR 270 and 124 - Hazardous Waste Permits

8. Underwriters Laboratories, Inc. (UL) UL586 - 1990 High Efficiency Particulate Air Filter Units

1.5 QUALITY ASSURANCE

A. Hazard Communication Program
The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

B. Compliance Plan (Site Specific)
The contractor shall establish a written compliance plan, which is specific to the project site, to include the following:

1. A description of work activity involving lead including equipment used, material included, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices.
2. Methods of engineering controls to be used to control lead exposure.
3. The proposed technology the Contractor will implement in meeting the PEL.
4. Air monitoring data documenting the source of lead emissions.
5. A detailed schedule for implementing the program, including documentation of appropriate supply of equipment, etc.
6. Proposed work practice which establishes proper protective work clothing, housekeeping methods, hygiene facilities, and practices.
7. Worker rotation schedule, if proposed, to reduce TWA.
8 A description of methods for informing workers of potential lead exposure.

C. Hazardous Waste Management
The Contractor shall establish a Hazardous Waste Management Plan, which shall comply with applicable regulations and address the following:

1. Identification of hazardous wastes
2. Estimated quantity of waste to be disposed of
3. Names and qualifications of each sub-contractor that will be transporting, storing, treating, and disposing of wastes
4. Disposal facility location and 24 hour point of contact
5. Establish EPA state hazardous waste and identification numbers if applicable
6. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes
7. List of waste handling equipment to be used in performing the work to include cleaning, volume reduction, if applicable, and transport equipment
8. Qualifications of laboratory to be utilized for TCLP sampling and analysis
9. Spill prevention, containment, and cleanup contingency measures
10. Work plan and schedule for waste containment, removal, treatment, and disposal

D. Medical Examinations

1. Before exposure to lead contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1910.1025 and 29 CFR 1926.62.
2. The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62 within the last year.
3. Medical examination shall include, at a minimum, approval to wear respiratory protection and biological monitoring.

E. Training

1. The Contractor shall ensure that workers are trained to perform lead paint disturbing activities and disposal operations prior to the start of work in accordance with 29 CFR 1926.62.

F. Respiratory Protection Program

1. The Contractor shall furnish each employee required to wear a negative pressure respirator with a respirator fit test at the time of initial fitting and at least once every six (6) months thereafter as required by 29 CFR 1926.62.
2. The Contractor shall establish a Respiratory Protection Program in accordance with ANSI Z88.2, 29 CFR 1910.134, and 29 CFR 1926.62.

1.6 SUBMITTALS

A. The Contractor shall submit to the Owner the following submittals prior to start of work:

1. Copies of medical records for each employee to be used on the project, including results of biological monitoring and a notarized statement by the examining physician that such an examination took place.
2. Copies of workers' training certificates.

3. Submit record of successful respirator fit testing performed by a qualified individual within the previous six (6) months, for each employee to be used on this project with the employee's name and social security number with each record.
4. The name and address of Contractor's blood lead testing lab, OSHA-CDC listing, and Certification in the State of Connecticut.
5. The name and address of Contractor's personal air monitoring and waste disposal lead testing laboratory/ies.
6. Name, address, and ID number of the hazardous waste hauler, waste transfer route, and proposed disposal site.

B. The Contractor shall submit to the Owner the following submittals during the job:

1. Results from personal air samples.
2. Medicals, certificates, and fit test 24 hours in advance of any new employee starting on the project.

C. The Contractor shall submit to the Owner the following submittals upon completion of the work:

1. Copies of manifests and receipts acknowledging disposal of all hazardous waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative.

1.7 PERSONAL PROTECTION

A. Exposure Assessment

1. The Contractor shall determine if any worker will be exposed to lead at or above the action level.
2. The exposure assessment shall identify the level of exposure a worker would be subjected to without respiratory protection.
3. The exposure assessment shall be achieved by obtaining personal monitoring samples representative of a full shift at least (8-hour TWA).
4. During the period of the exposure assessment, the Contractor shall institute the following procedures for protection of workers.

    a. Protective clothing shall be utilized
    b. Respiratory protection
    c. Change areas shall be provided
    d. Hand washing facilities and shower
    e. Biological monitoring
    f. Training of workers

B. Respiratory Protection

1. The Contractor shall furnish appropriate respirators approved by NIOSH/MSHA for use in atmospheres containing lead dust.
2. Respirators shall comply with the requirements of 29 CFR 1926.62.
3. Workers shall be instructed in all aspects of respiratory protection.
4. The Contractor shall have an adequate supply of HEPA filter elements and spare parts on site for all types of respirators in use.

5. The following minimum respirator protection for use during paint removal or demolition of components and surfaces with lead paint shall be the 1/2 mask air purifying respirator with high efficiency filters for exposures (not in excess of 500 ug/m^3 or 10 x PEL).

C. Protective Clothing

1. Personal protective clothing shall be provided for all workers, supervisors, and authorized visitors entering the work area.
2. Each worker shall be provided with a minimum of two (2) complete disposable coverall suits.
3. Removal workers shall not be limited to two (2) suits, and the Contractor shall supply additional suits as necessary.
4. Under no circumstances shall anyone entering the abatement area be allowed to re-use a contaminated disposable suit.
5. Disposable suits, such as TYVEK suits, and other personal protective equipment (PPE) shall be donned prior to entering the lead control area. A change room shall be provided for workers to put on suits and other personal protective equipment with separate areas to store their street clothes.
6. Eye protection for personnel engaged in lead operations shall be furnished when the use of a full-face respirator is not required.
7. Goggles with side shields shall be worn when working with power tools or a material that may splash or fragment, or if protective eye wear is specified on the Safety Data Sheet (SDS) for a particular product to be used on the project.

1.8 PERSONAL MONITORING

A. General: The Contractor is required to perform the personal air sampling activities during lead paint disturbing work. The results of such sampling shall be posted, provided to individual workers and submitted to the Owner as described herein.

B. Sampling: Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain unchanged, but must be taken every time there is a change in removal operations, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-weighted averages (TWA). The Contractor is responsible for personal sampling as outlined in OSHA Standard 29 CFR 1926.62 and 29 CFR 1910.1025.

C. Sampling Results: Air sampling results shall be reported to individual workers in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers, flow rate, sample duration, sample yield, cassette size, and analysts' name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ($\mu g/m^3$).

D. Testing Laboratory: The Contractor's testing lab shall be participating in AIHA's Environmental Lead Laboratory Accreditation Program (ELLAP). The Contractor shall submit to the Consultant for review and acceptance, the name and address of the laboratory, certification(s) of AIHA participation, a listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control Program.

PART 2 - PRODUCTS

2.1 GENERAL

A. Any substitution in materials, equipment, or methods to those specified shall be approved by the Owner prior to use. Any requests for substitution shall be provided in writing to the Owner. The request shall clearly state the rationale for the substitution.

B. Submit to the Owner product data of all materials and equipment and samples of all materials to be considered as an alternate.

C. Product data shall consist of manufacturer; catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, safety data sheets (SDS), and other standard descriptive data. Submittal data shall be clearly marked to identify pertinent materials, products or equipment and show performance characteristics and capacities.

D. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product or material with integrally related parts and attachment devices.

2.2 MATERIALS AND PRODUCTS

A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name and product technical description.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises.

C. The Contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, polyethylene sheeting of proper size and thickness, tape, and air filters.

D. Materials:

1. Polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to job site with factory label indicating 6 mil.
2. Polyethylene disposable bags shall be six (6) mil. Tie wraps for bags shall be plastic, five (5) inches long (minimum), pointed and looped to secure filled plastic bags.
3. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.
4. Impermeable containers are to be used to receive and retain any lead containing or contaminated materials until disposal at an acceptable disposal site. (The containers shall be labeled in accordance with EPA and DOT standards.)
5. HEPA filtered exhaust systems shall be used during powered dust generating abatement operations. The use of powered equipment without HEPA exhausts is prohibited.

2.3 TOOLS AND EQUIPMENT

A. Provide suitable tools for all lead disturbing operations.

B. The Contractor shall have available power cables or sources such as generators (where required).

C. Vacuum units, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining 99.97% of all mono-dispersed particles of 0.3 micrometers in diameter.

PART 3 - EXECUTION

3.1 WORKER PROTECTION/TRAINING

A. The Contractor shall provide appropriate training, respiratory and other personal protection, and biological monitoring for each worker and ensure proper usage during potential lead exposure and the initial exposure assessment.

B. Workers who will perform procedures must have completed one of the following training courses:

1. EPA Lead Abatement Supervisor (40 hours)
2. EPA Lead Abatement Worker (32 hours)
3. HUD/EPA course "Work Smart, Work Wet, and Work Clean to Work Lead Safe" (8 hours)
4. HUD/NARI course "The Remodeler's and Renovator's Lead Based Paint Training Program" (8 hours).
5. HUD "Lead Safe Work Practices" (8 hours)

3.2 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor is responsible for establishing and maintaining controls referenced herein to prevent dispersal of lead contamination from the lead work area.

B. The Contractor is also responsible for conducting work with applicable federal, state, and local regulations as referenced herein.

3.3 WORKER HYGIENE PRACTICES (REQUIRED DURING INITIAL EXPOSURE ASSESSMENT AND IF RESULTS OF AIR SAMPLING ARE ABOVE OSHA ACTION LEVEL)

A. Work Area Entry: Workers shall don personal protective equipment prior to entering work area, including respiratory protection, disposable coveralls, gloves, headgear, and footwear.

B. Work Area Departure: While leaving respirators on, workers shall remove all gross contamination, debris, and dust from disposable coveralls and proceed to change room and remove coveralls and footwear and place in hazardous waste disposal container.

C. Hand washing Facilities: All workers must wash their hands and faces upon leaving the work area.

D. Equipment: All equipment used by workers inside the work area shall be wet wiped or bagged for later decontamination before removal from the work area.

E. Prohibited Activities: Under no circumstances shall workers eat, drink, smoke, chew gum, or tobacco, or remove their respirators in the work area.

F. Shock Hazards: The Contractor is responsible for using safe procedures to avoid electrical hazards. All temporary electrical wiring will be protected by ground fault circuit interrupters (GFI).

3.4 LEAD WORK AREA (REQUIRED DURING INITIAL EXPOSURE ASSESSMENT AND IF RESULTS OF AIR SAMPLING ARE ABOVE OSHA ACTION LEVEL)

A. The Contractor shall place warning signs at all entrances and exits from the work area. Signage shall be a minimum of 20" x 14" and shall state the following:

DANGER
LEAD WORK AREA
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

B. The Contractor shall designate a change room as specified in this Section. The change room shall consist of two (2) layers of sheeting on the floor surface adjacent to the lead work area. The change room shall have separate storage facilities for street clothes to avoid cross contamination.

C. The Contractor shall provide potable water for hand and face washing and provide a portable shower unit.

D. The Contractor shall place six-mil polyethylene drop cloths on floor/ground surfaces prior to beginning removal work to facilitate clean-up.

3.5 WORK AREA CLEAN UP

A. The Contractor shall remove all loose chips and debris from floor surfaces and place in hazardous waste disposal bags.

B. The Contractor shall HEPA vacuum adjacent surfaces to remove dust and debris.

C. Polyethylene drop cloths shall be properly disposed of.

3.6 WASTE DISPOSAL

A. The Contractor's contractual liability shall be the proper disposal of all non-hazardous and hazardous wastes generated at the site in accordance with all applicable federal, state, and local regulations as referenced herein. Metal lead based paint components may be segregated for recycling at an approved facility. Lead TCLP sampling will be performed by the owner’s representative Langan (if required by landfill – for selective demolition debris and/or paint chip/debris/waste). The contractor will be responsible for all costs associated with lead/hazardous waste disposal should they, their haulers and/or the landfill of their choosing take samples and declare the waste as hazardous waste.

END OF SECTION

SECTION 028416 - UNIVERSAL WASTE REMOVAL AND RECYCLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Refer to all drawings and/or other Sections of these specifications to determine the type and extent of work therein affecting the work of this Section, whether or not such work is specifically mentioned herein.

C. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028213 – Asbestos Abatement
3. Section 028313 – Lead-Based Paint Awareness
4. Section 028432 – PCB Remediation
5. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 SUMMARY OF WORK

A. Work of this Section includes, but is not necessarily limited to, all which is necessary for complete removal and recycling/disposal of all PCB-containing caulking and glazing compounds, ballasts, newer ballasts, mercury containing devices, electronics, alarms, smoke detectors, sensors, emergency lighting, signage, paints, chemicals, laboratory chemicals/contaminated piping/waste traps, batteries, air conditioning units, CFC's, boiler and HVAC controls, other hazardous materials, wastes and special wastes that exist in the interior/exterior of the building structure(s) that will be impacted by proposed demolition of the building. The hazardous materials contractor will supply the packaging materials and pay for the proper disposal of these materials. The hazardous materials contractor will provide the labor to put the materials into the proper packaging for disposal.

1. All work including the removal, characterization (any testing that may be required by disposal facility) and disposal of hazardous materials and chemicals.
2. Removal, characterization (any testing that may be required by disposal facility) and disposal of fluorescent light ballasts and capacitors throughout all site structures.
3. Removal, characterization (any testing that may be required by disposal facility) and disposal of all containers, drums and unknown materials as well as fire extinguishers.
4. Removal, characterization (any testing that may be required by disposal facility) and disposal of contained gear oils, hydraulic oils and refrigeration liquids, etc. from various pieces of equipment.
5. Removal, characterization (any testing that may be required by disposal facility) and recycling/disposal of batteries, electronic devices, lighting signage, etc.
6. Removal, characterization (any testing that may be required by disposal facility) and recycling/disposal of science equipment, contaminated piping, chemicals, waste traps, etc.

7. File all necessary notices, obtain all permits and licenses, and pay all governmental taxes, fees, and other costs in connection with the work. Obtain all necessary approvals of all governmental departments having jurisdiction.
8. Comply with Health and Safety Plans.

B. The Contractor, under this Section, shall provide all materials, labor, equipment and appliances as necessary to properly remove and recycle/dispose of materials.

1.3 DESCRIPTION OF WORK

A. This specification covers the proper and legal removal and disposal of all Hazardous/Universal Waste to be affected by demolition activities from the Hillcrest Middle School project site located in Trumbull, Connecticut. The removal and disposal activities shall comply with all aspects of the contract documents and federal, state and local requirements.

B. Universal Wastes shall include, but not be limited to, fluorescent bulbs, light fixture ballasts containing polychlorinated bi-phenyls (PCBs) or DEHP, mercury lamps, mercury containing devices, electronics, alarms, smoke detectors, sensors, emergency lighting, signage, paints, chemicals, chemicals/contaminated piping/waste traps, batteries, air conditioning units, CFC's, boiler and HVAC controls, other hazardous materials, wastes and special wastes that exist in the interior/exterior of the building structure(s) that might be impacted by proposed selective demolition and demolition of the building. Whenever there is a conflict or overlap within these specifications and between applicable codes and regulations, the most stringent provision specified shall apply.

C. Trumbull Hillcrest Middle School was constructed in 1966. The school is a one-story building with classrooms, offices, auditorium/cafeteria, kitchen, media center, gymnasium, pool, planetarium, greenhouse, toilet rooms, storage rooms, and boiler/mechanical rooms and is approximately 119,000 square feet. A new school will be constructed on site and the existing building will be abated and demolished.

D. The Contractor shall independently identify and quantify all Universal Waste Items.

1.4 SUBMITTALS

A. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval.

1. Copy of State or local license for hazardous waste hauler;
2. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;
3. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;
4. Certificates of workers which have successfully completed the required employee training for universal/hazardous waste or appropriate type of training to the type of wastes being managed;
5. Name and address of the universal waste handler and/or a destination facility where the waste materials is to be treated, deposited or recycled in accordance with all regulatory requirements (include contact person and telephone numbers), if the universal waste meets

the definition of hazardous waste, the name and address of the hazardous waste treatment, storage and disposal (TSD) facility;

6. Work Plan: Provide a detailed written work plan that describes the procedures for the removal,

    a. Proposed level of worker training for each type of regulated and/or hazardous material to be removed.
    b. Names and applicable licenses of key personnel.
    c. Proof of appropriate training for workers.
    d. Proof of a current medical surveillance program for all personnel.
    e. Safety Data Sheets (SDS) for any chemicals to be used on the project. All products to be used on this project must have SDS approved by the Owner's Environmental Consultant.
    f. Proposed detailed work schedule.

7. Following final removal, and disposal or destruction, provide Owner with waste transport and disposal documents (e.g., manifests), as well as certificates of destruction and recycling as appropriate.

1.5 CODES AND REGULATIONS

A. Regulatory compliance includes but is not necessarily limited to applicable requirements set forth by:

1. Federal Regulations:
    a. 29 CFR 1910, "Occupational Safety and Health Standards" (General Industry Standards)
    b. 29 CFR 1910.134 "Respiratory Protection"
    c. 29 CFR 1910.1200 "Hazard Communication"
    d. 29 CFR 1926, "Safety and Health Regulations for Construction" (Construction Industry Standards)
    e. 40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards"
    f. 40 CFR 60, "Standards of Performance for New Stationary Sources," Appendix B, "Test Methods"
    g. 40 CFR 117, "Determination of Reportable Quantities for Hazardous Substances"
    h. 40 CFR 122, "USEPA Administered Permit Program: The National Pollutant Discharge Elimination System"
    i. 40 CFR 172, "Hazardous Waste Transportation"
    j. 40 CFR 261, "Identification and Listing of Hazardous Waste"
    k. 40 CFR 262, "Standards Applicable to Generators of Hazardous Waste"
    l. 40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste"
    m. 40 CFR 268, "Land Disposal Restrictions"
    n. 40 CFR 273, "Universal Waste Rule"
    o. 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan"
    p. 40 CFR 302, "Designation, Reportable Quantities, and Notification"
    q. 40 CFR 112 (oil pollution prevention)
    r. 40 CFR 279 (used oil)
    s. 40 CFR 273 (Universal Wastes)
    t. 40 CFR 761 (PCBs)

2. Toxic Substances Control Act (TSCA), US-EPA

3. Resource Conservation and Recovery Act (RCRA)
   a. Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) (Superfund Law)

4. Connecticut Regulations:
   State requirements which govern universal waste removal and disposal include but are not necessarily limited to the following:

   a. Connecticut Department of Energy and Environmental Protection (CT DEEP) (Hazardous and Universal Waste Management Regulations); Section 22a-454, 456 Waste Facility and Section 22a-449(c)-113 of the Regulations of Connecticut State Agencies (RCSA), respectively.
   b. Connecticut DEEP; 310 CMR 40 Connecticut Contingency Plan, 310 CMR 30 Hazardous Waste Regulations, 310 CMR 1-7 Clean Water Act, 310 CMR 16, 19 Solid Waste Regulations, 314 CMR 1-8 Clean Air Act
   c. Local Town, City or County Bylaws, rules and regulations.

B. Under TSCA, items that contain more than 500 parts per million (PPM) of PCBs are classified as PCB material, items that contain between 50 ppm and 500 ppm of PCB are classified as PCB-contaminated and items that contain less than 50 ppm of PCBs are classified as non-PCB items.

   Under the Small Capacitor Exemption, TSCA has allowed the disposal of non-leaking, intact "small capacitors", defined as containing less than three pounds of PCB dielectric fluid, in a municipal solid waste landfill. Light ballasts containing a small PCB capacitor are covered under this category. The intent of the "small capacitor" disposal rule is for "random disposal" in a landfill by "householders and other infrequent disposers". When commercial and industrial entities dispose of large quantities of small PCB capacitors, the EPA strongly encourages voluntary collection and disposal of PCB capacitors in chemical waste landfills or high-temperature incinerators.

C. Under the "Superfund" laws, PCBs are specifically listed as a hazardous substance. The "release" of more than one pound of PCBs into the environment triggers a "Superfund" notification and cleanup requirement.

   Since twenty-five ballasts collectively contain approximately one pound of PCBs, the disposal of twenty five or more PCB-containing ballast in a landfill would trigger a "Superfund" action.

D. The State of Connecticut General Hazardous Waste Statue 22A 454, 456 requires that PCB ballast must be incinerated or sent to a chemical waste landfill. The statue defines PCB waste, including PCB ballast, as Connecticut Regulated Wastes.

E. Other Regulations: The other relevant regulations affecting disposal of PCBs include the following:

   1. Department of Transportation (DOT) regulations – DOT regulation HM-181 regulates transportation of hazardous materials, including PCBs.
   2. Occupational Safety and Health Administration (OSHA) – OSHA regulates worker's safety and exposure to a variety of chemicals including PCB's.
   3. Resource Conservation and Recovery Act (RCRA) – RCRA regulates wastes, which fail Toxic Characteristic Leachate Procedure (TCLP) and which contain more than 50 ppm of PCBs.

PART 2 - PRODUCTS

2.1 GENERAL

A. 35 or 55-gallon metal, fiber drums or containers with lids that can be secured and sealed, DOT approved.

B. Appropriate waste labels identifying contents as regulated and hazardous wastes as defined by 49 CFR 172.

C. Fluorescent Lamp Disposal (Crusher) units, such as DexTrite Fluorescent® Lamp Disposal equipment, or equivalent. Such equipment must be capable of capturing fugitive mercury vapors during the bulb crushing process, as well as the fractured and broken waste products.

D. HEPA and charcoal filter equipped mercury capture vacuum.

E. Cardboard boxes and sleeves for packaging lamps that will be removed from the site intact or unbroken.

F. Recovery tanks to temporarily hold compressed gasses.

G. Health & Safety equipment complying with health and safety plan.

PART 3 - EXECUTION

3.1 GENERAL

A. Procedures and methods contained herein are to provide guidance to protect from the contamination of the environment, and exposure to workers, while handling hazardous waste and regulated waste-streams for disposal/recycling/destruction.

B. Owner to Stop Work: The Owner's representative and the Owner's Environmental Consultant shall have the authority to stop the work at any time that conditions are not within Specification and/or applicable regulations. The stoppage of work shall continue until conditions have been corrected to the satisfaction of the Owner's representative or Owner's Environmental Consultant. Standby time to resolve the problems shall be at the Contractor's expense.

C. Personal Protective Equipment:

1. Personal protective equipment shall consist of (at a minimum) safety goggles or other protective eye-ware, work shoes with non-slip soles (e.g., neoprene), chemical resistant gloves that cover the hand and an apron that covers the front of the worker's body from shoulder to toes (e.g., neoprene or nitrile gloves).
2. Personal protective equipment contaminated by handling operations should be disposed of as contaminated waste.
3. Hammering or sudden impact methods for removing ballasts from the light fixture shall not be employed, as such methods may cause leakage in an otherwise non-leaking ballast.
4. Throwing and tossing of ballasts into disposal drums shall not be conducted, as such activities may cause leakage in an otherwise non-leaking ballast.

D. Work Procedures

1. Contractor shall obtain a hazardous waste generator number from Region I, US EPA for the Owner.
2. During the light fixture removal stage during demolition, the following procedures (or equivalent alternate but protective measures) shall be followed:

    a. Carefully remove fixtures, and stack them in a designated portion of the work area.
    b. Designate an area where the fixtures can be disassembled, and components removed and segregated (e.g., lamps, ballasts). The area should be remote from other demolition activities, and have adequate ventilation and lighting.
    c. The work area for fixture disassembly shall (at a minimum) have the floor lined with one layer of 6-mil fire-retardant polyethylene plastic to control accidental spills or breakage. The work area should have a table or other solid work platform to facilitate disassembly of the fixtures, and the protective plastic sheeting should cover the work table area and waste drums/lamp crushing/lamp repackaging equipment.
    d. Carefully remove lamps from fixtures, and either crush them or repackage them for disposal.
    e. In the event a lamp breaks, utilize the mercury capture vacuum to remove all debris generated.

3. Carefully remove ballasts, and segregate for disposal in the following manner:

    a. Ballasts labeled as "No-PCBs" shall NOT be segregated and shall be treated as PCB waste as potting material may contain PCBs and DEHP. Handle and dispose of in the same manner as ballasts containing PCBs and/or DEHP.
    b. Non-leaking ballasts shall be segregated and drummed for disposal as hazardous wastes. These ballasts may be destroyed by high temperature incineration, or land filled at a properly permitted facility.
    c. Leaking ballasts shall be segregated and drummed. Punctures or damage to these ballasts exposes an oily or tar-like substance. These ballasts, and all materials it contacts, MUST be incinerated under TSCA; they cannot be landfilled.

E. Miscellaneous Stored Materials In Containers

1. Miscellaneous materials may include antifreeze, cleaning solutions, paints, and other miscellaneous materials.
2. During removing/recycling of materials enclosed in their original container, the Contractor shall package, and label (lab packed) by waste classification in accordance with appropriate RCRA and Connecticut Department of Transportation (ConnDOT). In turn these containers shall be transported, under proper manifesting procedures, to a recycling facility. The facility shall forward a certificate of recycling or disposal to the Contractor, who shall submit this information to the Owner.

F. Universal Waste

Universal waste includes, but is not limited to, fluorescent bulbs, light fixture ballasts containing polychlorinated bi-phenyls (PCBs) or DEHP, mercury lamps and switches, batteries, fire extinguishers, Halon fire suppression systems, paint, refrigerants, electronic devices (computers and monitors), and other compressed gases, mechanical fluids, oils, and lubricants, as defined in

40 CFR 273 and Section 22a-449(c)-113 of the Regulations of Connecticut State Agencies (RCSA). Follow procedures for handling, storage, labeling, shipping, recording keeping and other procedures as required in 40 CFR 273 and Section 22a-449(c)-113.

G. Regulated Waste

1. Non-thermostat mercury switches: Handle and dispose of in accordance with State regulation and applicable Federal regulations.
2. Used oil: Handle and dispose of in accordance with State regulations.
3. Refrigerants: Prior to disposal of refrigerant containing equipment, verify that refrigerant has been removed per the requirements of 40 CFR Part 82 (Protection of Stratospheric Ozone).
4. Diesel fuel: If possible, use on site to run equipment. Dispose of or recycle any remaining fuel as per applicable regulations.
5. Fire extinguishers: Contact manufacturer for recycling or donate to local fire department.
6. Halon Fire Suppression System: For recovery and management of Halon, utilize a technician EPA certified in appropriate level for the system. Technician is to use an EPA-certified reclaimer for disposal.

H. Transportation

1. Transport waste materials using properly permitted vehicles operated by drivers with Commercial Drivers Licenses (CDLs) and Hazardous Materials endorsements. Coordinate transportation routes with Connecticut Department of Transportation (ConnDOT). Provide Owner with copies of transporter certifications and EPA ID number a minimum of seven (7) days prior to first use. Chain of custody records shall be maintained which include the date of pickup, number of drums, name of transporter and destination.

I. Waste Disposal Documentation

1. Waste shipment records and manifests for all materials transported from the site as required by regulations and disposal facility are to be provided to the Owner every five (5) business days. Incorporate this information into the close out package to be provided to the Owner. Within thirty (30) days of generation, Contractor shall provide waste manifests/shipment records and Certificates of Recycling and Disposal (CRD) to Owner.

2. Certificates of Discontinuance for all equipment and fixtures.

J. Disposal Facilities

1. Contractor shall use only disposal facilities which have been pre-approved by the Owner and its insurers and with valid regulatory permits for type of waste being handled. Provide Owner with copies of disposal facility regulatory permits and EPA identification number a minimum of seven (7) days prior to shipping to that facility. Provide disposal facility required documentation including additional waste sampling.

END OF SECTION

SECTION 02432 – PCB REMEDIATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Supplementary Conditions apply to this Section.

B. Sections containing requirements related to this Section include, but are not limited to:
   1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
   2. Section 028213 – Asbestos Abatement
   3. Section 028313 – Lead-Based Paint Awareness
   4. Section 028416 – Universal Waste Removal and Recycling
   5. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 CONSULTANT

A. Langan CT, Inc. (Langan) has been retained as the Consultant for the purposes of construction administration and project monitoring during PCB Remediation. The Consultant will represent the Owner in all phases of the remediation project at the discretion of the Owner. The PCB Remediation Contractor shall regard the Consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the remediation, submission of data, and daily field punch list items.

1.3 USE OF THE CONTRACT DOCUMENTS

A. It shall be incumbent upon the PCB Remediation Contractor to visit the Site and determine what exists, its condition, and what will be required to accomplish the Work intended by the Contract Documents. No increase in the Contract Sum will be permitted as a result of the PCB Remediation Contractor's failure to visit the Site and understand the existing conditions.

B. All work shall comply with applicable Codes, laws, regulations, and ordinances wherever applicable. The most stringent of all the foregoing shall govern.

C. It is not intended that the Specifications show every detail of the Work, but the PCB Remediation Contractor shall be required to furnish within the Contract Sum all material and labor necessary for the completion of the Work in accordance with the intent of the Specifications.

D. In case of ambiguity among the Contract Documents, the more stringent requirement as determined by the Consultant shall prevail.

E. The Work of this Contract includes making modifications as necessary, subject to approval by Owner in consultation with the Consultant, to correct any conflicts.

F. All items, not specifically mentioned in the Specifications but implied by trade practices to complete the work, shall be included.

1.4 EXAMINATION OF THE SITE

A. It is understood that the PCB Remediation Contractor has examined the Site and made his/her own estimates of the facilities and difficulties attending the execution of the Work, and has based his price thereon.

B. Except for unforeseeable concealed conditions as determined by the Consultant, the PCB Remediation Contractor shall make no claim for additional cost due to the existing conditions at the Site.

1.5 CONTRACTOR QUALIFICATIONS

A. All bidders shall submit a record of prior experience in PCB remediation projects, specifically including removal of PCB-containing materials listing no less than three (3) completed jobs in the past year, with all projects being of similar size and scope. The PCB Remediation Contractor shall list the experience and training of the project foremen and all on-site personnel. The information that should be included is as follows:
   1. Project Name and Address
   2. Owner's Name and Address
   3. Architect/Consultant
   4. Contract Amount
   5. Date of Completion
   6. Extras and Changes

B. Submit a written statement regarding whether the PCB Remediation Contractor has ever been found out-of-compliance with federal or state regulations pertaining to worker protection, removal, transport, or disposal.

1.6 TESTING LABORATORY SERVICES

A. The PCB Remediation Contractor shall submit to the Consultant the name; address and qualifications of proposed laboratories intended to be utilized for sample analysis as required by this section.

1.7 GENERAL REQUIREMENTS

A. The PCB Remediation Contractor shall furnish all labor, materials, facilities, equipment, installation services, employee training, notifications, permits, licenses, certifications, agreements and incidentals necessary to perform the specified work. Work shall be performed in accordance with the contract documents, the latest regulations from the Occupational Safety and Health Administration (OSHA), the United States Environmental Protection Agency (US EPA), Connecticut Department of Energy and Environmental Protection (CTDEEP) and all other applicable federal, state and local agencies. Whenever the requirements of the above references conflict or overlap, the more stringent provision shall apply.

B. All project personnel engaged in the work covered under this section shall be trained in accordance with OSHA Regulations 29 CFR 1910.1000 and 29 CFR 1910.1200. It should also be noted that work associated with PCB removal may also involve exposure to PCBs during demolition and removal activities specified herein and the PCB Remediation Contractor shall perform required exposure assessment for PCBs.

C. The PCB Remediation Contractor shall provide a Project Health and Safety Officer having a minimum of eight (8) hours of supervisor training in hazardous waste site operations in accordance with the requirements of 29 CFR 1910.1200. The supervisor must be on site at all times during remediation work. This supervisor and other contractor representatives must attend a pre-remediation meeting to be scheduled by the building owner/owner's representative.

D. This section specifies the procedures for removal of the existing building materials assumed to contain polychlorinated biphenyls (PCB), equal to or greater than (>) 50 parts per million (ppm) bulk product waste (most materials also contain asbestos), in the form of:

Base Bid

- Laboratory Sink Caulking Compounds – ALL – Throughout Laboratory/Science Rooms;
- Display Case Caulking Compounds – ALL – Throughout Corridors;
- Pool Perimeter Caulking Compounds (Inside and Outside Pool) – ALL – Throughout Pool;
- Unit Ventilator Caulking Compounds – ALL – Throughout Building;
- Interior Wall, Ceiling, Ceramic Wall, Door, Door/Window Wall, Door Window, Window Caulking and Glazing Compounds – ALL – Throughout Building and Greenhouse;
- Exterior Window, Sill (Including Underneath Sills), Wall, Foundation, Door, Door Window, Door/Window Wall, Vent, Rock Wall, Wall Expansion and Other Caulking and Glazing Compounds – ALL – Throughout Building and Greenhouse; and
- Exterior Roof Dome Caulking Compound – ALL – Exterior Planetarium Roof.

The materials throughout the building are assumed PCB Bulk Product Waste (EPA Bulk Product Waste Reinterpretation dated October 24, 2012) (most are asbestos-containing also). Remediated surfaces may have to pass EPA post remediation verification sampling (if sampling of source materials is performed prior to abatement/remediation) and areas that fail will require additional remediation at no additional cost to the owner, until verification sampling passes and/or visual inspection deems all the materials have been removed (contractor owns additional remediation for verification sampling failures up to 20% however if the contractor is deemed by Langan to have contaminated the wall surfaces, all additional remediation is to be performed by the contractor at no additional cost to the owner). Abatement and Remediation in all areas will start with removing materials at the ceiling level and end with the materials at the flooring level. The contractor shall assume they will be setting up full containments throughout the work areas. The contractor will coordinate and perform enough selective demolition/demolition to access all materials to be removed/abated/remediated. Exterior abatement/remediation will be either removed in containment (interior) or the abatement/ remediation contractor will install polyethylene sheeting on the interior of the building and remove materials from the exterior. All ground surfaces must also be protected with plywood and two layers 10-mil reinforced polyethylene sheeting. This ground protection must extend at least 20 feet away from the building foundation (or farther - enough to prevent building materials from touching unprotected ground and floor surfaces). The contractor will pay for all contamination/ remediation/ abatement of

interior and exterior surfaces, including ground surfaces if Langan deems they have contaminated these surfaces. The contractor will supply lifts, scaffolding, staging, etc. to Langan in areas of remediation/abatement until all post remediation visual inspections have passed.

The contractor must dispose of Remediation Waste (all source materials, window and door systems and "newer" sealants, segregated adjacent materials, materials that fail verification sampling, sandblasted paint/debris and waste from remediation - suits, polyethylene sheeting, towels/rags, respirator cartridges, etc.).

E. Disturbance or removal of polychlorinated biphenyls (PCB) containing materials may cause a health hazard to workers and building occupants. The PCB Remediation Contractor shall disclose to all of his workers, supervisory personnel, subcontractors and consultants who will be at job site of the seriousness of the hazard and of proper work procedures which must be followed.

F. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb or otherwise function in the immediate vicinity of polychlorinated biphenyls (PCB) containing materials, appropriate, continuous measures as necessary to protect all workers from the hazard of exposure shall be taken. Such measures shall include the procedures and methods described herein, regulations of the OSHA, US EPA, and local requirements as applicable.

G. The PCB Remediation Contractor shall employ a Competent Person (Supervisor) with at least three (3) years' experience on projects of similar scope and magnitude who shall be responsible for all work involving PCB remediation as described in the specifications and defined in applicable regulations, and have full time daily supervision of the same. The Supervisor shall be the Competent Person as defined by OSHA regulations and have experience in the proper removal and disposal of PCB-Containing Materials.

H. The PCB Remediation Contractor shall allow the work of this contract to be inspected, if required, by local, state, federal, and any other authorities having jurisdiction over such work. The PCB Remediation Contractor shall immediately notify the Owner and Consultant and shall maintain written evidence of such inspection for review by the Owner and Consultant.

I. The PCB Remediation Contractor shall incur the cost of all fines resulting from regulatory non-compliance as issued by federal, state, and local agencies. The PCB Remediation Contractor shall incur the cost of all work requirements mandated by federal, state, and local agencies as a result of regulatory non-compliance or negligence. The PCB Remediation Contractor shall incur all costs associated with contaminating the school property and adjacent properties, including but not limited to all possible litigation costs of the owners, consultants, and other involved parties.

J. The PCB Remediation Contractor shall immediately notify the Owner and Consultant of the delivery of all permits, licenses, certificates of inspection, of approval, or occupancy, etc., and any other such instruments required under codes by authorities having jurisdiction, regardless of who issued, and shall cause them to be displayed to the Owner and Consultant for verification and recording.

K. The PCB Remediation Contractor shall provide enough labor to guarantee completion of the work within the time frame given and within the normal operating hours of the buildings.

L. The remediation/asbestos abatement contractor, their subcontractors, waste transporters and/or landfill(s) do not have permission to take/analyze building materials for PCB content/ concentrations without written permission from the building owner prior to such sampling. Should the contractor or other parties listed above take/analyze PCB samples without the owner's permission and PCB's are found to be >1 ppm, the hazardous materials/remediation contractor will be responsible for **all costs** associated with the abatement/ remediation/replacement of all the interior/exterior building materials and adjacent surfaces, including soil/asphalt/concrete/etc. as well as all costs associated with project delays, attorney fees for all parties affected and all costs resulting from CT DEEP/EPA requirements that may occur as a result.

1.8 SCOPE OF WORK

A. This specification covers the proper and legal removal and disposal of the building existing "older" materials assumed to contain polychlorinated biphenyls (PCB), equal to or greater than (>)50 parts per million (ppm) bulk product waste (most materials are asbestos-containing also) throughout the planned demolition at Hillcrest Middle School located in Trumbull, Connecticut. The remediation activities shall comply with all aspects of the contract documents and federal, state and local requirements.

B. Whenever there is a conflict or overlap within these specifications and between applicable codes and regulations, the most stringent provision specified shall apply.

C. The General Contractor or Remediation Subcontractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the General Contractor or Remediation Subcontractor of its obligation to furnish all labor and materials necessary to perform the Work.

D. Work outlined in this Section includes all work necessary for the complete removal and disposal of all PCB-Containing Materials impacted by the proposed work associated with the demolition project for the Hillcrest Middle School project site located in Trumbull, Connecticut.

E. Note the work in this section is subject to TSCA regulation 40 CFR 761 and Connecticut General Statutes in accordance with CT DEEP requirements for materials containing >50/1 ppm (PCB-Containing Materials). The Owner or the Owner's Authorized Representative is responsible for notifying the CT DEEP.

F. The quantities, if given below, are provided to establish the order of magnitude of the remediation project. Actual quantities may vary. The PCB Remediation Contractor is responsible for verification of all quantities scheduled for removal. This verification shall include an on-site walk-through inspection of the building. The materials/quantities listed are estimates and no extra will be accepted. All of the listed materials are included in the base bid work (no extra cost accepted) until <1 ppm PCB is obtained by verification sampling and/or visual inspection deems all the materials have been removed (contractor owns additional remediation for verification sampling failures up to 20% however if the contractor is deemed by Langan to have contaminated the wall surfaces, all additional remediation is to be performed by the contractor at no additional cost to the owner). Location, materials, and estimated quantities included in the base bid are noted below:

G. The scope of work is summarized as the following:

1. PCB Summary

The following materials are assumed to contain PCBs above the EPA threshold of >50 ppm source material bulk product waste (most materials are asbestos containing also):

Base Bid

- Laboratory Sink Caulking Compounds – ALL – Throughout Laboratory/Science Rooms;
- Display Case Caulking Compounds – ALL – Throughout Corridors;
- Pool Perimeter Caulking Compounds (Inside and Outside Pool) – ALL – Throughout Pool;
- Unit Ventilator Caulking Compounds – ALL – Throughout Building;
- Interior Wall, Ceiling, Ceramic Wall, Door, Door/Window Wall, Door Window, Window Caulking and Glazing Compounds – ALL – Throughout Building and Greenhouse;
- Exterior Window, Sill (Including Underneath Sills), Wall, Foundation, Door, Door Window, Door/Window Wall, Vent, Rock Wall, Wall Expansion and Other Caulking and Glazing Compounds – ALL – Throughout Building and Greenhouse; and
- Exterior Roof Dome Caulking Compound – ALL – Exterior Roof.

H. Project Scope Locations and Work Statement: The remediation site is the located at 530 Daniels Farm Road, Trumbull, Connecticut. The proposed removal and disposal activities to be performed by PCB Remediation Contractor shall include the following:

1. Site preparation and controls to facilitate remediation of PCBs. Containment procedures referenced for the remediation zone must be utilized for PCB Bulk Product Waste/Remediation Waste removal.
2. Health and Safety in accordance with Occupation Safety and Health Administration (OSHA) requirements.
3. Remove and dispose of entire/all materials assumed to contain PCBs > 50 ppm listed above throughout the original building planned areas of work. All exterior protection shall include the use of water impervious membrane covering which shall be secured to the ground surface. Edges shall be raised to prevent water run-off used for dust control during cutting and demolition of structures/systems. Plywood will be installed on all exterior ground surfaces first. The exterior membrane shall be covered with a minimum of 2 layers of 10-mil reinforced polyethylene sheeting securely fastened to foundation. This ground protection must extend at least 20 feet away from the building foundation.
4. Cleaning of each work area following complete removal of PCB containing materials to ensure adherence for post cleaning verification levels and/or visual inspection.
5. Recordkeeping and distribution as required in accordance with 40 CFR part 761.125 (c)(5).

I. Abatement and Remediation in all areas will start with removing materials at the ceiling level and end with the materials at the flooring level. The contractor shall assume they will be setting up

full containments throughout all areas of planned work. The contractor will coordinate and perform enough selective demolition/demolition to access all materials to be removed/abated/remediated. Exterior abatement/remediation will be either removed in containment (interior) or the abatement/remediation contractor will install polyethylene sheeting on the interior of the building and remove materials from the exterior. All ground surfaces must also be protected with plywood and two layers 10-mil reinforced polyethylene sheeting. This ground protection must extend at least 20 feet away from the building foundation (far enough to prevent building materials from touching unprotected ground and floor surfaces). The contractor will pay for all contamination/remediation/ abatement of interior and exterior surfaces, including ground surfaces if Langan deems they have contaminated these surfaces. The contractor will supply lifts, scaffolding, staging, etc. to Langan in areas of remediation/abatement until all post remediation visual inspections have passed. The contractor will provide temporary shoring in areas that require it.

J. Additional materials as discovered outside of those listed will be covered by unit prices if all is not listed as the quantity. Quantities are estimates only and should be verified by the Contractor. Safety data sheets for chemicals to be used during the project must be submitted to the Owner's Representative prior to site delivery. The contractor is responsible for providing temporary water, power, and heat as needed at the site. Temporary lighting/Blast Trac machines/Negative air units within the work areas must be connected to Ground Fault Circuit Interrupter (GFCI) Power Panels installed by a State of Connecticut licensed electrician and located outside of the work areas. The contractor shall be responsible for paying for the use of power and water unless the owner agrees to supply free of charge. It shall also be the contractor's responsibility to provide all fixed and temporary connections and hook-ups as well as obtaining permits and paying all fees for making such services available for his work as is necessary. The Contractor shall provide services as specified herein, and as required or as necessary to carry out the work. This will include such items as temporary hard-line installation, portable generators for short term work, water tank trucks, pumps and necessary accessories or the means and equipment and services necessary to temporarily connect to and maintain such services from adjacent utility systems. The contractor is responsible for contacting all utility services and getting power connections from the electrical lines located on or adjacent to the properties. All power and water must be supplied 24 hours a day throughout the abatement project. CT DPH will be notified immediately if active containments do not have sufficient negative pressure throughout the abatement process until acceptable reoccupancy air results are received. The use of portable generators will require 24 hour a day, 7 day a week continuous operation if negative air machines in containments are powered by them. This continuous operation must remain in place from the time the pre-abatement visual is completed up until clearance re-occupancy sampling results have passed. The contractor will pay the owner a $2,500 penalty should the power found to not be running the negative air machines in active abatement containments. This penalty will apply daily, and the contractor is also responsible for paying all CT DPH fines that may be imposed on the contractor and owner.

K. The contractor(s) will be responsible for hiring an engineer and other appropriate personnel to ensure that all required selective demolition and demolition activities are safe to perform for all personnel on site. The contractor(s) will be financially responsible for any damage that may occur to the site, on-site personnel, fines, penalties, etc. They will also be responsible for paying/reimbursing all legal fees/costs for all parties involved with the project should selective demolition or demolition activities cause injury or death to any persons on site.

L. The general/remediation contractors shall only use heavy equipment operators that have proper asbestos and/or HAZWOPER training when disturbing/removing/moving and packing asbestos, lead and PCB containing materials. Acceptable training for asbestos can be 32/40 hour asbestos worker/supervisor training with annual refresher training. 40 hour HAZWOPER training and annual refresher training is required for operators handling lead and/or PCB containing/contaminated materials. All operators must also have current medicals, fit test data and wear respirators during work.

M. The hazardous building materials contractor may be required to perform multiple mobilizations for some of the abatement/remediation work. The contractor will need to coordinate the abatement/remediation with the owner's representative and/or general contractor.

N. The remediation/asbestos abatement contractor, their subcontractors, waste transporters must submit landfill information to Langan and the owner prior to the shipment of any waste. The contractor(s)/hauler(s) cannot ship waste until Langan and the owner have approved the landfill the contractor/hauler is/are proposing to ship the waste to. PCB TCLP sampling of the waste may be required by the landfills permits and this testing must be performed by the contractor (if testing is approved by Langan and the owner), with Langan present during sampling, and the results made available to Langan and the owner prior to waste shipment. If Langan is not present during the sampling, Langan may perform additional PCB TCLP sampling to confirm the contractor's results and these results will supersede the contractors sample results.

O. The General Contractor, or Remediation Subcontractor, is responsible for conducting all work involving the removal, management, storage, and disposal of PCB waste materials in accordance with this specification, with all referenced documents included as part of this specification, with the standards and guidance documents listed below, and with all Federal, state and local regulations. The General Contractor or Remediation Subcontractor shall provide all labor, materials, and equipment necessary to complete the work of this Section.

1.9 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Where a conflict or overlap among regulations and/or these specifications exist, the most stringent requirements shall apply.
   1. American National Standards Institute (ANSI)
      a. ANSI.Z89.1 Personnel Protective Equipment - Protective Headwear for Industrial Worker's Requirements (Latest Revision)
      b. ANSI.Z87
   2. Code of Federal Regulations (CFR)
      a. 29 CFR Subpart D- Walking, Working Surfaces
      b. 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response (HAZWOPER).
      c. 29 CFR 1910.134 - Respiratory Protection Standard
      d. 29 CFR 1910.146 - Permit-Required Confined Spaces
      e. 29 CFR 1910.1000 — Air Contaminants (Table Z-1)
      f. 29 CFR 1910.1200 - Hazard Communication
      g. 29 CFR 1926.20 - General Health and Safety Provisions
      h. 29 CFR 1926.57 – Ventilation
      i. 29 CFR 1926.59 - Hazard Communication Program
      j. 29 CFR 1926.62 - Lead Exposure in Construction

k. 29 CFR 1926.95 - Criteria for Personal Protective Equipment
l. 29 CFR 1926, Subpart H - Materials Handling, Storage, Use and Disposal
m. 29 CFR 1926, Subpart L - Scaffolding
n. 29 CFR 1926, Subpart M -Fall Protection
o. 29 CFR 1926, Subpart X – Ladders
p. 29 CFR 1926, Subpart Z - Toxic and Hazardous Substances
q. 40 CFR 50.6 - National Primary and Secondary Ambient Air Quality Standards for Particulate Matter
r. 40 CFR 260 - Hazardous Waste Management System: General
s. 40 CFR 261 - Identification and Listing of Hazardous Waste
t. 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste
u. 40 CFR 263 - Standards Applicable to Transporters of Hazardous Waste
v. 40 CFR 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
w. 40 CFR 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
x. 40 CFR 268 - Land Disposal Restrictions
y. 40 CFR 700 - Toxic Substances Control Act (TSCA)
z. 40 CFR 761- PCBs Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
aa. 49 CFR 105 - Hazardous Materials Program Definitions and General Procedures
bb. 49 CFR 171 - General Information, Regulations and Definitions
cc. 49 CFR 172 - Hazardous Material Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
dd. 49 CFR 173 - Shippers-General Requirements for Shipments and Packaging
ee. 49 CFR 177 - Carriage by Public Highway
ff. 49 CFR 176 - Specifications for Packaging

3. National Institute for Occupational Safety and Health (NIOSH)

   a. Publication Number 87-106 Respiratory Decision Logic
   b. NIOSH /OSHA Booklet 3142 Lead in Construction
   c. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH Publication 85-115)

4. U.S. Environmental Protection Agency (US EPA), Toxic Substances Control Act (TSCA)
   a. Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act
   b. 40 CFR Part 761.50 - Applicability (b) (1-8)
   c. 40 CFR Part 761.61 - PCB Remediation Waste
   d. 40 CFR Part 761.62 - PCB Bulk Product Waste
   e. 40 CFR Part 761.79 – Decontamination

5. Center for Disease Control (CDC): Air Pollution and Respiratory Health.

1.10 DEFINITIONS

A. The following definitions as used within this technical specification as well as references to specific sections of the Code of Federal Regulation section 40 CRF Part 761 are provided. Definitions are extracted in part from 40 CFR Part 761.3, for full definitions refer to the specified section of regulations.

1. CERCLA means the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601-9657).

2. Chemical waste landfill means a landfill at which protection against risk of injury to health or the environment from migration of PCBs to land, water, or the atmosphere is provided from PCBs and PCB Items deposited therein by locating, engineering, and operating the landfill as specified in §761.75.
3. Cleanup Site means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of a cleanup of PCB remediation waste, regardless of whether the site was intended for management of waste.
4. Containment means the enclosure within the building which establishes a contaminated area and surrounds the location where PCB and/or other toxic or hazardous substance removal is taking place and establishes a Control Work Area.
5. Designated Facility means the off-site disposer or commercial storer of PCB waste designated on the manifest as the facility that will receive a manifested shipment of PCB waste.
6. Disposal means intentionally or accidentally to discard, throw away, or otherwise complete or terminate the useful life of PCBs and PCB Items. Disposal includes spills, leaks, and other uncontrolled discharges of PCBs as well as actions related to containing, transporting, destroying, degrading, decontaminating, or confining PCBs and PCB Items.
7. DOT means the United States Department of Transportation.
8. EPA identification number means the 12-digit number assigned to a facility by EPA upon notification of PCB waste activity under §761.205.
9. Excluded PCB products means PCB materials which appear at concentrations less than 50 ppm as defined in 40 CFR §761.3.
10. Fixed Object means mechanical equipment, electrical equipment, fire detection systems, alarms, and all other fixed equipment, fixtures or other items which cannot be removed from the work area.
11. Generator of PCB waste means any person whose act or process produces PCBs that are regulated for disposal under subpart D of 40 CFR Part 761, or whose act first causes PCBs or PCB Items to become subject to the disposal requirements of subpart D, or who has physical control over the PCBs when a decision is made that the use of the PCBs has been terminated and therefore is subject to the disposal requirements of subpart D. Unless another provision of 40 CFR Part 761 specifically requires a site-specific meaning, "generator of PCB waste" includes all of the sites of PCB waste generation owned or operated by the person who generates PCB waste.
12. HEPA means High Efficiency Particulate Air filtration efficiency of 99.97 percent down to 0.3 microns. Filtration provided on specialized vacuums and air filtration devices to trap particles.
13. High occupancy area means any area where PCB remediation waste has been disposed of on-site and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is: 840 hours or more (an average of 16.8 hours or more per week) for non-porous surfaces and 335 hours or more (an average of 6.7 hours or more per week) for bulk PCB remediation waste. Examples could include a residence, school, day care center, sleeping quarters, a single or multiple occupancy 40 hours per week workstation, a school class room, a cafeteria in an industrial facility, a control room, and a work station at an assembly line.
14. Incinerator means an engineered device using controlled flame combustion to thermally degrade PCBs and PCB Items. Examples of devices used for incineration include rotary kilns, liquid injection incinerators, cement kilns, and high temperature boilers.
15. Laboratory means a facility that analyzes samples for PCBs and is unaffiliated with any entity whose activities involve PCBs.

16. Liquid PCBs means a homogenous flowable material containing PCBs and no more than 0.5 percent by weight non-dissolved material.
17. Low occupancy area means any area where PCB remediation waste has been disposed of on-site and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is: less than 840 hours (an average of 16.8 hours per week) for non-porous surfaces and less than 335 hours (an average of 6.7 hours per week) for bulk PCB remediation waste. Examples could include an electrical substation or a location in an industrial facility where a worker spends small amounts of time per week (such as an unoccupied area outside a building, an electrical equipment vault, or in the non-office space in a warehouse where occupancy is transitory).
18. Manifest means the shipping document EPA form 8700-22 and any continuation sheet attached to EPA form 8700-22, originated and signed by the generator of PCB waste in accordance with the instructions included with the form and subpart K of this part.
19. Mark means the descriptive name, instructions, cautions, or other information applied to PCBs and PCB Items, or other objects subject to these regulations.
20. Marked means the marking of PCB Items and PCB storage areas and transport vehicles by means of applying a legible mark by painting, fixation of an adhesive label, or by any other method that meets the requirements of these regulations.
21. Municipal solid wastes means garbage, refuse, sludges, wastes, and other discarded materials resulting from residential and non-industrial operations and activities, such as household activities, office functions, and commercial housekeeping wastes.
22. Non-liquid PCBs means materials containing PCBs that by visual inspection do not flow at room temperature (25°C or 77°F) or from which no liquid passes when a 100 g or 100 ml representative sample is placed in a mesh number 60 ±5 percent paint filter and allowed to drain at room temperature for 5 minutes.
23. Non-porous surface means a smooth, unpainted solid surface that limits penetration of liquid containing PCBs beyond the immediate surface. Examples are: smooth un-corroded metal; natural gas pipe with a thin porous coating originally applied to inhibit corrosion; smooth glass; smooth glazed ceramics; impermeable polished building stone such as marble or granite; and high density plastics, such as polycarbonates and melamines, that do not absorb organic solvents.
24. On site means within the boundaries of a contiguous property unit.
25. PCB and PCBs means any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance. Refer to §761.1(b) for applicable concentrations of PCBs. PCB and PCBs as contained in PCB items are defined in §761.3. For any purposes under this part, inadvertently generated non-Aroclor PCBs are defined as the total PCBs calculated following division of the quantity of mono-chlorinated biphenyls by 50 and di-chlorinated biphenyls by 5.
26. PCB Article means any manufactured article, other than a PCB Container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. "PCB Article" includes capacitors, transformers, electric motors, pumps, pipes and any other manufactured item (1) which is formed to a specific shape or design during manufacture, (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use, and (3) which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the PCB Article.

27. PCB Article Container means any package, can, bottle, bag, barrel, drum, tank, or other device used to contain PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs.
28. PCB Bulk Product Waste means waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal is >50 ppm PCBs. PCB bulk product waste does not include PCBs or PCB Items regulated for disposal under §761.60(a) through (c), §761.61, §761.63, or §761.64. PCB bulk product waste is further defined in 40 CFR §761.3. Note in accordance with October 2012 re-interpretation from the U.S. Environmental Protection Agency (EPA), adjacent porous materials in contact with PCB Bulk Products shall be considered PCB Bulk Product Material for disposal purposes.
29. PCB Capacitor means any capacitor that contains >500 ppm PCB. Concentration assumptions applicable to capacitors appear under §761.2.
30. PCB Container means any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.
31. PCB-Contaminated means a non-liquid material containing PCBs at concentrations >50 ppm but < 500 ppm; a liquid material containing PCBs at concentrations >50 ppm but < 500 ppm or where insufficient liquid material is available for analysis, a non-porous surface having a surface concentration >10 pg/100 cm2 but < 100 pg/100 cm2, measured by a standard wipe test as defined in §761.123.
32. PCB Equipment means any manufactured item, other than a PCB Container or a PCB Article Container, which contains a PCB Article or other PCB Equipment, and includes microwave ovens, electronic equipment, and fluorescent light ballasts and fixtures.
33. PCB Item means any PCB Article, PCB Article Container, PCB Container, PCB Equipment, or anything that deliberately or unintentionally contains or has as a part of it any PCB or PCBs.
34. PCB Remediation Waste means waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: Materials disposed of prior to April 18, 1978, that are currently at concentrations >50 ppm PCBs, regardless of the concentration of the original spill; materials which are currently at any volume or concentration where the original source was >500 ppm PCBs beginning on April 18, 1978, or >50 ppm PCBs beginning on July 2, 1979; and materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, as further defined in 40 CFR §761.3.
35. PCB waste(s) means those PCBs and PCB Items that are subject to the disposal requirements of subpart D in 40 CFR Part 761.
36. Porous surface means any surface that allows PCBs to penetrate or pass into itself including, but not limited to, paint or coating on metal; corroded metal; fibrous glass or glass wool; unglazed ceramics; ceramics with a porous glaze; porous building stone such as sandstone, travertine, limestone, or coral rock; low-density plastics such as Styrofoam and low-density polyethylene; coated (varnished or painted) or uncoated wood; concrete or cement; plaster; plasterboard; wallboard; rubber; fiberboard; chipboard; asphalt; or tar paper. For purposes of cleaning and disposing of PCB remediation waste, porous surfaces have different requirements than nonporous surfaces.
37. RCRA means the Resource Conservation and Recovery Act (40 U.S.C. 6901 et seq.).

38. Standard wipe sample means a sample collected for chemical extraction and analysis using the standard wipe test as defined in §761.123. Except as designated elsewhere in part 761, the minimum surface area to be sampled shall be 100 cm2.
39. Storage for disposal means temporary storage of PCBs that have been designated for disposal.
40. SW-846 means the document having the title "SW-846, Test Methods for Evaluating Solid Waste,"
41. Totally enclosed manner means any manner that will ensure no exposure of human beings or the environment to any concentration of PCBs.
42. Transfer facility means any transportation-related facility including loading docks, parking areas, and other similar areas where shipments of PCB waste are held during the normal course of transportation. Transport vehicles are not transfer facilities under this definition, unless they are used for the storage of PCB waste, rather than for actual transport activities. Storage areas for PCB waste at transfer facilities are subject to the storage facility standards of §761.65, but such storage areas are exempt from the approval requirements of §761.65(d) and the recordkeeping requirements of §761.180, unless the same PCB waste is stored there for a period of more than 10 consecutive days between destinations.
43. Transporter of PCB waste means, for the purposes of subpart K of 40 CFR Part 761, any person engaged in the transportation of regulated PCB waste by air, rail, highway, or water for purposes other than consolidation by a generator.
44. Transport vehicle means a motor vehicle or rail car used for the transportation of cargo by any mode. Each cargo-carrying body (e.g., trailer, railroad freight car) is a separate transport vehicle.
45. TSCA means the Toxic Substances Control Act (15 U.S.C. 2601 et seq.).

1.11 SUBMITTALS

A. A pre-remediation meeting shall occur with the PCB Remediation Contractor, Owner or the Owner's Authorized Representative, and environmental consultant two weeks prior to commencement of work. The following documents shall be submitted immediately upon project award to the Owner prior to commencement of PCB Removal work:
   1. Site Specific Health and Safety Plan (HASP): The PCB Remediation Contractor shall prepare a site specific HASP plan for protection of workers and control of the work site in accordance with OSHA regulatory requirements. The HASP shall govern all work conducted at the site during the remediation of PCB materials and related debris; waste handling, sampling, waste management; and waste transportation. At a minimum, the HASP shall address the requirements set forth in 29 CFR 1910.120, as further outlined below:
      a. Health and Safety Organization
      b. Site Description and Hazard Assessment
      c. Training
      d. Medical Surveillance
      e. Work Areas
      f. Personal Protective Equipment
      g. Personal Hygiene and Decontamination
      h. Standard Operating Procedures and Engineering Controls
   2. Emergency Equipment and First Aid Provisions
      a. Equipment Decontamination
      b. Air Monitoring

3. Telephone List
    a. Emergency Response and Evacuation Procedures and Routes
    b. Site Control
    c. Permit-Required Confined Space Procedures
    d. Spill prevention and Containment Plan
    e. Heat and Cold Stress
    f. Record Keeping
    g. Community Protection Plan
4. Training Documentation: Documentation of OSHA 40-Hour HAZWOPER Training for all employees and subcontractors to be used for the remediation work, and 8-Hour HAZWOPER Supervisor Training for the designated on-site Health and Safety Officer for the remediation work.
5. PCB and or other Toxic or Hazardous Substances Disposal Plan: A written plan that details the PCB Remediation Contractor's plan for transportation and disposal of PCB-containing or other Toxic or Hazardous Substance wastes generated during the project. The Disposal Plan shall identify:
    a. Waste packaging, labeling, placarding and manifesting procedures.
    b. The name, address and 24-hour contact number for the proposed treatment or disposal facility or facilities to which waste generated during the project will be transported.
    c. The name, address, contact person(s) and state-specific permit numbers for proposed waste transporters, and EPA identification number for firms that will transport waste.
    d. The license plate numbers of vehicles to be used in transporting of the waste from the site to the disposal facility.
    e. The route(s) by which the waste will be transported to the designated disposal facility, and states or territories through which the waste will pass.
    f. disposal facility, and states or territories through which the waste will pass.
6. Safely Data Sheets: Safety Data Sheets (OSHA Form 174 or equivalent) and manufacturer's information shall be provided for all chemicals and materials to be used during the project including but not limited to specialty cleaners and chemical stripping products.

B. The following documents shall be submitted to the Owner within fifteen (15) work days following removal of waste from the site:
    1. Waste Profile Sheets
    2. Pre-Disposal Analysis Test Results (If required by disposal facility)
    3. Manifests signed by the disposal facility
    4. Tipping Receipts provided by the disposal facility
    5. Certification of Final Treatment/Disposal signed by the responsible disposal facility official.

C. PCB Work Closeout Submittals:
    1. Disposal Site Receipts: Copy of waste shipment record and disposal site receipt showing the PCB-containing or other Toxic or Hazardous Substances materials have been properly disposed.

D. Product Data: Catalog sheets, specifications, and application instructions for any removal products, if used.

1.12 REGULATIONS AND STANDARDS

A. The PCB Remediation Contractor shall be solely responsible for conducting this project and supervising all work in a manner that will be in conformance with all federal, state, and local regulations and guidelines pertaining to PCB Containing Material removal. Specifically, The PCB Remediation Contractor shall comply with the requirements of the following as applicable to the work to be performed:
   1. Toxic Substance Control Act (TSCA) (40 CFR Part 761).
   2. Comprehensive Environmental Response, Compensation, and Liability Act (Superfund Law).
   3. Department of Transportation (DOT) regulations - DOT regulation HM-181 regulates transportation of hazardous materials, including PCBs.
   4. Occupational Safety and Health Administration (OSHA) - OSHA regulates workers' safety and exposure to a variety of chemicals including PCBs.
   5. Connecticut Basic Building Code (BOCA) (including Connecticut Supplements);
   6. Life Safety Code (NFPA); and
   7. Local health and safety codes, ordinances or regulations pertaining to hazardous materials remediation and all national codes and standards including ASTM, ANSI, and Underwriter's Laboratories.

1.13 FINAL VISUAL CLEARANCE

A. Following the completion of the work, the Consultant shall perform a final visual inspection of the work area per guidelines EPA and State of Connecticut CT DEEP regulations and to assess that the above-indicated PCB-containing materials were removed.

1.14 POSTING AND RECORD MAINTENANCE REQUIREMENTS

A. The following items shall be conspicuously displayed proximate but outside of remediation work areas.
   1. Exit Routes -Emergency exit procedures and routes.
   2. Emergency Phone Numbers - A list indicating the telephone numbers and locations of the local hospital(s); the local emergency squad; the local fire department; the local police department; the Poison Control Center; Chemical Emergency Advise (CHEMTREC); the local Department of Health's local office; the PCB Remediation Contractor (on-site and after-hours numbers); and the environmental consultant (on-site and after hours numbers).
   3. Warning Signs - Warning signs shall be in English and the language of any workers onsite who do not speak English, and be of sufficient size to be clearly legible and display the following or similar language in accordance with 29 CFR 1910.1200:

      WARNING
      HAZARDOUS WASTE WORK AREA
      PCBs-POISON
      NO SMOKING, EATING OR DRINKING
      AUTHORIZED PERSONNEL ONLY
      PROTECTIVE CLOTHING IS REQUIRED IN THIS AREA

      In addition, all entrances to work areas shall be posted with a PCB M_L marker.

B. The PCB Remediation Contractor shall maintain the following items on-site and available for review by all employees and authorized visitors:
   1. PCB Remediation Contractor's Project Specific Health and Safety Plan
   2. Certificates of Training for all employees and the project Supervisor
   3. Codes, Standards and Publications
   4. Safety Data Sheets (SDS) for all chemicals used during the project.
   5. Copies of the PCB Remediation Contractor's written hazard communication, respiratory protection, and confined space entry programs.

C. Fees, Permits and Licenses. The PCB Remediation Contractor shall pay all licensing fees, royalties, and other costs necessary for the use of any copyrighted or patented product, design, invention, or processing in the performance of the work specified in this Section.
   1. The PCB Remediation Contractor shall be solely responsible for costs, damages, or losses resulting from any infringement of these patent rights or copyrights. The PCB Remediation Contractor shall hold the Owner and the Owner's Authorized Representative harmless from any costs, damages, and losses resulting from any infringement of these patent rights or copyrights.
   2. The PCB Remediation Contractor shall be responsible for securing all necessary permits for work under this Section, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

1.15 QUALITY ASSURANCE

A. The PCB Remediation Contractor shall provide and assure that the quality of work practices and procedures to be utilized are consistent with the above listed agencies and regulations. PCB Remediation Contractor shall utilize the latest edition, including all addenda, revisions and supplements for all regulatory agencies codes, etc.

B. Worker's Qualifications: The persons performing PCB remediation and their supervisors shall be personally experienced in PCB remediation work and shall have been regularly employed by a company performing PCB remediation for a minimum of 3 years.

C. Pre-Work Conference: Before the Work of this Section is scheduled to commence, a conference will be held by the Owner at the Site for the purpose of reviewing the Contract Documents, discussing requirements for the Work, and reviewing the Work procedures.

   1. The conference shall be attended by the PCB Remediation Contractor, and the Owner's Authorized Representative employed by the Owner. This pre-remediation meeting may consist of multiple meetings.

1.16 MINIMUM REQUIREMENTS FOR WORKER HEALTH AND SAFETY

A. The PCB Remediation Contractor is responsible and liable for the health and safety of all onsite personnel and the offsite community affected by the project. All onsite workers or other persons entering the remediation work areas, decontamination areas or waste handling and staging areas shall be knowledgeable of and comply with the requirements of the site specific Health and Safety Plan at all times. The PCB Remediation Contractor's HASP shall comply with all applicable federal, state, and local regulations protecting human health and the environment from the hazards posed by the work to be performed under this project.

B. Consistent disregard for the provisions of the HASP shall be deemed as sufficient cause for immediate stoppage of work and termination of the Contract or any Sub Contracts without compromise or prejudice to the rights of the Owner or the Owner's Authorized Representative.

C. Any discrepancies between the PCB Remediation Contractor's HASP and these specifications or federal and state regulations shall be resolved in favor of the more stringent requirements that provide the highest degree of protection to the project personnel and the surrounding community and environment.

D. In addition to exposure concerns relating to the presence of PCBs, other health and safety considerations will apply to the work. The PCB Remediation Contractor shall be responsible for recognizing such hazards and shall be responsible for the health and safety of PCB Remediation Contractor employees at all times. It is the PCB Remediation Contractor's responsibility to comply with all applicable health and safety regulations.

E. The HASP shall be reviewed by all persons prior to entry into the remediation, decontamination, or waste staging areas, whether a representative of the PCB Remediation Contractor, owner, architect/engineer, environmental consultant, subcontractor(s), waste transporter or federal, state or local regulatory agency. Such review shall be acknowledged and documented by the PCB Remediation Contractor's Health and Safety Officer by obtaining the name, signature and affiliation of all persons reviewing the HASP.

F. The HASP shall be maintained so as to be readily accessible and reviewable by all site personnel throughout the duration of the remediation project and until all waste materials are removed from the site and disposed of at the appropriate disposal facility.

G. The PCB Remediation Contractor's on-site Health and Safety Officer shall be responsible for ensuring that project personnel and site visitors are informed of and comply with the provisions of the HASP at all times during the project.

1.17 WORK AREAS AND ZONES

A. The PCB Remediation Contractor shall lay-out and clearly identify work areas in the field. Access by equipment, site personnel, and the public to the work areas shall be limited as follows:

1. Remediation Zone: The Remediation Zone(s) shall consist of all interior and exterior areas where removal of PCBs and other Toxic or Hazardous Substances and waste handling and staging activities are on-going and the immediately surrounding locale or other areas where contamination could occur. The Remediation Zone for purposes of interior and exterior removal of PCB materials or other Toxic or Hazardous Substances for disposal shall be performed within a containment to isolate work areas from non-work areas. The containment shall be visibly delineated with appropriate warning signs at all approaches to Remediation (including a PCB ML marker), and be restricted from access by all persons except those directly necessary for the completion of the respective remediation tasks. The Remediation Zone shall be located and delineated as necessary to limit access to the remediation area and to minimize risk of exposure to site workers and the general public. Access shall be controlled at the periphery of the Remediation Zone to regulate the flow of personnel and equipment into and out of the zone and to help verify that proper procedures for entering and exiting are followed. All persons within the Remediation Zone shall wear the appropriate level of protection established in the HASP.

2. Decontamination Zone: The Decontamination Zone is the transition zone between the remediation area and the clean support zone of the project site, and is intended to reduce the potential for contaminants from being dispersed from the Remediation Zone to clean areas of the site. The Decontamination Zone shall consist of a buffer area surrounding the Remediation Zone through which the transfer of equipment, materials, personnel and containerized waste products will occur and in which decontamination of equipment, personnel, and clothing will occur. The Decontamination Zones shall be constructed as a three-chamber decontamination unit for workers and a two chamber equipment room for waste load out as detailed in Section 3.4. All emergency response and first aid equipment shall be readily maintained in this Zone. All protective equipment and clothing shall be removed or decontaminated in the Decontamination Zone prior to exiting to the Support Zone.
3. Support Zone: The Support Zone will consist of the area outside the Decontamination Zone and the remainder of the project site. Administrative and other support functions and any activities that by nature need not be conducted in the Remediation or Decontamination Zone related to the project shall occur in the Support Zone, Access to the Remediation and Decontamination Zones shall be controlled by the Health and Safety Officer and limited to those persons necessary to complete the remediation work and which have reviewed and signed the HASP.
4. The remediation contractor is responsible for supplying the direct-reading particulate meter, performing testing and documenting the daily readings. The consultant may choose to perform independent sampling as well.

1.18 PERSONNEL PROTECTIVE EQUIPMENT

A. The PCB Remediation Contractor shall be responsible to determine and provide the appropriate level of personal protective equipment in accordance with applicable regulations and standards necessary to protect the PCB Remediation Contractor's employees from all hazards present.

B. The PCB Remediation Contractor shall provide all employees with the appropriate safety equipment and protective clothing to ensure an appropriate level of protection for each task, taking into consideration the chemical, physical, ergonomic and biological hazards posed by the site and work activities.

C. The PCB Remediation Contractor shall establish in the HASP criteria for the selection and use of personal protective equipment (PPE).

D. The PPE to be utilized for the project shall be selected based upon the potential hazards associated with the project site and the work to be performed. Appropriate protective clothing shall be worn at all times within the Remediation Zone.

E. The PCB Remediation Contractor shall provide the appropriate level of respiratory protection to all field personnel engaged in activities where respiratory hazards exist or there is a potential for such hazard to exit.

F. The PCB Remediation Contractor shall provide, as necessary, protective coveralls, disposable gloves and other protective clothing for all personnel that will be actively involved in remediation activities or waste handling activities or otherwise present in the Remediation Zones. Coveralls shall be of Tyvek or equivalent material. Should the potential for exposure to liquids exist, splash resistant disposable suits shall be provided and utilized.

G. Protective coveralls, and other protective clothing shall be donned and removed within the Decontamination Zone and shall be disposed of at the end of each day. Ripped coveralls shall be immediately replaced after appropriate decontamination has been completed to the satisfaction of the Health and Safety Officer. Protective clothing shall not be worn outside of the Decontamination Zone.

H. Hard Hats, protective eyewear, rubber boots and or other non-skid footwear shall be provided by the PCB Remediation Contractor as required for workers and authorized visitors.

I. All contaminated protective clothing, respirator cartridges and disposable protective items shall be placed into proper containers to be provided by the PCB Remediation Contractor for transport and proper disposal in accordance with 40 CFR 262.

1.19 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

A. The PCB Remediation Contractor shall provide and maintain at the site, at a minimum, the following Emergency and First Aid Equipment:
   1. Fire Extinguishers: A minimum one (1) fire extinguisher shall be supplied and maintained at the site by the PCB Remediation Contractor throughout the duration of the project. Each extinguisher shall be a minimum of a 20 pound Class ABC dry fire extinguisher with Underwriters Laboratory approval per 29 CFR 1910.157.
   2. First Aid Kit: A minimum of one (1) first aid kit meeting the requirements of 29 CFR 1910,151 shall be supplied and maintained at the site by the PCB Remediation Contractor throughout the duration of the project.
   3. Communications: Telephone communications (either cellular or land line) shall be provided by the PCB Remediation Contractor for use by site personnel at all times during the project.

B. The Health and Safely Officer shall be notified immediately in the event of personal injury, potential exposure to contaminants, or other emergency. The Health and Safety Officer shall then immediately notify the Owner's Authorized Representative.

1.20 STANDARD SAFETY AND HEALTH PROCEDURES AND ENGINEERING CONTROLS

A. The following provisions shall be employed to promote overall safety, personnel hygiene and personnel decontamination:
   1. Each PCB Remediation Contractor or Subcontractor shall ensure that all safety equipment and protective clothing to be utilized by its personnel is maintained in a clean and readily accessible manner at the site.
   2. All prescription eyeglasses in use on this project shall be safety glasses conforming to ANSI Standard Z87.1. No contact lenses shall be allowed on the site.
   3. Prior to exiting the delineated Decontamination Zone(s), all personnel shall remove protective clothing, and place disposable items in appropriate disposal containers to be dedicated to that purpose. Following removal of PPE, personnel shall thoroughly wash and rinse their face, hands, arms and other exposed areas with soap and tap water wash and subsequent tap water rinse. A fresh supply of tap water shall be provided at the site on each work day by the PCB Remediation Contractor for this purpose.
   4. All PPE used on site shall be decontaminated or disposed of at the end of each work day. Discarded PPE shall be placed in sealed DOT approved 55-gallon barrels for off-site disposal.

5. Respirators, if necessary due to an upgrade to Level C PPE, shall be dedicated to each employee, and not interchanged between workers without cleaning and sanitizing.
6. Eating, drinking, chewing gum or tobacco, smoking, and any other practice that increases the likelihood of hand to mouth contact shall be prohibited within the delineated remediation and decontamination work zones. Prior to performing these activities, each employee shall thoroughly cleanse their face, hands, arms and other exposed areas.
7. All personnel shall thoroughly cleanse their face hands, arms and other exposed areas prior to using toilet facilities.
8. No alcohol, tobacco, illicit drugs or firearms will be allowed on the site at any time.
9. Contact with potentially contaminated surfaces should be avoided, if possible. Field personnel should minimize walking through standing water/puddles, mud or other wet or discolored surfaces; kneeling on ground; and placing equipment, materials or food on ground or other potentially contaminated surface.
10. The use of the "Buddy System" shall be employed at all times while conducting work at the site. Each employee shall frequently monitor other workers for signs of heat stress or chemical exposure or fatigue: periodically examine others PPE for signs of wear or damage; routinely communicate with others; and notify the Health and Safety Officer in the case of an emergency.

B. Workers must wear protective suits, protective gloves, eye protection and a minimum of half-face respirator with HEPA filter cartridge for all projects. Respiratory protection shall be in accordance with OSHA regulation 1910.134 and ANSI Z88.2.

C. Workers must be trained as per OSHA and US EPA requirements, have medical clearance and must have recently received pulmonary function test (PFT) and respirator fit tested by a trained professional.
1. A personal air sampling program shall be in place as required by OSHA.
2. The use of respirators must also follow a complete respiratory protection program as specified by OSHA.

1.21 INDEPENDENT INSPECTION AND MONITORING

A. This section describes independent visual inspection and monitoring work being performed on behalf of the Owner. This work is not in the Contract Sum. This section describes monitoring carried out by the Owner's Consultant (Langan) to verify that the building beyond the work area and the outside environment remains uncontaminated.

B. The purpose of the Owner's Consultant's monitoring is to detect faults in the work area isolation such as:
1. Contamination of the building outside of the work area by PCB dust.
2. Failure of filtration or rupture in the differential pressure system as applicable.
3. Contamination of the outside of the containment.

C. Should any of the above occur, the PCB Remediation Contractor shall immediately cease removal activities until the fault is corrected. Do not recommence work until authorized by the Owner's Consultant.

D. The Owner's Consultant may monitor the Work Area. The purpose of this monitoring will be to detect dust outside containment, which may challenge the ability of the Work Area isolation procedures to protect the balance of the building or outside of the building from contamination.

E. The Owner's Consultant will perform on-site monitoring throughout the course of the project, as follows:
   1. All work procedures shall be continuously monitored by the Consultant to assure that areas outside the designated work locations in the buildings will not be contaminated.
   2. Prior to work on any given day, The PCB Remediation Contractor's designated "competent person" shall discuss the day's work schedule with the Consultant to evaluate job tasks with respect to safety procedures and requirements specified to prevent contamination of the building or the employees. This includes a visual survey of the work area and the decontamination of the building or the employees.

PART 2 - PRODUCTS

2.1 REMEDIATION PRODUCTS

A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name and product technical description.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with PCBs shall be decontaminated or disposed of as PCB waste.

C. Polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to the job site with factory label indicating:
   1. Type: Minimum 6 mil., opaque, fire retardant polyethylene sheets.
   2. Floor/Ground Protective Layer: Minimum of multiple layers of 10 mil., reinforced polyethylene sheets (minimum of 20 feet out/away from building footprint).

D. Respirators:
   1. Type: Approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

E. Polyethylene disposable bags shall be six (6) mil with pertinent pre-printed label. Tie wraps for bags shall be plastic, five (5) inches long (minimum), pointed and looped to secure filled plastic bags.

F. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

G. Cleaning Products: Contractor shall at their discretion utilize specialty cleaning products such as Capsur, TechXtract or other cleaners for use in decontaminating porous and nonporous surfaces to remain. All such products shall be utilized in accordance with manufacturer's specifications as intended. PCB Remediation Contractor shall ensure appropriate use and disposal associated with use in accordance with the SDS sheets for each product utilized. It shall be incumbent upon the PCB Remediation Contractor to determine the need for use of specialty products to meet required cleaning verification levels established herein and in accordance with the SIP or Performance Based Plan.

H. The PCB Remediation Contractor shall have available spray equipment capable of mixing wetting agent with water and capable of generating sufficient pressure and volume and having sufficient hose length to reach all areas with PCBs.

I. HEPA filtered local exhaust ventilation shall be utilized during the installation of enclosures and supports where PCB-containing materials may be disturbed.

2.2 TOOLS AND EQUIPMENT

A. The PCB Remediation Contractor shall provide a sufficient supply of disposable mops, rags, and sponges for work area cleaning and decontamination shall be available.

B. The PCB Remediation Contractor shall provide a sufficient supply of scaffolding, ladders, lifts, and hand tools (e.g., scrapers, wire cutters, brushes, utility knives, wire saws, etc.) shall be provided as needed.

C. The PCB Remediation Contractor shall provide all tools and equipment necessary for PCB removal.

D. The PCB Remediation Contractor's air monitoring professional shall have air-monitoring equipment of type and quantity to monitor operations and conduct personnel exposure surveillance per OSHA requirements.

E. The Remediation Contractor is responsible for supplying direct-reading particulate meters, performing testing and documenting the daily readings for exterior, and if requested, interior areas. The consultant may choose to perform independent sampling as well.

F. The PCB Remediation Contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, polyethylene sheeting of proper size and thickness, tape and air filters.

G. The PCB Remediation Contractor shall provide (as needed) temporary electrical power panels, electrical power cables, and electrical power sources (such as generators). Any electrical connection work affecting the building electrical power system shall be performed by a State of Connecticut licensed electrician.

H. The PCB Remediation Contractor shall have available shower stalls and plumbing to support same to include sufficient hose length and drain system or an acceptable alternate.

I. Exhaust air filtration system units shall contain HEPA filter(s) capable of sufficient air exhaust to create negative pressure of -0.02 inches of water within enclosure with respect to outside area. Equipment shall be checked for proper operation by smoke tubes or differential pressure gauge before the start of each shift and at least twice during the shift. Adequate exhaust air shall be provided for a minimum of four (4) air changes per hour within the enclosure. No air movement system or air filtering equipment shall discharge unfiltered air outside.

J. Vacuum units, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter or larger.

2. 3 PERSONNEL PROTECTION

A. Safety equipment (e.g., hard hats meeting the requirements of ANSI Standard 289.11981, eye protection meeting the requirements of ANSI Standard Z87.1-1979, safety shoes meeting the requirements of ANSI Standard Z41.1-1967, disposable PVC gloves or other work gloves), shall be provided to all workers and authorized visitors.

B. Non-skid footwear shall be provided to all remediation workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.

PART 3 - EXECUTION

3.1 WORK AREA PROTECTION — REMEDIATION ZONE GENERAL

A. Protection of Existing Construction: Perform PCB Bulk Product Waste and PCB Remediation Waste removal work without damage or contamination of adjacent areas, asphalt and/or concrete paving, soils, and existing construction.

B. Prior to commencement of PCB remediation activities at each work area, a containment system shall be constructed by the PCB Remediation Contractor to capture and contain all materials removed during the remediation. Containment procedures referenced for the remediation zone must be utilized for PCB Bulk Product Waste removal.

C. During all remediation activities, PCB Remediation Contractor shall maintain control of all entrances and exits to the work areas to ensure only authorized personnel enter the work areas and are afforded proper personal protective equipment and as required respiratory protection. All approaches to work areas shall be demarcated with appropriately worded warning signs.

D. Work zones shall be established in accordance with this section to include remediation zone, decontamination zone, and support zone.

E. Negative pressure containments shall be constructed consisting of two layers of 6-mil polyethylene sheeting on wall surfaces and two layers of 10-mil polyethylene sheeting on floor surfaces if required.

3.2 WORK AREA PROTECTION — REMEDIATION ZONE FOR PCB BULK PRODUCT

A. Ground protection to prevent debris from escaping the remediation zone and to protect areas outside of remediation zone from PCB contamination shall be utilized. Protection shall include the use of water impervious membrane covering which shall be secured to the ground surface. Edges shall be raised to prevent water run-off used for dust control during cutting and demolition of structures/systems. The membrane shall be covered with plywood and multiple layers of 10-mil reinforced polyethylene sheeting securely fastened to foundation (extending a minimum of 20 feet away from the building foundation). All interior removal will occur with full containments – negative pressure enclosures including hard solid barriers (wood or similar material), 6 and 10-mil fire retardant polyethylene sheeting on the interior/exterior to maintain containment integrity and abutting decontamination units.

B. Isolation barriers shall be installed on the interior of the building to isolate the building exterior where work shall be performed. Protection shall be affixed to the inside finish surfaces to isolate window. One layer of 6-mil polyethylene sheeting shall create the exterior critical barrier between the Remediation Zone and Interior of the Building.

C. All other openings to the building interior such as ducts, grilles, etc. shall be securely sealed with a single layer of 6-mil polyethylene sheeting from the building exterior.

D. Ground protection and isolation barriers shall remain in place throughout work to collect dust and debris resulting from PCB Bulk Product Waste removal.

E. All debris and dust generated during operations shall be HEPA vacuumed continuously throughout the work shift and at the end of a work shift to avoid accumulation. Any tears or rips that occur in protections shall be repaired or removed and replaced with new protections.

F. All surfaces adjacent to materials removed shall be properly decontaminated upon completing the removal of PCB Bulk Product Waste.

G. Warning Signage: Post warning signs in accordance with 29 CFR 1910.1200 at all approaches to the work area. Signs shall be conspicuously posted to permit a person to read signs and take precautionary measures to avoid exposure to PCBs or other Toxic or Hazardous Substances. These signs should include the PCB M_L markers at each entrance to the work area.

H. Waste Containers for PCB Bulk Product Waste: Appropriate PCB waste containers shall be placed adjacent to remediation zones. Containers shall be lined covered and secured. The PCB waste containers shall be properly marked as described in 40 CFR part §761.40. Marking shall include a PCB M_L marker formatted in accordance with 40 CFR part §761.45.

3.3 DECONTAMINATION ZONE

A. The PCB Remediation Contractor shall establish contiguous to the work area, a decontamination enclosure consisting of equipment room, shower room, and clean room in series. The only access between contaminated and uncontaminated areas shall be through this decontamination enclosure. The PCB Remediation Contractor shall ensure that employees enter and exit the Remediation Zone through the decontamination area.

B. Access between rooms in the decontamination system shall be through double flap curtain opening airlocks. The clean room, shower and equipment room within the decontamination enclosure, shall be completely sealed ensuring that the sole source of airflow through this area originates from uncontaminated areas outside the work area.

C. Construct the decontamination systems with wood or metal framing, 3/8" sheathing and cover both sides with a double layer of six (6) mil polyethylene sheeting, spray glued or taped at the joints. Caulk joints watertight at floor, walls, and ceiling.

D. The PCB Remediation Contractor shall visually inspect interior and exterior critical barriers that separate the Remediation Zone and the Interior of the Building, respectively, several times daily to assure effective seal and the PCB Remediation Contractor shall repair defects immediately.

E. Equipment room. The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective equipment.

F. Shower area. Shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be adjacent both to the equipment room and the clean room.

G. Clean change room. The clean room shall be equipped with a locker or appropriate storage container for each worker's use. Following showering, each worker must then change into street clothing in clean change areas.

H. Decontamination area entry procedures. The PCB Remediation Contractor shall ensure that all workers follow proper decontamination procedures for entry into a Regulated Work area including but not limited to the following:
   1. Enter the decontamination area through the clean room;
   2. Remove and deposit street clothing within a locker provided for their use;
   3. Put on protective clothing and respiratory protection before leaving the clean room.
   4. Before entering the Remediation Zone, the PCB Remediation Contractor shall ensure that workers pass through the equipment room.

I. Decontamination area exit procedures. The PCB Remediation Contractor shall ensure that all workers follow proper decontamination procedures for exit from a Regulated Work area including but not limited to the following:
   1. Before leaving the regulated area, workers shall remove all gross contamination and debris from their protective clothing.
   2. Workers shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.
   3. Workers shall not remove their respirators in the equipment room.
   4. Workers shall shower prior to entering the clean room.
   5. After showering, workers shall enter the clean room before changing into street clothes.

J. Equipment Room for Waste Removal: The PCB Remediation Contractor shall establish a two chamber equipment room or area that is adjacent to the Remediation Zone for the decontamination of waste containers and equipment as noted above.
   1. The area must be of sufficient size as to accommodate cleaning of equipment and removing waste without spreading contamination beyond the area (as determined by visible accumulations).

2. All equipment and surfaces of containers filled with PCB waste must be cleaned prior to removing them from the equipment room or area.

3.4 PCB BULK PRODUCT MATERIAL REMOVAL

A. PCB Bulk Product Waste Materials – Interior and exterior materials listed in 1.08 Scope of Work per the EPA PCB Bulk Waste Reinterpretation Memorandum dated October 24, 2012. The PCB Bulk Product Waste will also include asbestos containing materials (see asbestos specifications).

B. Materials shall be removed in a manner which does not breakdown the materials into fine dust or powder to the extent feasible. Equipment and tools to be utilized shall include hand tools and mechanical equipment such as demolition hammers to remove materials from adjacent substrates. Mechanical removal equipment shall as appropriate be fitted with dust collection systems.

C. Any dry or brittle sealant/caulking/glazing materials shall be removed with additional engineering controls such as use of a HEPA vacuum to remove accumulated dust or debris during removal.

D. Sequence of removal shall follow the following general requirements:
1. Site preparation and controls shall be completed. Work shall not proceed until authorized by owner's representative.
2. The materials listed in 1.08 shall be removed in their entirety for disposal as PCB Bulk Product Waste. The removal of the systems shall be performed so that the sealant/caulking/glazing compounds and other source/adjacent materials are not disturbed.
3. The adjacent surfaces shall be cleaned of all residues using EPA recommended methods.

E. Waste shall be immediately containerized in temporary 6-mil polyethylene disposal bags for disposal. These containers shall be sealed in remediation zone when full during collection and then placed in disposal containers/storage trailers. The containers shall not be emptied into other containers to avoid dispersal of dust or fugitive emissions.

F. The use of minimal quantities of water to moisten the generated dust prior to collection shall be utilized. Under no circumstances shall the PCB waste show evidence of free liquid water, pooling or ponding within the waste stream. Any liquid used to wet the dust and debris to control fugitive emissions shall be properly containerized and decontaminated in accordance with 40 CFR Part §761.79 (b)(1) or disposed of in accordance with 40 CFR Part §761.60 (a).

G. PCB Bulk Product Waste shall be stored for disposal in accordance with 40 CFR Part §761.65 and marked in accordance with 40 CFR Part §761.40 and §761.45.

H. All waste containers shall be appropriately labeled in accordance with 40 CFR Part §761.40 and §761.45. Labeling shall include the PCB M_L marker.

3.5 PCB REMEDIATION WASTE — IF VERFIFICATON SAMPLING FINDS >1 PPM PCB

A. All adjacent components (if failing verification sampling – if required) shall be removed, in containments and transported off-site for disposal as PCB Remediation Waste. This includes adjacent building materials/asphalt/soil failing verification sampling (if contractor contaminates these surfaces/materials) and will be performed at no extra cost to the owner. The contractor owns additional remediation for verification sampling failures up to 20% however if the contractor is deemed by Langan to have contaminated the wall surfaces, all additional remediation is to be performed by the contractor at no additional cost to the owner.

B. All PCB Remediation Waste shall be stored for disposal in accordance with 40 CFR Part §761.65.

C. All waste containers shall be appropriately labeled in accordance with 40 CFR Part §761.40 and §761.45. Marking shall include the PCB M_L marker.

D. Soil excavations will be backfilled with certified clean soil meeting the CT DEEP Remediation Standards Regulations (RSRs) for the Residential Direct Exposure Criteria (RDEC) and Groundwater Classification A (GB) Pollutant Mobility Criteria (PMC). Asphalt excavations shall be replaced in kind. Additionally brushes removed during soil excavation shall be replaced in kind.
   1. Scope for soil sample collection:
      a. Owner's Representative will review the characterization data of soil being brought on-site.
      b. Collect one composite soil sample (made up of three sample locations) for every 500 cubic yards (CY) of material planned to be brought to the site for use as clean fill.
   2. Laboratory analysis of soil characterization shall include the following:
      a. Volatile Organic Compounds (VOCs by method 8260)
      b. Polynuclear Aromatic Hydrocarbons (PAHs by method 8270)
      c. Extractable Total Petroleum Hydrocarbons (ETPH)
      d. Polychlorinated Biphenyls (PCBs by method 8082)
      e. Pesticides and Herbicides (by method 8081)
      f. RSR metals (Mass and SPLP)

3.6 CLEANING AND DECONTAMINATION

A. The PCB Remediation Contractor shall be responsible for complete cleaning and decontamination of the Remediation Zone upon completion of work. The Remediation Zone will be required to meet proposed Verification Sampling limits prior to containment tear down.

B. The PCB Remediation Contractor shall utilize HEPA vacuum and wet cleaning products to remove all visible dust and debris from all surfaces within the work area. If specialty products are utilized the PCB Remediation Contractor shall utilize in accordance with manufacturer's specifications including any additional safety and disposal requirements for such use.

C. Cleaning of containment barriers shall be performed prior to removal leaving critical barriers at openings, decontamination units and negative air filtration devices in place until results of post verification sampling indicate acceptable limits. Cleaning shall be performed from ceiling to floors.

D. Any liquid used to wet the dust and debris to control fugitive emissions shall be collected and decontaminated in accordance with 40 CFR Part §761.79 (b)(1) or disposed of in accordance with §761.60 (a).

E. All rags and other cleaning materials used to clean shall also be properly disposed as PCB Remediation Waste. All PCB Remediation Waste shall be stored for disposal in accordance with 40 CFR Part §761.65. All waste containers shall be appropriately marked in accordance with 40 CFR Part §761.40 and §761.45.

F. Equipment to be utilized in connection with the removal of PCB Bulk Product Waste and PCB Remediation Waste including waste collection or that will or may come in direct contact with the site contaminants shall be decontaminated prior to leaving the site to prevent migration of the contaminated residues from the project site. Decontamination shall be in accordance with 40 CFR Part §761.79 and Subpart S procedures.

G. All non-disposable equipment and tools employed in the course of the project will be decontaminated at the conclusion of each work day through the following sequence:

Initial tap water rinse, to remove gross contaminants.
1. Tap water and hexane or equivalent wash
2. Tap water rinse
3. Second tap water and hexane or equivalent wash
4. Second tap water rinse

H. The wash water and decontamination liquids shall be captured and containerized in DOT approved 55-gallon barrels for off-site disposal.

3.7 CONSULTANTS INSPECTION RESPONSIBILITIES

A. The Owner shall retain an industrial hygiene firm (Owner's Authorized Representative) to perform periodic inspections and sampling during the work. Site visits shall be scheduled based on the progress of the work and at critical time periods.

B. Consultant shall conduct inspections throughout the progress of the removal project. Inspections shall be conducted in order to document the progress of the removal work as well as the procedures and practices employed by the PCB Remediation Contractor.

C. The Consultant shall perform the following inspections during the course of remediation activities:
1. Pre-commencement Inspection. Pre-commencement inspections shall be performed at the time requested by the remediation Contractor. The Consultant shall be informed 12 hours prior to the time the inspection is needed. If, during the course of the pre-commencement inspection, deficiencies are found, the PCB Remediation Contractor shall perform the necessary adjustments in order to obtain compliance.
2. Work Area Inspections. Work area inspections shall be conducted on a daily basis at the discretion of the Consultant. During the course of the work inspections, the Consultant shall observe the PCB Remediation Contractor's removal procedures, verify barrier integrity, assess project progress, and inform the remediation Contractor of specific remedial activities if deficiencies are noted.

D. The Owner's Authorized Representative may perform real time monitoring for dust particulate using Dust Trak or equivalent monitoring devices for total dust. Sampling may be performed prior to remediation for background comparison to during remediation sampling. In addition, air sampling outside of the Remediation Zone, may be performed periodically during active removal activities at the Owner's Authorized Representative's discretion for laboratory confirmation. **The remediation contractor is responsible for supplying the direct-reading particulate meters (minimum of 2), performing testing and documenting the daily readings. The consultant may choose to perform independent sampling as well.**

E. It should be noted that if the results of air samples exceed established action levels or ambient background conditions for real time monitoring whichever is less the PCB Remediation Contractor will be required to implement work stoppage to determine causes of exceeding results and as necessary utilize additional containment measures or engineering controls. Any resulting decontamination of areas beyond the Remediation Zone shall be responsibility of the PCB Remediation Contractor.

F. The Owner's Authorized Representative shall perform post removal and decontamination visual clearance inspection as necessary to determine complete removal of PCB's. Verification sampling may be performed on adjacent building materials.

G. Once verification sampling and/or visual inspection has documented the Remediation Zone meets required criteria, the PCB Remediation Contractor shall be permitted to remove decontamination unit, critical barriers, etc. These areas shall be subjected to a visual inspection to ensure no visible dust is present.

3.8 MARKING OF WASTE CONTAINERS

A. All waste containers must be marked with the name of the waste contained; the date in which the first material was placed in the vessel; and the last date at which addition of waste occurred. All waste containers must be marked with a PCB M_L marker.

B. All waste containers containing PCB Bulk Product Waste, Bulk PCB Remediation Waste and PCB contaminated debris, containment system components, used personnel protective equipment, personal and equipment wash water and decontamination fluids, or other wastes generated during the remediation work shall be labeled as follows:

DOT Class 9 UN3432 (solid)
Or UN2315 (liquid) PCB Waste
RQ
Waste for Disposal
Federal law prohibits improper disposal.
If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.
Generator's Information: NOa-g
Manifest Tracking No.:
Accumulation Start Date:
EPA ID No.:
EPA Waste No.:
Total Weight:
Container No.:

HANDLE WITH CARE!

In addition, these containers must be marked with a PCB M_L marker.

Such marking must be durable, in English and printed on or affixed to the surface of the package or on a label, tag or sign; displayed on a background of sharply contrasting color; un-obscured by labels or attachments and located away from any other marking (such as advertising) that could substantially reduce its effectiveness.

3.9 ON-SITE WASTE MANAGEMENT AND DISPOSAL OF SOLID HAZARDOUS WASTES

A. All solid waste material, containment system components, used personnel protective equipment, and other solid wastes generated during the work, shall be placed directly in appropriate waste receptacles immediately upon removal from its in-situ position. Suitable waste receptacles may consist of roll-off containers or DOT-approved 55-gallon barrels.

B. The PCB Remediation Contractor shall be responsible for all packaging, labeling, transport, disposal and record-keeping associated with PCB or PCB contaminated waste in accordance with all federal, state and local regulations.

C. The PCB Remediation Contractor shall ensure that the person transporting the waste holds a valid permit issued in accordance with appropriate federal, state, and local regulations.

D. The PCB Remediation Contractor shall provide to the transporter at the time of transfer appropriate shipping records or uniform waste manifests as required by the federal, state and local regulations with a copy to the Owner and Owner's Authorized Representative.

E. PCB Remediation Contractor shall maintain proper follow up procedures to assure that waste materials have been received by the designated waste site in a timely manner and in accordance with all federal, state and local regulations.

F. The PCB Remediation Contractor shall assure that disposal of polychlorinated biphenyls (PCB) containing waste material is at a facility approved to accept such waste and shall provide a tracking/manifest form signed by the landfill's authorized representative.

G. If roll-off containers are to be utilized for containerization of the remediation wastes the following shall apply:
   1. All roll-off containers or other similar vessels utilized shall be watertight and lined with 6-mil polyethylene sheeting or equivalent impermeable lining, and equipped with a secured and impermeable cover.
   2. The impermeable cover shall remain securely in place at all times when material is not being actively placed in the vessels. The PCB Remediation Contractor shall be responsible for ensuring that the cover remains securely intact until the container is removed from the site.

H. If 55-Gallon barrels are to be utilized for waste containerization, the barrels shall consists of suitable DOT-approved 55-gallon barrels that are watertight and free of corrosion, perforations, punctures, or other damage. All barrels shall be securely covered and sealed at the conclusion of each work day.

I. The waste containers shall remain staged at the site with a secure impermeable cover in place until the materials are transported from the site to be delivered to the designated disposal facility.

J. A waste roll-off and barrel staging area shall be designated prior to initiation of the remediation work, and approved by the Owner's Authorized Representative. If this area is located outside of the building, the area (or areas) shall be surrounded by a chain-link fence with a minimum height of six feet. The fence shall be labeled with a PCB ML marker.

K. Properly containerized waste must be transported by a licensed hauler and shipped as PCB Bulk Product Waste for disposal at a permitted waste facility in accordance with 761.62.

L. PCB Remediation Waste must be transported by a licensed hauler and shipped as PCB Remediation Waste for disposal in accordance with 40 CFR 761.61(b) to a EPA TSCA permitted hazardous waste landfill (EQ's Wayne Disposal Landfill in Belleville, Michigan, CWM Model City Disposal Landfill in Youngstown, NY or equivalent); and dispose of non-liquid PCB remediation waste in a high temperature incinerator approved under 761.70, alternate disposal method approved under 761.60(e), and/or a chemical waste landfill approved under 40 CFR 761.75 which is an EPA, TSCA approved facility for PCB Remediation Waste. Provide required copies of the uniform waste manifests for hazardous wastes to the Owner, waste generation State and waste destination State as required.

M. Bulk Product Waste will be transported under manifest for off-site disposal to a hazardous waste landfill (EQ's Wayne Disposal Landfill in Belleville, Michigan or equivalent); and/or other appropriate waste will be transported under manifest for off-site disposal at a non-hazardous waste landfill permitted to accept such materials (Waste Management's Turnkey Landfill in Rochester, New Hampshire, Minerva, Ohio or GROWS Landfill in Morrisville, Pennsylvania or equivalent).

N. Provide required copies of the uniform waste manifests for hazardous wastes to the Owner, waste generation State and waste destination State as required.

O. Any PCB Liquid Water Waste shall be properly containerized and decontaminated in accordance with 40 CFR Part §761.79 (b)(1) or disposed of in accordance with 40 CFR Part §761.60 (a).

P. Any chemicals, solvents or other products used during decontamination shall be properly containerized as PCB Liquid Waste. Waste must be properly decontaminated or disposed in accordance with 40 CFR Part §761.60 (a) or 40 CFR Part §761.79 (g). PCB Liquid Waste shall be transported by a licensed hauler and shipped for treatment or disposal. Provide required copies of the uniform waste manifests for hazardous wastes to the Owner, waste generation State and waste destination State as required.

Q. All contaminated waste shall be carefully loaded on trucks or other appropriate vehicles for transport. Before and during transport, care shall be exercised to ensure that no unauthorized persons have access to the material.

R. Transporters of the waste are prohibited from "back hauling" any freight after the disposition of the Owner's waste stream until decontamination of the vehicle and/or trailer is assured.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 CT HPB documentation:

A. For all installed products and materials of the Section, submit the following information:

1. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
2. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
3. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
4. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

B. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

C. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

1.3 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.

B. Related Sections:

1. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.

2. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
3. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 SUBMITTALS

B. Product Data: For each type of product indicated.

C. Shop Drawings

1. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

2. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction Manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination items with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

3. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

4. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

5. Shop drawings shall be submitted in the form of an electronic file (PDF).

6. The following is the definitions for the Shop Drawing stamp disposition:

No Exceptions Taken - Re-submission is not required unless document is revised.

Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.

Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.

Rejected - Resubmit for review.

Reviewed – Reviewed for general compliance with the structural Contract Documents. Proprietary items or items designed by Others are reviewed only and shall not be approved by MHAI. Resubmission is not required.

Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

D. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

G. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Fiber reinforcement.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semi-rigid joint filler.
12. Repair materials.

H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

J. Field quality-control reports.

K. Minutes of pre-installation conference.

L. CT HPB documentation:

1. For all installed products and materials of the Section, submit the following information:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
   c. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
   d. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

3. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete. Sections 1 through 5 and Section 7, "Lightweight Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

D. Deformed-Steel Wire: ASTM A 496/A 496M.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

F. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150 Type I/II, gray

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source[with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch at typical slabs and 3/8-inch at stair pan slabs nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
b. CETCO; Volclay Waterstop-RX.
c. Concrete Sealants Inc.; Conseal CS-231.
d. Greenstreak; Swellstop.
e. Henry Company, Sealants Division; Hydro-Flex.
f. JP Specialties, Inc.; Earth Shield Type 20.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
b. Fortifiber Building Systems Group; Moistop Ultra 15.
c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
d. Raven Industries Inc.; Vapor Block 15.
e. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Euco Chemical Co.; Euco Diamond Hard
2. Dayton Superior Corporation; Day-Chem Sure Hard.
3. BASF Chemical Company; Kure-N-Harden.

2.9 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and foundation walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Water/ Cement ratio not to exceed 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 at 28 days.

2. Calculated Equilibrium Unit Weight: 115lb/cu.ft, plus or minus 3 lb/cu.ft as determined in ASTM C 567.
3. Water/ Cement ratio not to exceed 0.50.
4. Slump Limit: 4 inches, plus or minus 1 inch (25 mm).
5. Air Content: 5 to 7 percent

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement per CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete per ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Do not chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls 30 feet maximum. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth depth of concrete thickness slabs for typical slabs and a maximum of 1” for with embedded piping for radiant heat:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install diamond dowel and support assemblies at joints where indicated.

3.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6

inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M):

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for typical slabs-on-grade.
b. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24; for gymnasium slab-on-grade.
c.
d. Specified overall values of flatness, F(F) 35; with minimum local values of flatness, F(F) 24; for suspended slabs.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or

that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033001 – SITE CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies requirements for concrete cast-in-place on the site.

B. The work of includes cast-in-place concrete pavement, bases, foundations, structures and thrust blocks.

1.2 RELATED SECTIONS

A. Sections which directly relate to the work of this Section include:

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. References herein are made in accordance with the following abbreviations and all work under this Section shall conform to the latest editions as applicable.

American Concrete Institute (ACI)

ACI 301 - Specifications for Structural Concrete for Building

ACI 305R - Hot Weather Concreting

ACI 306R - Cold Weather Concreting

ACI 316R - Recommendations for Construction of Concrete Pavements and Concrete Bases

American Society for Testing and Materials (ASTM)

ASTM 185 - Welded Wire Steel Fabric for Concrete Reinforcement

ASTM 615 - Deformed and Plain Billot Steel Bars for Concrete Reinforcement

ASTM C33 - Concrete Aggregates

ASTM C94 - Ready-Mixed Concrete

ASTM C143 - Slump of Portland Cement Concrete

ASTM C150 - Portland Cement

ASTM C171 - Sheet Materials for Curing Concrete

ASTM C231 - Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260 - Air Entraining Admixtures for Concrete

ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C494 - Chemical Admixtures for Concrete

ASTM C1116 - Standard Specifications for Fiber-Reinforced Concrete and Shortcrete.

Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice.

Americans with Disabilities Act and State Regulations

1.5 QUALITY ASSURANCE

A. Work and materials for construction of the cement concrete walks shall conform to ACI 316R. Other cast-in-place concrete shall conform to ACI 301.

B. Work, materials, and color of the wheelchair ramp paving shall conform to applicable sections of Americans with Disabilities Act (ADA) and State standards, whichever is more stringent.

C. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features shown on the drawings are approximate. Manufacturer's approved shop Drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size and details.

1.6 SUBMITTALS

A. Description of methods and sequence of placement for each type of specially-finished concrete, including description of methods and sequence of placement.

B. Manufacturer's product data for the following:

1. Form release agent.

2. Concrete coloring additive.

3. Preformed joint filler.

4. Concrete reinforcement specification data from manufacturer.

5. Stamp and Imprinting tools, manufacturers literature.

1.7 TESTING

A. The Owner may employ an independent testing laboratory to inspect and test concrete paving and other cast-in-place concrete work.

B. Testing of materials and installed work may occur at any time during progress of the work. Rejected materials and installed work shall be removed and replaced.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Steel reinforcing bars shall conform to ASTM A615, Grade 60, deformed.

1. Bars employed as dowels shall be hot-rolled plain rounds.

B. Steel wire: ASTM A82, plain cold drawn steel.

C. Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

D. Supports for Reinforcement: Bolsters, chairs, and other devices for spacing, supporting, and fastening reinforcing bars, and welded wire fabric in place shall be wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1).

2.2 MIX DESIGN AND TESTING

Concrete mix design and testing shall comply with requirements of ACI.

Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following properties:

1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on Contract Documents.
2. Slump Range: 4-inches +/- 1-inch at time of placement
3. Air Entrainment: 4 to 7 percent
4. Have a maximum water cement ratio of 0.45 conforming to ACI 316R.
5. Be Air-entrained type conforming to ASTM C94. Air content by volume shall be tested in accordance with ASTM C260.
6. Use cement conforming to ASTM C150, Type I or II. Only one color of cement, all of the same manufacturer, shall be used for the work.
7. Use fine and coarse aggregates conforming to ASTM C33.
8. contain a water reducing agent to minimize cement and water content of the concrete mix at the specified slump. Water reducing agent shall conform to ASTM C494, Type A.
9. Contain no calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of the Engineer in each case.

2.3 CONCRETE AGGREGATES

A. Provide in conformance with ASTM C33.

B. Fine aggregates in conformance with ASTM C33, part 6.

C. Coarse aggregates in conformance with ASTM C33, parts 9 thru 11 and tables 2 and 3, with the following Class designations:

1. 1S – For footings and foundations not exposed to the weather.

2. 4S – For pavements, driveways, curbs, walkways, sidewalks, and retaining walls, that are exposed to the weather.

3. 1N – For pavements, driveways, curbs, walkways, sidewalks, and retaining walls that are not exposed to the weather.

D. Exposed Aggregate for ADA curb ramps shall be selected, hard, durable, washed rounded stones free of deleterious reactivity to cement with graded sizes between ½ to ¾ inch diameter nominal sieves.

2.4 CURING MATERIALS FOR UNCOLORED CONCRETE

A. Curing shall be accomplished by the following methods:

1. Moist curing with burlap covering.

2. Curing paper, non-staining, fiber reinforced laminated Kraft bituminous product conforming to ASTM C171. Four mil polyethylene sheeting may be substituted for curing paper.

3. Curing compound, a resin-base, white pigmented compound conforming to ASTM C309, Type 2.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. The subgrade of areas to be paved shall be graded and compacted as specified in Section 312316 of these Specifications.

B. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade, subbase, base, or pavement, subsequent backfill and compaction shall be performed as required by the Engineer and as specified in Section 310000, Earthwork.

C. Materials shall not be stored or stockpiled on subgrade.

D. Prepared subgrade will be observed by the Engineer. Subgrade shall be approved for installation of the gravel base course. Disturbance to subgrade caused by observation procedures shall be repaired.

3.2 BASE COURSE

A. Base course for concrete paving shall be pavement subbase course or gravel base materials specified in Section 312316 of these Specifications, as shown on the Drawings.

B. Width of base course shall extend beyond edge of the proposed pavement as shown on the drawings.

C. Material shall be placed in lifts no more than 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade.

2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.

3. Surface irregularities which exceed 1/2 inch as measured by means of a 10 foot long straightedge, shall be regraded and recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95 percent of maximum density as determined by ASTM D1557.

E. The base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with the base course material.

3.3 STEEL REINFORCEMENT

A. Before being placed in position, reinforcing steel shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be reinspected and cleaned when required.

B. Any bar showing cracks after bending shall be discarded.

C. Unless otherwise shown on the Drawings, reinforcing shall extend within 2 inches of form work and expansion joints. Reinforcing shall continue through control joints. Adjacent sheets of fabric reinforcing shall lap 6 inches.

D. After forms have been coated with form release agent, but before concrete is placed, reinforcing steel shall be securely wired in the required position and shall be maintained in that position until concrete is placed and compacted. Chair bars and supports shall be installed in a number and arrangement approved by the Engineer.

3.4 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits.

1. Provide Class A tolerances for concrete surfaces exposed to view.

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, anchorages, and inserts, and other features required for the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and other features for easy removal.

D. Chamfer exposed corners and edges, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

E. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.5 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork the anchorage devices and other embedded items required for work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screen strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.6 PREPARING FORM SURFACES

A. Coat contact surfaces of forms with an approved, nonresidual, low-VOC form-coating compound before placing reinforcement.

3.7 CONCRETE PLACING

A. Equipment, methods of mixing and placing, and precautions to be observed as to weather, and condition of base shall meet the requirements of ACI 316R.

B. The Engineer shall be notified of scheduled concrete placement sufficiently in advance of start of operation to allow preliminary observation of the work, including subgrade, forms, and reinforcing steel.

C. Work shall not be performed during rainy weather or when temperature is less than 40°F (4.4°C).

D. Adjacent work shall be protected from stain and damage. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

E. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.

F. Concrete which has set or partially set, before placing shall not be used. Retempering of concrete will not be permitted.

G. Concrete shall be thoroughly vibrated, or otherwise consolidated to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

H. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 inch thick, shall be well scrubbed into the thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.8 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40°F or is expected to fall to below 40°F within 72 hours. The concrete, after placing, shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Engineer. Procedures shall be in accordance with provisions of ACI 306R.

3.9 HOT WEATHER CONCRETING

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. Every effort shall be made to minimize delays which will result in excessive mixing of the concrete after arrival on the site.

B. During periods of excessively hot weather (95°F., or above), ingredients in the concrete shall be cooled with cold mixing water to maintain the temperature of the concrete at permissible levels in accordance with the provisions of ACI 305. Any concrete with a temperature above 95°F., when ready for placement, will be rejected.

C. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.10 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently.

END OF SECTION

SECTION 034800 – PRECAST CONCRETE

PART 1 - GENERAL

1.1 REFERENCES:

A. Prestressed Concrete Institute MNL 117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products" - 3rd Edition, primarily Appendix J.

B. Prestressed Concrete Institute's "Architectural Precast Concrete Design Manual, 2nd Edition".

C. ASTM standards as stated herein.

1.2 SUMMARY

A. This is a general specification for precast architectural concrete intended for informational purposes only. Refer to structural engineer specifications and drawings for further information. All precast elements to be reviewed by project structural engineer and project landscape architect prior to installation. The specification refers to the following site elements:

1. Precast Concrete Walls

2. Precast Concrete Tiered Seating

3. Joint sealant

B. The Fabricator shall have a minimum of 5 years successful experience in fabrication of architectural precast concrete units, similar to units required for this project. Fabricator must be an APA (Architectural Precast Association) Certified Plant or a PCI (Prestressed/Precast Concrete Institute) certified Plant for category AT or A1 (Architectural Precast). Fabricator must adhere to procedures that are applicable to the manufacturing of Architectural Precast Concrete trim pieces as outlined in Appendix J of PCI MNL-117 (3rd Edition) and the PCI Design Manual (2nd Edition).

1. Fabricator requirements:

A. Proof of APA Plant Certification or proof of PCI Certification for category AT or A1.

B. Brochures or photos showing integrally colored precast from at least three previous projects that are of acceptable appearance in the opinion of the Architect. Names and locations of projects must be provided.

C. At least three test reports less than 12 months old showing that the 5000 psi compressive cylinder strength and absorption requirements (less than 5%) called for in this specification can be met. Tests must have been performed by a professional testing laboratory.

D. List of five successfully completed precast jobs at least five years old that include project name, location, General Contractor, and Architect.

2. Under no circumstances shall items labeled as precast concrete be cast in the field.

3. The setting contractor shall unload, store, protect, and install as covered by this Specification and shall provide and install all anchors and accessories for same. The setting contractor shall have a minimum of 3 years successful experience in erection of architectural precast concrete units similar to units required for this project.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 SUBMITTALS

1. Fabricator information as listed above.

2. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit type. Indicate joints, reveals, and extent and location of each surface finish. All shop drawings are to be signed and sealed by a MA-licensed structural engineer.

   A. Indicate finish surface.

   B. Indicate units to receive furnishing.

   C. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.

   D. Include plans and elevations showing unit location and sequence of erection for special conditions. Indicate location of each architectural precast concrete unit on site.

   E. Indicate relationship of architectural precast concrete units to adjacent grades, materials and elements.

   F. Indicate locations and details of footings, also indicate all footings and footing types related to precast in plan. Include locations and details of anchors, and joint widths.

G. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

H. Erection drawings indicating locations shown in relationship to the project baselines as indicated in Contract Documents, sequence of erection, field coordinated dimensions, field verified dimensions. All field measurements shall be shown on drawings annotating special elements.

I. Installation drawings for every type and at major interface areas indicating – all accessories including anchors, plates, grout, leveling devices, spacers, and shims. Drawings to show relationship of precast units to adjacent material and elements.

3. Color & Samples

A. Precast material for seat walls and tiered seating:
   a. Minimum size - 6" x 6" x 2" to illustrate the quality, color, and surface finish texture.
   b. Color: Light, based upon review of physical samples (or approved equal)
   c. Texture: Smooth, dense, fine-grained texture achieved by acid etching to thoroughly remove all surface cement paste.
   d. Refer to drawings for acceptable manufacturers

B. Grout, Joint sealer and expansion joints Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.

C. Grout, Joint sealer and expansion joints

D. Samples for Verification: Showing color and texture of joint treatment.

E. Water repellant on precast concrete

4. Mockups: After sample approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

A. Build mockups of each precast element indicated on Drawings. Mockups to include walls and complete with anchors, connections, flashings, sealer finishes and joint filler.

B. Build mockup of each curb type as indicated on Drawings. Mock ups to include each curb color, texture, connections, sealer finishes and joint filler.

C. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Landscape Architect in writing.

E. Obtain Landscape Architect approval of mockup before starting fabrication.

1.5 INFORMATIONAL SUBMITTALS

1. Qualification Data: For Installer and fabricator.
2. Welding certificates.
3. Material Certificates: For the following items, signed by manufacturers:
   A. Cementitious materials.
   B. Reinforcing materials
   C. Admixtures
   D. Spacers
   E. All inserts
   F. Caulking
   G. Silicon Sealer
4. Material Test Reports:
   A. For aggregates.
   B. Concrete mix test report, obtain approval from structural engineer before fabrication
5. Source quality-control test reports.
6. Field quality-control test and special inspection reports.
7. Product data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years or period of warranty, whichever is greater.

1.6 DELIVERY, STORAGE, AND HANDLING.

1. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, warping, staining, or other physical damage and so that markings are visible. Lift and support units only at designated lifting or supporting points as shown on final shop drawings.

PART 2 - PRODUCTS

2.1 FORMWORK

1. Provide forms and, where required, form-facing materials of metal, plastic, wood, or other acceptable material that is nonreactive with concrete and will produce required finish surfaces per the approved sample. Maintain form work to provide completed precast concrete trim units within specified fabrication tolerances.

2.2 REINFORCEMENT

1. Refer to project structural engineer for reinforcement recommendations.

2.3 CONCRETE MATERIALS

1. Portland Cement: ASTM C 150, Type I or Type III.

2. Coarse Aggregate: ASTM C 33, except for gradation.

3. Fine Aggregate: ASTM C 33, except for gradation

4. Pigments: ASTM C 979; Inorganic, nonfading, resistant to lime and other alkalis. Pigments not to exceed 10% of the cement weight.

5. Water: Drinkable, free from foreign materials in amounts harmful to concrete or cast in steel.

6. Air-Entraining Admixture: ASTM C 260.

7. Water-Reducing, Retarding, or Accelerating Admixtures: ASTM C 494, type as selected by Fabricator and containing not more than 0.1 percent chloride ions.

2.4 CONNECTION MATERIALS

1. Refer to project structural engineer for connection recommendations.

2.5 PROPORTIONING AND DESIGN OF MIXES

1. Refer to project structural engineer for mix design recommendations.

2.6 FABRICATION

1. Refer to fabricator for recommendations.

2.7 JOINT SEALER

1. Provide joint sealants, backing materials, primers, bond breakers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

2. Colors and texture of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range of standard, special and custom colors for this characteristic.

3. Joint sealer for horizontal applications: Subject to compliance with ASTM C920, Type M, Grade P, Class 25 Use T, provide one of the following or approved equal:

A. Sikaflex-2CNS: Sika Corporation.
B. Sonolastic SL2 (slope grade); Sonneborn Building Products Div., ChemRex, Inc.
C. Vulkem 245/255: Tremco Inc.
D. Or approved equal.

4. Joint sealer for vertical applications: Subject to compliance with ASTM C920, Type M, Grade NS, Class 25 Use NT, provide one of the following or approved equal:

A. Sikaflex-2CNSTG: Sika Corporation.
B. Sonolastic NP2; Sonneborn Building Products Div., ChemRex, Inc.
C. Vulkem 227: Tremco Inc.
D. Or approved equal.

5. Joint sealer backer material: Provide joint-sealant backer materials that are closed cell, non-absorbent and non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Do not install any precast units that have any defects that exceed the acceptable PCI MNL-117 tolerances for dimensions and color if installation would result in unsatisfactory performance or appearance in the opinion of the Architect.

2. Install precast concrete members plumb, level, and in alignment in accordance with PCI MNL-117 erection tolerances and the contract documents. Provide temporary supports and bracing as required to maintain position, stability, and alignment as members are being permanently connected.

3. Protect the precast units from discoloration and staining when washing down the surrounding masonry by covering the precast units with plastic sheeting and/or by thoroughly soaking them with clear water to prevent dirty washdown water from being absorbed into them. If dirty washdown water gets on the precast, hose it off immediately with clear water.

4. Patching: The repair of chipped or damaged precast shall be done with materials and instructions furnished by the Fabricator. The precast shall show no obvious repairs or imperfections other than minimal color variations when viewed with the unaided eye under good typical day lighting at a 20 foot distance.

5. Cleaning: Before pointing and/or caulking, the face of all precast shall be scrubbed with a fiber brush, using mild detergent and water and shall then be thoroughly rinsed with clean running water. Any mortar on the face of the precast shall be removed. No acids or prepared cleaners shall be used without the approval of the precast Fabricator.

6. Sealing: Only exterior stair treads and other units that may come in contact with salt or other deicing compounds must be sealed with a penetrating sealer approved by the Architect. The sealer is to be applied in accordance with the sealer manufacturer's instructions after the units have been installed, cured, patched, and cleaned. Do not apply sealer before installation since it may prevent mortar, joint sealant and patches from adhering.

3.2 PERFORMANCE REQUIREMENTS

1. Applicable standards for inspection and quality control shall be Appendix J (Architectural Trim Requirements) in PCI MNL - 117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products" (3rd Edition) and PCI's "Architectural Precast Concrete Design Manual, 2nd Edition".

2. The Architectural Precast Concrete units shall show no obvious repairs or imperfections other than minimal color variations when viewed with the unaided eye at a 20 foot distance in good typical daylight illumination.

3. Any unacceptable precast units that cannot be repaired to the Architect's satisfaction in accordance with the aforementioned criteria are deemed unacceptable and are to be replaced by the Contractor.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Related Sections:

1. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Division 05 Section "Metal Fabrications" for furnishing steel lintels for unit masonry.
3. Division 07 Section “Joint Sealants” for sealing control and expansion joints in unit masonry.
4. Division 32 Section "Unit Paving" for exterior unit masonry paving.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide concrete unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.

2. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

3. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement. Show elevations of reinforced walls.

D. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/vents.

1.7 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

D. Sample Panels for masonry color selection: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build (3) three total sample panels in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Clean one-half of exposed faces of panels with masonry cleaner indicated.

3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for typical exterior and interior walls in sizes approximately 60 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    b. Include selected masonry color from sample panels, as selected by architect.
    c. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
    d. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    e. Include masonry back-up, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
2. Clean exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners inside the building unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
2. Density Classification: Lightweight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Units: Running Bond

C. Decorative CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
2. Basis of Design Manufacturer: Westbrook Concrete Block, “Westbricks”
3. Exterior Size: 2-1/4” high, by 3-5/8” wide, by 11-5/8” or 15-5/8” or 23-5/8” long.
4. Interior Size: 7-5/8” high, by15-5/8” long, by widths as indicated.
5. Pattern and Texture:
   a. Random pattern, ground-face finish on interior masonry and smooth moulded finish on exterior masonry.
6. Colors: 3 colors.
   a. 3 custom colors in random pattern.
7. Water Repellency: All exterior units to be manufactured with “Dry Block” by Grace Construction Products.

2.4 MASONRY LINTELS

A. General: Provide the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Davis Colors; True Tone Mortar Colors.
    b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
    c. Solomon Colors, Inc.; SGS Mortar Colors.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

G. Aggregate for Grout: ASTM C 404.

H. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Wire Size for Veneer Ties: 0.188 inch diameter.

5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of and an amplitude of 0.06 to 0.10 inch made from 0.030-inch- thick, steel sheet, galvanized after fabrication.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

2. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual", Division 07 Section "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: Provide 7-oz./sq. ft. copper sheet with non-asphalt adhesive glass fabric laminated to each copper face. Hemmed edge. Use only where flashing is fully concealed in masonry.

a. Available Products:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) Sandell Construction Solutions; Copper Fabric Flashing NA.
3) York Manufacturing, Inc.; York Multi-Flash 500.

C. Solder and Sealants for Sheet Metal Flashings:

1. Elastomeric Sealant: ASTM C 920, chemically curing sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Advanced Building Products Inc.; Mortar Maze weep vent.
        2) Blok-Lok Limited; Cell-Vent.
        3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
        4) Heckmann Building Products Inc.; No. 85 Cell Vent.
        5) Hohmann & Barnard, Inc.; Quadro-Vent.
        6) Wire-Bond; Cell Vent.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Hohmann & Barnard; Mortar Trap.
    b. Mortar Net USA, Ltd.; Mortar Net.

2. Provide the following configurations:

    a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type X, closed-cell product extruded with an integral skin, LTTR value no less than 5.0.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For interior and exterior, above grade, decorative CMU, use Type N.
2. For all other locations, use type S.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.

2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry as follows; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
1. CMU: Running bond.

2. Decorative CMU: Random (head joints must not align).

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Section 072726 "Fluid-Applied Membrane Air Barrier." Where backup wythe is cold formed metal framing, provide air barrier to comply with 072713 “Modified Bituminous Sheet Air Barriers”.

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL

A. Anchor masonry to structural steel where masonry abuts or faces structural steel to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form joints in masonry as follows:

1. Build in compressible joint filler full depth of wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.10 LINTELS

A. Install steel lintels where indicated or required.

B. Provide masonry lintels where shown and where openings of more 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal

penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing, at top course, and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 051200 – STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 CT HPB documentation:

A. For all installed products and materials of the Section, submit the following information:

1. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
2. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
3. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
4. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

B. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

C. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

1.3 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.

4. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.

5. Division 05 Section "Metal Stairs."

1.4 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.5 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer licensed in the State of Connecticut, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use ASD; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained and designed by a qualified professional engineer licensed in the State of Connecticut.

C. Brace Frame Connections: Design for loading given on the drawings. Connections shall be designed by a qualified professional engineer licensed in the State of Connecticut.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Identify members and connections of the seismic-load-resisting system.

6. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.

7. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

8. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination items with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

9. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

10. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

11. Shop drawings shall be submitted in the form of 1 reproducible plus 2 prints. Electronic submittals will be acceptable.

12. The following is the definitions for the Shop Drawing stamp disposition:

    No Exceptions Taken - Re-submission is not required unless document is revised.

    Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.

    Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.

    Rejected - Resubmit for review.

    Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

D. Qualification Data: For qualified Installer and fabricator. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Mill test reports for structural steel, including chemical and physical properties.

G. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

C. Tolerances: Structural steel fabricator shall coordinate with the requirements for tolerances as required by the selected building finish systems, and to construct to those tolerances if they are stricter than the AISC standards.

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 35 percent.

B. W-Shapes: ASTM A 992.

C. Channels, Angles: ASTM A 36.

D. Plate and Bar: ASTM A 36.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Finish: Black except where indicated to be galvanized.

G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

H. Steel Forgings: ASTM A 668/A 668M.

I. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436 , Type 1, hardened carbon-steel washers; all with plain finish.

   1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.

   1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436 Type 1, hardened carbon-steel washers.

   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36

   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain

F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A 36 carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

2.3 PRIMER

A. Primer: Comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members..

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges." Level and plumb individual members of structure within specified AISC tolerances, unless stricter tolerances are otherwise required by finish building systems being provided on the project. Contractor is responsible to coordinate all construction tolerances, and to construct to the tolerances as required with all the selected building finish systems supported by or adjacent to the structural steel.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened or Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 051250 -ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the Section.

1.2 CT HPB documentation:

A. For all installed products and materials of the Section, submit the following information:

1. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
2. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
3. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
4. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

B. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

C. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

1.3 SUMMARY

A. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel. (AESS). Refer to division 5 section 'Structural Steel' for all other requirements regarding steel work not included in this section. This section applies to any members noted on Architectural and Structural drawings as AESS.[and in the areas defined as AESS below]

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.

2. Division 5 Section "Structural Steel"

3. Division 5 Section "Metal Decking" for erection requirements relating to exposed steel decking and its connections

4. Division 5 Section “Metal Fabrications” for loose steel bearing plates and miscellaneous steel framing.

5. Division 9 Section "Painting" for finish coat requirements and coordination with primer and surface preparation specified in this section.

1.4 SUBMITTALS

A. General: Submit each item below per the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings

1. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

2. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction Manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination items with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

3. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

4. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

5. Shop drawings shall be submitted in the form of an electronic file (PDF) plus 1 print.

6. The following is the definitions for the Shop Drawing stamp disposition:

No Exceptions Taken - Re-submission is not required unless document is revised.

Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.

Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.

Rejected - Resubmit for review.

Reviewed – Reviewed for general compliance with the structural Contract Documents. Proprietary items or items designed by Others are reviewed only and shall not be approved by MHAI. Resubmission is not required.

Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

D. Qualification data for firms and persons specified in the 'Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel', engage a firm experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.

B. Erector Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel', engage an experienced Erector who has completed AESS work similar in material, design, and extent to that indicted for this Project and with a record of successful in-service performance.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC "Code of Standard Practice," latest edition, Section 10 as amended herein.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver AESS to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

C. Erect pre-painted finish pieces using padded slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting.

Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.8 COORDINATION

A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation. [Anchorage concepts shall be as indicated on drawings and approved on final shop drawings.]

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Meet requirements Division 5 Section 'Structural Steel' as amended below.

B. High-Strength Bolts, Nuts, and Washers: Per section 05120 heavy hex heads and nuts Provide rounded bolt heads with twist off bolts. Provide standard carbon steel Mechanically galvanized finish.

2.2 PRIMERS

A. Compatibility: The General Contractor shall submit all components/procedures of the paint system for AESS as a single coordinated submittal. As a minimum identify required surface preparation, primer, intermediate coat (if applicable) and finish coat. All of the items shall be coordinated with the finish coat specified in division 9.

A. Primer: Fast curing, universal modified alkyd, rust inhibiting shop coat with good resistance to normal atmospheric corrosion. Primer shall comply with all federal standards for VOC, lead and chromate levels

2.3 FABRICATION

A. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up. Use special care in handling and shipping of AESS both before and after shop painting.

C. In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques.

1. Fabrication Tolerance: Fabricate steel to one half the normal tolerance as specified in the Code of Standard Practice section 10.

2. Welds ground smooth: Fabricator shall grind welds of AESS smooth. For groove welds, the weld shall be made flush to the surfaces each side and be within + 1/16", -0" of plate thickness.

3. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.

4. Continuous Welds: Where welding is noted on the drawings, provide continuous welds of a uniform size and profile.

5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.]

6. Coping and Blocking Tolerance: Maintain a uniform gap of 1/8" ± 1/32 at all copes and blocks].

7. Joint Gap Tolerance: Maintain a uniform gap of 1/8" ± 1/32

8. Piece Marks Hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.]

10. Mill Mark Removal: Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc) in exposed locations. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator may fill and/or grind to a surface finish consistent with the approved mock up.]

11. Grinding of sheared edges: Fabricator shall grind all edges of sheared, punched or flame cut steel to match approved mockup.]

12. Rolled Members: Member specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges or legs of angles shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition determined by the Architect. Tolerances for the vertical and horizontal walls of rectangular HSS members after rolling shall be the specified dimension +/- ½".

13. Seal Welds: Seal weld open ends of round and rectangular hollow structural section with 3/8" closure plates. Provide continuous, sealed welds at angle to gusset plate connections and similar locations where AESS is exposed to weather.

2.4 SHOP CONNECTIONS

A. Bolted Connections: Make in accordance with Section 05120. Provide bolt type and finish as noted herein and align bolt heads as indicated on the approved shop erection drawings.

B. Weld Connections: Comply with AWS D1.1 and Section 05120. Appearance and quality of welds shall be consistent with the mock up. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding the tolerance of this section.

2.5 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections, if primer does not meet the specified AISC slip coefficient.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:

1. SSPC-SP 3 “Power Tool Cleaning.

2. SSPC-SP 6 “Commercial Blast Cleaning” at all columns exposed to view in finished architecture.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer’s instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Refer to section 050513 for Color Galv requirements. Fabricate such that all connections of assemblies are made in the field with bolted connections. Provide galvanized finish or members and assemblies within the range of color and surface textures presented in the mock ups.

PART 3 – EXECUTION

3.1 EXAMINATION

A. The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.2 PREPARATON

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process of erection.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. In addition to the special care used to handle and erect AESS, employ the following erection techniques:

1. AESS Erection Tolerances: Erection Tolerances shall meet the requirements of chapter 10 of the AISC "Code of Standard Practice".

2. Welds ground smooth: Erector shall grind welds smooth in the connections of AESS members. For groove welds, the weld shall be made flush to the surfaces each side and be within + 1/16", -0" of plate thickness.

3. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up].

4. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.]

5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.

6. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.

7. Removal of field connection aids: Run out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up, and welding in the field shall be removed from the structure. Field groove welds shall be selected to eliminate the need for backing bars or to permit their removal after welding. Welds at run out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth.

8. Filling of weld access holes: Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled. Filling shall be executed with proper procedures to minimize restraint and address thermal stresses in group 4 and 5 shapes.

C. Field Welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.

D. Splice members only where indicated.

E. Obtain permission for any torch cutting or field fabrication from the Architect. Finish sections thermally cut during erection to a surface appearance consistent with the mock up.

F. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

3.4 FIELD CONNECTIONS

A. Bolted Connections: Install bolts of the specified type and finish in accordance with Division 5 section "Structural Steel".

B. Welded Connections:

1. Comply with AWS D1.1 for procedures, and appearance. Refer to Division 5 section "Structural Steel" for other requirements.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

3. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.

4. Obtain Architects approval for appearance of welds in repaired or field modified work.

3.5 FIELD QUALITY CONTROL

A. Structural requirements: The Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports. Refer to Division 5 section "Structural Steel" for detailed bolt and weld testing requirements.

B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the mockup. The Testing Agency shall have no responsibility for enforcing the requirements of this section.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall completed to blend with the adjacent surfaces of AESS.

Such touch up work shall be done in accordance with manufacturer's instructions as specified in Division 9, Section “Painting.”

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 051250

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 CT HPB documentation:

A. For all installed products and materials of the Section, submit the following information:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).

c. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.

d. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

3. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project

1.3 SUMMARY

A. This Section includes the following:

1. Long-span steel joists.
2. Joist accessories.

1.4 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/360 of the span.

1.6 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Identify members and connections of the seismic-load-resisting system.

6. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.

7. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

8. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination items with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

9. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

10. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

11. Shop drawings shall be submitted in the form of 1 reproducible plus 2 prints. Electronic submittals will be acceptable.

12. The following is the definitions for the Shop Drawing stamp disposition:

    No Exceptions Taken - Re-submission is not required unless document is revised.

    Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.

    Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.

    Rejected - Resubmit for review.

    Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

C. Welding certificates.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

F. Qualification Data: For manufacturer.

G. Field quality-control test and inspection reports.

H. Research/Evaluation Reports: For joists.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

1. Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:

1. Joist Type: LH-series steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: Double pitched.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Camber long-span steel joists according to SJI's "Specifications.

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST ACCESSORIES

A. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

B. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Field welds will be visually inspected according to AWS D1.1/D1.1M.

B. Bolted connections will be visually inspected.

C. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. CT HPB documentation:

1. For all installed products and materials of the Section, submit the following information:
   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
   c. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
   d. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

3. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

1.3 SUMMARY

A. This Section includes the following:

1. Roof deck
2. Composite floor deck
3. Acoustic roof deck

C. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

4. Division 09 painting Sections for repair painting of primed deck.

1.4 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

2. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination items with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

3. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

4. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

5. Shop drawings shall be submitted in the form of 1 reproducible plus 2 prints.

6. The following is the definitions for the Shop Drawing stamp disposition:

No Exceptions Taken - Re-submission is not required unless document is revised.

Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.

Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.

Rejected - Resubmit for review.

Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of

construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

D. Product Certificates: For each type of steel deck, signed by product manufacturer.

E. Welding certificates.

F. Field quality-control test and inspection reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

H. Research/Evaluation Reports: For steel deck.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

D. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.7 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:
   a. Canam Steel Corp.; The Canam Manac Group.
   b. Consolidated Systems, Inc.
   c. Epic Metals Corporation.
   d. New Millennium Building Systems, LLC.
   e. Nucor Corp.; Vulcraft Division.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade , G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Profile Depth: 2 inches (51 mm).
3. Design Uncoated-Steel Thickness: 0.0358 inch.
4. Span Condition: Triple span or more.

2.4 ACOUSTICAL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: Gray.

2. Deck Profile: Type 3DR, deep rib, with bottom plate as indicated on plan.

3. Profile Depth: As indicated.

4. Design Uncoated-Steel Thickness: As indicated.

5. Span Condition: Triple span or more.

6. Side Laps: Overlapped or interlocking seam at Contractor's option.

7. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.

8. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.
   a. Factory install sound-absorbing insulation into cells of cellular deck.

9. Acoustical Performance: NRC 0.80, tested according to ASTM C 423.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

L. Acoustical elements shall be factory installed above the perforated holes in the bottom flat area between the dovetail-shaped ribs to provide NRC rating of 0.95. To facilitate field painting of the perforated surfaces, the sound absorbing elements shall be supported above the surface. Sound absorbing elements and spacers shall be furnished under the specification section for installation by the roofing contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. All components of the ER3.5A Acoustical Roof Deck Ceiling System shall be protected from significant damage during shipment and handling. If storage at the jobsite is required, bundles or packages of these materials shall be elevated above the ground, sloped to provide drainage, and protected from the elements with a ventilated waterproof covering.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by pneumatic fasteners, and as follows:

1. Fastener: HILTI X-ENP-19-L15 or equal.
2. Fastener Spacing: Fasteners edge and interior ribs of deck units with a minimum of two fasteners per deck unit at each support. Space fasteners as indicated on drawing S6-03.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches minimum

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified by manufacturer.

3.4 ROOF DECK CEILING SYSTEMS

A. Bundles or packages of Acoustical Roof Deck System components shall be located on supporting members in such a manner that overloading of any individual members does not occur.

B. Before being permanently fastened, Acoustical Rood Deck panels shall be placed with ends accurately aligned and adequately bearing on supporting members. Proper coverage of the Acoustical Roof Deck panels shall be maintained. Care must be taken by the erector to maintain uniform spacing of the bottom rib opening (equal to the openings in the profiled sheet) at the sidelaps. Consistent coverage shall be maintained so that panels located in adjacent bays will be properly aligned.

C. Field cutting of the Acoustical Roof Deck panels shall be performed in a neat and precise manner. Only those openings shown on the structural drawings shall be cut. Other openings shall be approved by the structural engineer and cut by those requiring the opening.

D. Acoustical Roof Deck panels shall be fastened to all supporting members with pneumatic fasteners.

E. Sidelaps of Acoustical Roof Deck panels shall be fastened by screws at a spacing of 36” on center or less as indicated on the manufacturer’s erection drawings. Sides of Acoustical Roof Deck panels that are located at perimeter edges of the building shall be fastened to supporting members at a spacing of 36” on center or less as indicated on the S6.02 drawing.

G. Sump pans, ridge, valley, transition, eave plates, and supplied reinforcement for small openings shall be fastened as indicated on the manufacturer’s erection drawings.

3.5 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Substitute #12 screws where fastening shall be to light gage cold form framing.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:

a. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

b. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

F. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

C. Construction loads that could damage the ER3.5A Acoustical Roof Deck such as heavy concentrated loads and impact loads shall be avoided. Planking shall be used in all high traffic areas.

D. Prior to the placement of the sound absorbing elements, the top surface of the Acoustical Roof Deck shall be cleaned of all debris, grease, oil and other foreign substances. Cleaning the bottom surface of the Acoustical Roof Deck for field painting shall be the responsibility of the painting contractor.

E. Galvanized coatings that are significantly damaged shall be repaired. Appropriate galvanized repair paint shall be used, and the paint manufacturer’s application instructions shall be followed.

F. Sound absorbing elements shall be dry before installation of the elements or overlying roof materials.

END OF SECTION 053100

SECTION 054000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

A. SECTION INCLUDES

B. This Section includes the following:

1. Exterior framing
2. Auditorium interior framing

1.2 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 5 Specifications, apply to this Section.

B. The General Conditions state that the Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated in the General Notes.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 for non-masonry veneer and 1/720 for masonry veneer of the wall height.
   b. Auditorium Framing: Horizontal deflection of 1/240.
3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1-1/2 inches.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings:

1. Submit shop drawings of all members to be furnished. Detail drawings of the members and their connections shall follow standard practice as set forth in the AISC "Manual of Structural Steel Detailing" (Second Edition). In particular, welding shall be shown, using standard AWS welding symbols. Show on detail drawings the paint to be used.

2. Shop drawings will not be accepted for review by the Engineer unless there is substantial evidence that the General Contractor or Construction manager on the project has reviewed the submittal for compliance with the contract documents and has addressed questions to be responded to by the Contractor. All coordination item with other trades and submittals are to be performed and the submittal marked accordingly before submission. Failure to provide the above will result in the submittal being returned and not reviewed.

3. Contractor shall perform review and schedule shop drawing submittals to permit a minimum of 15 calendar days for review by the Engineer. Shop Drawings will be returned to the Architect for their required review and processing.

4. Shop drawings will not be reviewed unless accompanied by erection drawings which locates and identifies the members. Copies or reproductions of contract drawings will not be accepted or reviewed as shop drawings.

5. Shop drawings shall be submitted in the form of an electronic file (PDF).

6. The following is the definitions for the Shop Drawing stamp disposition:

    a. No Exceptions Taken - Re-submission is not required unless document is revised.
    b. Make Corrections Noted - If checked, fabrication may be undertaken. Contractor is responsible for making noted corrections. Re-submission of record copies are required.
    c. Revise and Resubmit - If checked, fabrication may not be undertaken. Resubmit corrected copies for final review, with all changes clouded.
    d. Rejected - Resubmit for review.
    e. Corrections or comments made on shop drawings during this review do not relieve the Contractor from compliance with the requirements of the project drawings and specifications. This check is only for the review of general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, techniques and sequence of construction, coordinating his work with that of other trades, and performing his work in accordance with OSHA requirements and other sections of the Project Specifications.

C. CT HPB documentation:

1. For all installed products and materials of the Section, submit the following information:

    a. Cost breakdowns for the materials included in the Contractor or subcontractor's

work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
c. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
d. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.

3. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2- PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Clark Steel Framing.
2. Dietrich Metal Framing; a Worthington Industries Company.
3. Innovative Steel Systems.
4. MarinoWare; a division of Ware Industries.
5. Steel Construction Systems.
6. Steeler, Inc.
7. Super Stud Building Products, Inc.
8. United Metal Products, Inc.

2.2 MATERIALS

A. Recycled Content: Provide cold-formed metal framing and misc metal accessories with post-consumer recycled content plus one-half of pre-consumer recycled content calculated by weight not less than 35 percent.

B. Regional Materials: Provide cold-formed metal framing that is regionally manufactured within a 500 mile radius of the project site and that are made from regionally extracted, harvested, or recovered materials from a 500 mile radius of the project site.

For adhesives, sealants, paints and coatings used inside the weatherproofing system and applied on-site, provide products that comply with the VOC and chemical component limitations as defined in Section 01 35 20 13 – LEED Requirements Summary including, but not limited to the following:

1. Sealants: 250g/l VOC (includes grout)
2. Metal Primers: 50 g/L VOC
2. Anti-Corrosion Metal Primer: 250 g/L VOC (galvanizing repair paint)

C. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

D. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. 5

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dietrich Metal Framing; a Worthington Industries Company.
    b. MarinoWare, a division of Ware Industries.
    c. SCAFCO Corporation
    d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Minimum Base-Metal Thickness: 0.0428 inch.
3. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Hole reinforcing plates.
10. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at centers indicated on Shop Drawings.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal ladders.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim including steel edgings and loading-dock edge angles.
4. Metal bollards.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Stairs."

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, rooftop and ground level support framing for equipment screens, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples for Verification: For each type and finish of extruded nosing tread.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

F. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated or required.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.079-inch nominal thickness.

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated or required by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

A. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.10 LOOSE STEEL LINTELS

A Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. B Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
6. Galvanize exterior ladders, including brackets.
7. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

2.13 METAL BOLLARDS

A. Fabricate metal bollards from galvanized Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch- thick steel plate.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

   A. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, or masonry, or unless otherwise indicated.

   A. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

   A. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   B. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   C. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

   A. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

   A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   B. Obtain fusion without undercut or overlap.
   C. Remove welding flux immediately.
   B. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

   A. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Ornamental steel-framed stairs.
3. Interior tube handrails and guards.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.
2. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
3. Division 05 Section “Metal Fabrications” for abrasive nosings.
4. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

5. Limit deflection of treads, platforms, and framing members to L/240, L/360 at Stair No. 1, or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5

1.4 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Paint products.
3. Grout.
4. Stainless steel mesh.

B. Sustainable Design Submittals:
1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Abrasive nosings.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class, Service class at ST-5.

2. Ornamental Stair (Stair #2): Architectural class.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

F. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

F. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel channels or tubes as indicated.

    a. Provide closures for exposed ends of channel and tube stringers.

2. Construct platforms of steel plate, channel or tube headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated hot-rolled steel sheet.

2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.

3. Shape metal pans to include nosing integral with riser.
4. Where indicated in the drawings, provide steel sheet riser with perforations. Perforation diameter is 1/4” with an overall open area percentage of 58%. Perforation pattern is staggered.

5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.8 GUARDRAILS AND HANDRAILS

A. Tube Railings and Guards: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Fabricate interior handrails from aluminum pipe
2. Fabricate interior guards from steel

B. Welded Connections: Fabricate railings and guards with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

C. Form changes in direction of railings as follows:

1. As detailed.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, Channels, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, channels and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing and channels by direct welding unless otherwise indicated.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Stair No 1: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
2. Stairs and guardrails: SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise

indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.10 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Mill Finish: AA-M12, non-specular as fabricated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING HANDRAILS AND GUARDS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

D. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.4 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

END OF SECTION 055100

SECTION 055200 – METAL RAILINGS

PART 1 - GENERAL

1.1 GENERAL

A. Section Includes:

1. Furnishing and installing steel pipe hand-railings at steps.

1.2 REFERENCE STANDARDS

A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. American Society for Testing and Materials (ASTM).

1. ASTM A36 - Specification for Structural Steel.
2. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
4. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A143 - Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
6. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
8. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
9. ASTM A384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
10. ASTM A385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
11. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.
12. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
13. ASTM A780 - Practice for Repair of Damaged Hot-Dip Galvanized Coatings.

14. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.

15. ASTM D2092 - Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint.

D. National Association of Architectural Metal Manufacturers (NAAMM).

1. “Pipe Railing Manual, Including Round Tube"

E. Submittals

F. Shop Drawings

1. Submit shop drawings of metal handrails and railings, showing sizes, details of fabrication and construction, bends and radii, handrail brackets, locations of hardware, anchors, and accessories, and installation details. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.

2. Submit manufacturers' product data of railing system and railing components, handrails, and handrail brackets. Include corrosion-inhibitive shop coat painting system.

G. Product data for primer and paint demonstration compliance with these specifications.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project’s environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Supply: Railing materials must be supplied in consistent quality in appearance and physical properties.

B. Materials shall be wrapped or otherwise packaged for shipment and storage as appropriate.

C. Store materials to avoid damage from moisture, abrasion, and other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel Handrails: ASTM A 269, stainless steel tube: 316, welded ornamental tubing - (1.5 inches O.D. for handrail).

B. Stainless Steel Fittings: 316 stainless steel. Stainless steel fittings shall be used in all applications where stainless steel railings are called-for.

C. Stainless Steel Finishes

1. Stainless steel pipe and tubing: #6 polish.

2. Machined stainless steel fittings: # 8 polish.

2.2 FABRICATION

A. Metal handrails and railings shall be fabricated by firms or shops experienced and skilled in the custom fabrication of architectural metal handrails and railings, and shall meet the quality requirements of NAAMM's Pipe Railing Manual.

B. Bends in rails shall be precision-formed to a smooth continuous radius by skilled workers. Work quality and finish shall be true to detail.

C. Joints

1. Steel welded connections shall be made in accordance with applicable requirements of the AWS Structural Welding Code. Welding shall be performed in the shop unless otherwise indicated. Welded joints of handrails and railings shall be ground and dressed smooth to match adjacent surfaces and so that the shape and profile of the item welded is maintained.

2. All mitered and welded corners shall be ground smooth to match finish.

3. Butt joints shall have internal pipe sleeve or dowel.

4. Ends shall be closed with similar materials, welded and ground smooth.

D. Metal handrails and railings shall be prefabricated and preassembled in the factory or shop as far as practicable.

PART 3 - EXECUTION

3.1 GENERAL

A. Install metal handrails and railings as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved. Conform with installation requirements of NAAMM's Pipe Railing Manual, as applicable.

B. Install metal handrails and railings with accessories furnished by the railing fabricator as required for complete and finished railing installations. The rail elements shall be erected to produce a smooth, continuous rail.

C. Installation of handrails and railings shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.

3.2 GALVANIZING REPAIR

A. Galvanized surfaces which have become damaged from welding, handling, installation, or stripping, shall be repaired immediately after installation with galvanizing repair material, ASTM A780.

3.3 CLEANING AND PAINTING

A. Prior to site surface preparation and coating applications, remove, mask, or otherwise protect, finished work, hardware, hardware accessories, and other such items not to be coated.

B. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

C. Removal of coatings: All surfaces of metal handrails and railings to be re-coated shall be stripped using chemical or abrasive blast methods approved by Engineer.

D. All surfaces of metal handrails and railings to be re-coated shall be thoroughly cleaned and treated to assure maximum paint adherence, prior to application of the shop prime coat.

E. Rust-inhibitive metal primer shall be applied in accordance with manufacturer’s instructions.

F. Final coatings shall be applied in accordance with manufacturer’s instructions.

G. After installation of new railings, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as used for shop painting.

H. Lightly sand and feather out damaged surfaces so that paint touch-up becomes invisible.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels for mechanical, telephone, data, and electrical equipment.
3. Wood sleepers.
4. Fasteners and accessories.
5. Miscellaneous material.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
4. For fire-retardant treatments on plywood sheathing, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc3: Include submittal documentation requirement for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect lumber from the weather. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Certified Wood: Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency

certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. Application: Treat the following:
1. Plywood backing panels.

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated below according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Framing: Construction or No. 2 grade and any of the following species:

1. Douglas fir-larch; WCLIB or WWPA.
2. Douglas fir-south; WWPA.
3. Douglas fir-larch (north); NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Hem-fir (north); NLGA.
6. Southern pine; SPIB.

7. Mixed southern pine; SPIB.
8. Spruce-pine-fir (south); NELMA, WCLIB, or WWPA.
9. Spruce-pine-fir; NLGA.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

2. Rooftop equipment bases and support curbs.

3. Cants.
4. Sleepers.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.

D. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

H. For sleepers at wood flooring, layout sleepers such that the space between sleepers does not exceed 100 square feet. Close gaps between sleepers and substrate with fire caulk.

2.5 PLYWOOD BACKING PANELS

A. Telephone, Data, Mechanical and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

I. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

J. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Building Paper: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

C. Polyethylene vapor barrier, neoprene pads, stop blocks, and batt insulation for platform floor assembly, as indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Provide blocking and framing to support facing materials, fixtures, specialty items, and trim.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach carpentry work to substrate by anchoring and fastening in compliance with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 BLOCKING, AND NAILER INSTALLATION

A. Install at all locations where required for attaching other work. Cut to shapes and lengths as required for true line and level of attached work. Verify locations of other items that will be fastened to blocking and nailers.

B. Attach blocking and nailers to sound substrates to support applicable loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. Section Includes:
   1. Exterior wall sheathing.
   2. Composite nail base insulated sheathing.

B. Related Requirements:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for dimension lumber items.
   2. Division 07 Section "Modified Bituminous Sheet Air Barriers" for vapor-permeable membrane applied over sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Manufacturer’s product literature including structural properties and installation instructions,

B. Product Test Report: Evaluation report from ICC-ES for compliance with the 2018 International Building Code (IBC).

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

C. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings. Protect SIP and nail based insulated sheathing edges from crushing during transportation, delivery and storage. Protect panels from delamination. Do not lift panels by the top skin.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.
4. Use high-temperature fire-retardant treatment.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood sheathing, including plywood in nail based insulation, unless otherwise indicated.

2.2 EXTERIOR WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide the following or approved equal:
   a. G-P Gypsum Corporation; Dens-Glass Gold.

2. Type and Thickness: Type X, 5/8 inch thick.

3. Size: 48 by 120 inches for vertical installation.

B. General: Provide fasteners of size and type that comply with requirements of installation.

1. For exterior wall sheathing, provide fasteners compatible with formed metal wall panels.

2.3 COMPOSITE NAIL BASE INSULATED SHEATHING

A. Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 plywood on one face.
1. Polyisocyanurate-Foam Thickness:
   a. Walls: 2- inch.
   b. Roof: 3-1/2- inch.

2. Plywood Nominal Thickness: 1/2 inch.

2.4 FASTENERS

A. General: Provide fasteners of size and type that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. Use screws that comply with ASTM C 954.

G. Screws for Fastening Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing, joint sealant installation, and vapor-permeable membrane so these materials are installed in proper sequence, and to minimize exposure of sheathing and membrane to the weather prior to installation of

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 COMPOSITE NAIL BASE INSULATED SHEATHING INSTALLATION

A. Fasten to cold-formed metal framing with engineered fasteners.

B. Install panels horizontally and to minimize the number of joints. Offset panel joints vertically.

C. Allow a minimum 1/8-inch gap and maximum ¼-inch gap between panels to accommodate movement.
   1. Fill all gaps exceeding ¼-inch with foam sealant.

D. At multi-layer installations, stagger joints between layers.

END OF SECTION 061600

SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior composite decking.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:
1. For decking, with 1/2 of exposed surface finished; 50 sq. in..

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's warranties.

1.5 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components that fails due to defects in manufacturing or workmanship within specified warranty period. Failures include, but are not limited to, structural failures, including cracking, splitting, and deforming.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

2.2 EXTERIOR TRIM

A. Composite Decking: Recommended by manufacturer for exterior use, made from UV- and heat-stabilized, rigid material.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Deckorators
b. TimberTech/AZEK
c. Fiberon
d. Trex

2.3 MISCELLANEOUS MATERIALS

A. Deck Fastening System: Provide concealed decking clips.
1. Decking Clips: Black-oxide-coated, stainless steel clips designed to secure decking material and provide uniform spacing of decking material.

B. Metal Zee Furring: Provide aluminum 1-1/2” x 1” x 1-1/2” zee furring.
1. Thickness: 0.250 inch.
2. Finish: Clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work.

2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.

3.4 COMPOSITE DECKING INSTALLATION

A. Install decking to comply with manufacturer's written instructions.

B. Install zee furring at 16 inches on center.

C. Secure decking with concealed deck clips and screws.

D. Install deckiong with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary.
1. Stagger end joints in adjacent and related members.

3.5 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean exterior finish carpentry on exposed surfaces.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

END OF SECTION 062013

SECTION 064000 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. Section Includes:
   a. Wood cabinets.
   b. Plastic laminate countertops
   c. Closet and utility shelving.
   d. Flush wood paneling.
   e. Shop finishing of interior woodwork.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products cabinet hardware and accessories and finishing materials and processes.

B. Sustainable Design Submittals:

   a. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
   b. For MRc3: Include submittal documentation requirement for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.
   c. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

   a. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

D. Samples for Initial Selection:

   a. Shop-applied transparent finishes.
   b. PVC edge material.
   c. Thermoset decorative panels.

E. Samples for Verification:

a. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
b. Veneer leaves representative of and selected from flitches to be used for transparent-finish..
c. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 12 by 12 inches for panels, for each finish system and color, with one-half of exposed surface finished.
d. Thermoset decorative panels, 12 by 12 inches, for each color, pattern, and surface finish, with edge banding on one edge.
e. Corner pieces as follows:

a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

f. Metal reveals, exposed cabinet hardware, and accessories, one unit for each type.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For the following:

a. Composite wood and agrifiber products.
b. Thermoset decorative panels.
c. Glass.
d. Adhesives.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

a. Build mockups of typical architectural wood cabinet.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

a. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.

a. Provide labels and certificates from AWI certification program indicating that woodwork, including installation**,** complies with requirements of grades specified.

b. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

c. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

d. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   a. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
   b. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
   c. Softwood Plywood: DOC PS 1.
   d. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
   e. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   a. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   b. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   c. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   a. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.

   b. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.

   c. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
   d. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:
   a. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141 or roller catches, BHMA A156.9, B03071.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

G. Shelf Rests: BHMA A156.9, B04013; metal.
   a. At glass shelves: Knape & Vogt # 346 ANO with #129 rubber cushion.

H. Drawer Slides: BHMA A156.9.
   a. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   b. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
   c. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
   d. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
   e. For computer keyboard shelves, provide Grade 1HD-100.

I. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

J. Door Locks: BHMA A156.11, E07121. Provide at all doors

K. Drawer Locks: BHMA A156.11, E07041. Provide at all drawers

L. Door and Drawer Silencers: BHMA A156.16, L03011.

M. Counter Support Brackets: Extruded aluminum L-shaped bracket.
   a. Basis-of-Design: EH Series by Rakks
      a. Finish: Mill finish.

N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   a. Satin Stainless Steel: BHMA 630.

O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Paneling Trim: Extruded aluminum, clear anodized, Millwork Reveals as manufactured by Fry Reglet.
   a. Shapes: Millwork Reveal; Millwork Reveal L Angle.

E. Paneling Lighting: Extruded aluminum, clear anodized, Millwork Reveals as manufactured by Fry Reglet.
   a. Shapes: LI Millwork Mid F9; LI Millwork Edge F11

2.5 FABRICATION

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

   b. Corners of Cabinets: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Regional Materials: Wood cabinets for transparent finish shall be manufactured within 500 miles of Project site.

C. Type of Construction: Frameless.

D. Cabinet and Door and Drawer Front Interface Style: Reveal overlay.
   a. Provide locks on all cabinet doors.

E. Reveal Dimension: 1/2 inch.

F. Wood for Exposed Surfaces:

   a. Species: White maple.
   b. Cut: Rotary.
   c. Grain Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

   d. Matching of Veneer Leaves: Random match.

   e. Veneer Matching within Panel Face: Balance match.

G. Semi-exposed Surfaces: Provide surface materials indicated below:

   a. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

      a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

   b. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber.
   c. Drawer Bottoms: Hardwood plywood.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

   a. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

I. Semiexposed Surfaces or where Indicated:

   a. Thermoset decorative panels.

   b. Panel Edges: Solid-hardwood lumber.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

   1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by the following:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart, High Wear Finish.
      b. Nevamar Company, LLC; Decorative Products Div.

c. Formica Group
d. Pionite Surface Systems

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGP.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. As selected by Architect from manufacturer's full range.

E. Edge Treatment: As indicated.

F. Core Material: Particleboard or medium-density fiberboard.

G. Core Material at Sinks: Particleboard made with exterior glue.

H. Paper Backing: Provide paper backing on underside of countertop substrate.

2.8 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4-inch thermoset decorative panel with PVC or polyester edge banding.

C. Cleats: 3/4-inch solid lumber.

2.3 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

A. Grade: Custom.

B. Wood Species and Cut: White maple, rotary.

C. Veneer Matching Method:

a. Adjacent Veneer Leaves: Pleasing (Random) match.
b. Within Panel Face: Balance match.

D. Panel-Matching Method:

a. No matching is required between adjacent panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.

E. Panel Core Construction: Fire-retardant plywood.
a. Thickness: 3/4 inch.

F. Exposed Panel Edges: Legs of metal channels forming reveals.

G. Panel Reveals: Extruded aluminum channels or light fixtures.

H. Fire-Retardant-Treated Paneling: Panels are to have a flame-spread index of 75 or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

I. Assemble panels by gluing and concealed fastening.

2.9 SHOP FINISHING

A. General: Finish architectural wood cabinets and paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.

a. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

C. Transparent Finish:

a. Grade: Custom.

b. Finish: System - 5, conversion varnish.
c. Wash Coat: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
d. Staining: Match Architect's sample.

e. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

a. For shop finished items use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

a. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
b. Maintain veneer sequence matching of cabinets with transparent finish.

c. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Secure backsplashes to walls with adhesive.
3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Paneling: Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

a. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
c. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening.
d. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064000

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. Section Includes:

1. Polyurethane waterproofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including, but not limited to, the following:

a. Surface preparation specified in other Sections.
b. Minimum curing period.
c. Forecasted weather conditions.
d. Special details and sheet flashings.
e. Repairs.
f. Field quality control.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

C. Shop Drawings:

1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For each exposed product and for each color and texture specified, including the following products:

1. Drainage panel, 4 by 4 inches (100 by 100 mm).

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.

1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace waterproofing that fails to remain watertight within specified warranty period.

1. Warranty includes leak remediation.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials and molded-sheet drainage panels from single source from single manufacturer.

2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

A. Single-Component, Reinforced, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.

1. Products: Subject to compliance with requirements, provide Tremco, Inc; TREMproof 250GC or an equivalent product from the following:

a. BASF Construction Chemicals, LLC, Building Systems
b. Carlisle Coatings & Waterproofing Inc

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.

C. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.

1. Adhesive: Manufacturer's recommended contact adhesive.

D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.

E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

F. Joint Sealant: as specified in Section 079200 "Joint Sealants"; and as recommended by manufacturer for substrate and joint conditions.

1. Backer Rod: Closed-cell polyethylene foam.

2.4 MOLDED-SHEET DRAINAGE PANELS / PROTECTION COURSE

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 18 gpm per ft. minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids with concrete repair mortar.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471/C 1471M.

B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471/C 1471M. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Comply with ASTM C 1193 for joint-sealant installation.
2. Apply bond breaker on sealant surface, beneath preparation strip.
3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

B. Install sheet flashing and bond to deck and wall substrates where required according to waterproofing manufacturer's written instructions.

1. Extend sheet flashings for 4 inches (100 mm) onto perpendicular surfaces and items penetrating substrate.

3.5 WATERPROOFING APPLICATION

A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471/C 1471M.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.

D. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.

1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes with an average dry film total thickness of 120 mils.
2. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).

E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

F. Install protection course with butted joints over waterproofing before starting subsequent construction operations.

1. For horizontal applications, install protection course loose laid over fully cured membrane.

2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections:

1. Testing agency shall verify thickness of waterproofing during application for each 100 sq. ft. (56 sq. m) of installed waterproofing or part thereof.

B. Waterproofing will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 071416

SECTION 072100 - THERMAL AND ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the CT High Performance Building Standard (CTHPS) Mandatory Requirements and minimum required sustainable strategies, as indicated on the Sustainable Matrix. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral wool board
4. Nail base insulation

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

2. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
3. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
4. Division 07 Section “EPDM Roofing” for insulation installed as part of a roofing system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 RIGID INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Basis-of-Design: Owens Corning “Foamular NGX”.

1. Acceptable Manufacturers: Subject to compliance with requirements, products by one of the following are allowed:

a. DiversiFoam Products.
b. Dow Chemical Company (The).

2. Type VI, 40 psi.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

B. Basis-of-Design: Owens Corning “Eco Touch Pink Fiberglass”
1. R value: R-value not less than 21 for nominal 6 inch batts.
2. Acceptable Manufacturers: Subject to compliance with requirements, products by one of the following are allowed:

a. Rockfon
b. CertainTeed Insulation

2.3 MINERAL WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation: ASTM C612, Type IA and Type IB; passing ASTM E136 for combustion characteristics.
1. Nominal Density: 4 lb/cu. ft.
2. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
4. R value: R-value not less than 4.0/inch @ 75 deg per ASTM C518.
a. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Mineral-Wool Board Insulation, Types IA and IB, Faced: ASTM C612, Types IA and IB; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.
1. Nominal Density: 4 lb/cu. ft..
2. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
4. Thickness: 1-1/2 inch.
5. Application: Provide board insulation at Insulating Glass, Spandrel Type.

2.4 NAIL BASE INSULATION

A. Basis of Design Product: Subject to compliance with requirements, provide Carlisle R2+ Base Commercial Grade Insulating Nail Base; or a comparable product by one of the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

B. Description: insulating nail base of coated-glass-faced rigid polyisocyanurate insulation board of various thicknesses factory-laminated to a 5/8" fire-treated plywood facer.

C. Coordinate required thickness of plywood, screw type and screw spacing with cladding manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

D. Nail Base Insulation:
1. Provide separation of the edge of product from concrete at grade
2. Begin at base of wall from firm, permanent support
3. Attach product to structure with mechanical fasteners
4. Apply product horizontally in a running bond pattern using maximum board lengths to minimize number of joints. Offset product board joints minimum 6- inches.
5. Pre-cut product to fit openings and projections.
6. L-cut or saddle cut product at windows and large openings.
7. Allow a minimum 0.125 inch and maximum 0.25 inch gaps between boards to accommodate hygric movement of wood.
8. Fasten boards tightly to provide a flush, level surface
9. Fastening:
   a. Fastening shall be approved by a structural engineer to verify sufficiency to secure the both the weight of the product and the weight of the cladding for the project conditions.
   b. Use specified fasteners and spacing as recommended by manufacturer guidelines.
10. Fill all gaps between insulation boards exceeding 0.25 inch across and gaps between insulation and penetrations exceeding 0.25 inch across with foam sealant

3.5 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers. Only for use at substrates that are sheathing. Utilize fluid-applied air barriers at all masonry locations.

B. Related Sections include the following:
   1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

   2. Division 04 Section "Unit Masonry" for embedded flashings.
   3. Division 05 Section "Cold-Formed Metal Framing" for wall sheathing.
   4. Division 07 Section "Fluid-Applied Membrane Air Barriers."
   5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
   6. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers

1.5 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material

changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Compatibility: Air barrier must be compatible with bituminous damproofing.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

C. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.7 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.8 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Build mockups to set quality standards for materials and executioN.

1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint

treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Coordinate construction of mockups to permit inspection of air barrier before external insulation and cladding are installed.
b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace air barrier that fails from manufacturer defect to remain watertight or meet published performance properties within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace, W. R. & Co.; Perm-A-Barrier.
   b. Henry Company; Blueskin SA.
   c. Meadows, W. R., Inc.; SealTight Air-Shield.
   d. Johns Manville; JM Vapor Barrier SAR

2. Physical and Performance Properties:

   a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
   c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
   d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
   e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
   f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.15 cfm/sq. ft. of surface area at 0.30 in, w.g. when tested in accordance with ASTM E1827.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of air barrier material.

C. Counterflashing Strip: Modified bituminous 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, crosslaminated polyethylene film with release liner backing.

D. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

E. Modified Bituminous Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

J. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

K. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

D. Bridge and cover discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 INSTALLATION

A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of through-wall flashings to air barrier sheet with an additional 6-inch- wide, strip.

H. Seal exposed edges of sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

J. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings using accessory materials and according to manufacturer's tested assembly.

K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

M. At end or each working day, seal top edge of membrane to substrate with termination mastic.

N. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.4 FIELD QUALITY CONTROL

A. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.
4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Surfaces have been primed.
6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
7. Termination mastic has been applied on cut edges.

8. Air barrier has been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

B. Testing Services: Owner shall perform testing and inspection of installed air barriers as follows:

1. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E1827.
2. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 1000 sq. ft. of installed air barrier or part thereof.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 072713

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vapor-retarding, fluid-applied air barriers for masonry.

B. Related Requirements:
   1. Section 018110 “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

   2. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. LEED Submittals:
   1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc3: Regional Materials: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for regional materials indicating the extraction and manufacturing distances of the product or material as they relate to the project site.

4. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

5. For EQc2: Low Emitting Materials. For curing compounds, include submittal documentation requirements for IEQ Credit 2 Low Emitting Materials that meet the California Department of Public Health (CDPH) Standard Method v1.2-2017 for emissions compliance. Wet applied products within the building waterproofing barrier layer must also meet applicable chemical content requirements. Coatings must meet the applicable VOC limits of the SCAQMD Rule 1113.

C. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
   a. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

A. High-Build, Vapor-Retarding Air Barrier Modified Bituminous Type: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

B. Physical and Performance Properties:

1. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
2. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Procedure A, Desiccant Method.
3. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
4. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
5. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

E. Bridge joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Re-prime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

K. Seal all exterior wall penetrations with manufacturer’s recommended sealer to maintain continuous barrier.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than not less than 45 mils, applied in two equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.

6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

B. Testing Services: Owner shall perform testing and inspection of installed air barriers as follows:
   1. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E1827.

C. Air barriers will be considered defective if they do not pass tests and inspections.

   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074113 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vertical-rib, seamed-joint, standing-seam metal roof panels.
   2. Vapor retarder.

B. Related Requirements:
   1. Section 018113 “Sustainable Design Requirements” for LEED strategies.
   2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 DEFINITIONS

A. Structural Standing-Seam Metal Roof Panel System: A roof system designed to resist positive and negative loads applied normal to the metal roof panel surface without the benefit of a supporting deck or sheathing.

1.3 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data:

   1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

   1. Include fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal roof panels and metal panel accessories.

1. Size: Manufacturers' standard size.

E. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates for portable roll-forming equipment.

B. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.

C. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal roof panels.

1.7 QUALITY ASSURANCE

A. Portable Roll-Forming Equipment Certification: UL-certified, portable roll-forming equipment capable of producing metal roof panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof area and eave, including fascia, and soffit as shown on Drawings; including attachments, underlayment, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness, with positive slope for drainage of water. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal roof panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal roof panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metal and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 30 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer agrees to repair or replace standing-seam metal roof panel systems that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal roof panel systems capable of withstanding the effects of the following loads when tested in accordance with ASTM E1592:

1. Wind Loads:
   a. Zone 1 (Roof Area Field): 44 lbf/sq. ft..
   b. Zone 2 (Roof Area Perimeter): 58 lbf/sq. ft..
   c. Zone 3 (Roof Area Corners): 58 lbf/sq. ft..
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E1680 or ASTM E283/E283M at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 or ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS, GENERAL

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with seamed joint type indicated and mechanically attaching panels to supports using concealed fasteners in side laps. Include all accessories required for weathertight installation.

2.3 VERTICAL-RIB, SEAMED-JOINT, STANDING-SEAM METAL ROOF PANELS

A. Basis-of-Design: ATAS International, Inc. “Field-Lok series.”

B. Metal Roof Panels Type A: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Structural Support: Over solid deck.
2. Material: Aluminum.
3. Seam Type: Manufacturer's standard.
4. Panel Profile: Flat pan without ribs or striations.
5. Panel Coverage: 13 inches nominal.
6. Panel Height: 1 inch nominal.
7. Clips: Two piece, floating, designed to accommodate thermal movement.
    a. Stainless Steel Clips: 0.0250-inch- thick, stainless steel sheet.
    b. Clip Spacing: As indicated on approved Shop Drawings.

C. Metal Roof Panels Type B: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Structural Support: Over solid deck.
2. Material: Aluminum.
3. Seam Type: Manufacturer's standard.
4. Panel Profile: Flat pan without ribs or striations.
5. Panel Coverage: 16 inches nominal.
6. Panel Height: 2 inches nominal.
7. Clips: Two piece, floating, designed to accommodate thermal movement.
    a. Stainless Steel Clips: 0.0250-inch- thick, stainless steel sheet.
    b. Clip Spacing: As indicated on approved Shop Drawings.

2.4 METAL ROOF PANEL MATERIAL

A. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Thickness:
    a. Type A: 0.032 inch.
    b. Type B: 0.040 inch.
2. Surface: Smooth, flat texture.
3. Exterior Finish: Two-coat fluoropolymer.
4. Color: 2 colors, match Architect's sample.

2.5 VAPOR RETARDER

A. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Roof Panel Accessories: Provide components required for a complete, weathertight metal roof panel system including trim, copings, fasciae, mullions, sills, corner units, fasteners, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Backing Plates: Provide metal backing plates at roof panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal roof panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

D. Roof Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Roof Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with metal roof panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.7 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-site Fabrication: Subject to compliance with requirements of this Section, metal roof panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.

C. Provide roof panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not permitted on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal roof panel manufacturer.

a. Size: As recommended by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.8 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Roof Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal roof panel manufacturer's written installation instructions.

3.3 INSTALLATION OF VAPOR RETARDER

A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.4 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

A. Install metal roof panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal roof panels.

2. Flash and seal metal roof panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal roof panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal roof panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal roof panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Aluminum Roof Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal roof panel manufacturer.

D. Concealed Clip, Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

E. Roof Panel Joints: Fasten panel joints to substrate in accordance with manufacturer's instructions.
1. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
2. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal roof panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 ft. on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

SECTION 074214 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the CT High Performance Building Standard (CTHPS) Mandatory Requirements and minimum required sustainable strategies, as indicated on the Sustainable Matrix. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

B. Related Sections:

   1. Division 06 Section “Sheathing” for plywood sheathing.
   2. Division 07 Section "Air Barriers" for continuous air barrier systems.
   3. Division 07 Section “Standing Seam Metal Roof Panels” for standing seam roofing.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:

   1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

   2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 30 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer agrees to repair or replace standing-seam metal roof panel systems that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
1. Basis-of-Design: ATAS International, Inc “Design Wall Reveal” or approved equal.
2. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
    a. Thickness: 0.040 inch.
    b. Surface: Smooth, flat texture.
    c. Exterior Finish: Two-coat fluoropolymer.
    d. Color: Match Architect's sample.
    e. Panel Coverage: 8 inch nominal.
    f. Reveal: 1.0 inch
    g. Panel Height: 1.0 inch nominal.

2.3 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Roof Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074214

SECTION 074233 – PHENOLIC WALL PANELS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SECTION INCLUDES

A. Exterior solid phenolic cladding panel system and accessories for a complete drained and back-ventilated rainscreen system.

1.3 RELATED SECTION

A. Section 072100 – Thermal Insulation.
B. Section 074800 – Rainscreen Attachment System

1.4 SUBMITTALS

A. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Preparation instructions and recommendations
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.

D. Code Compliance: Documents showing product compliance with requirements. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

E. Engineering Calculations: Submit engineering calculations showing that the installed panels and attachments system meets the wind load requirements for the project.

F. Select Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please not that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.

G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches representing actual product, color, and patterns. Sample edges may vary from field panel edges.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single manufacturer.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacture or representative.

C. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.

1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

D. Pre-installation Meetings: Conduct preinstallation conference to verity project requirements, substrate conditions, Manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. During transportation, use stable flat pallets that are at least the same dimension as the sheets.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden sideboards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.

2. Store products in manufacturer's unopened packaging until ready for installation.
3. Stack panels using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
5. Do not store sheets, or fabricated panels vertically.

C. Handling:

1. Remove protective film within 24 hours of the panels being removed from the pallet.
2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
3. Remove all labels and stickers immediately after installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited ten-year warranty covering defects in materials.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Vertical siding. Provide ship-lap profile with 7.3" face exposure. Basis-of-Design: Trespa Pura by Trespa International or a comparable product from the following manufacturers:
1. Parklex Prodema Natursiding - Custom cut by manufacturer to 7.3"
2. Abet Laminati Easy Meg - Custom cut by manufacturer to 7.3"

2.2 WALL PANELS

A. Solid Phenolic Wall Panels:

1. Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting resins, homogenously reinforced with wood-based fiber and an integrated decorative surface or printed décor.

2. Color on Primary Face: PU08, “Romantic Walnut” color with brown core.
3. Finish: Matt.
4. Panel Thickness: 5/16 inch.
5. Physical Properties:
   a. Modulus of Elasticity: 1,300, 000psi Minimum, ISO 178.
   b. Tensile Strength: 10,100 psi ISO 527-2.
   c. Flexural Strength: 14,500 psi minimum, ISO 178.
   d. Structural Performance (ASTM E330):
      1. Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:
      2. Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175
6. Fire Performance:
   a. Flame Spread: Class A, ASTM E 84.
   b. Smoke Development: Less than 450, ASTM E 84.
   c. Ignition Temperature: Greater than 650-degree F (350-degree C) above ambient, ASTM D1929
   d. Burning Classification: CC1 or CC2, ASTM D635.

B. Mounting System: Concealed fastening using Climate Shield CST1 extruded clip.

C. Fasteners (Concealed/ Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels.

2.3 FABRICATION

A. Panels: Solid phenolic impregnated Kraft paper wall panels with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer’s recommendations and approved submittals.

B. Panel Weight: 2.4 lb./sf/

C. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.

D. Appearance: Panel lines, breaks, and angles shall be sharp, true and surfaces free from warp and buckle.

PART 3 – EXECUTION

3.1 EXAMINIATION

A. Do not begin installation until substrates have been properly prepared.

B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

C. Confirm exterior sheathing is plumb and level, with no deflection greater than ¼ inch in 20 feet.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.

3.3 INSTALLATION

A. Install phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.

C. Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

E. Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.

F. Component parts with require alteration to the shop for re-fabrication or replacement.

G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as in dictated on the Contract Drawings and as recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.

B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.

C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by panel manufacturer. After installation clean, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION 074233

SECTION 074600 – FIBER CEMENT SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fiber-concrete siding.

B. Related Sections:

1. Section 074800 “Rainscreen Attachment System” for metal Z-girts and hat channels.

2. Section 061053 "Misc. Rough Carpentry" for wood furring, nailers, and blocking.

3. Section 076200 “Sheet Metal Flashing and Trim” for aluminum trim associated with siding and soffits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Samples for Initial Selection: For siding and soffit including related accessories.

D. Samples for Verification: For each type, color, texture, and pattern required.

1. 24-inch- long-by-actual-width Sample of siding.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of siding, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of siding and soffit and related accessories to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of siding and soffit including related accessories, in a quantity equal to 1 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, from single source from single manufacturer.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockups for siding including accessories.

a. Size: 72 inches long by 60 inches high.
b. Include outside corner on one end of mockup.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

C. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.9 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.10 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and soffit that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failures including cracking, deforming, and fading.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING

A. General: ASTM C 1185, fiber-cement board. Noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
a. American Fiber Cement Corp; Cembonit, Patina.
b. Equitone; Tectiva
c. Cement Board Fabricators; Silbonit
d. Swiss Pearl; Largo, Carat
2. Thickness: 5/16 inch nominal.
3. Finish: Through-colored matte.
4. Color: As selected by Architect from manufacturers full range.

2.2 FIBER-CEMENT SOFFITS

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board. Noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
1. Basis-of-Design: Provide Hardie “Architectural Panel – Fine Sand w/ ColorPlus” or an equal product from one of the following:
a. CertainTeed Corporation.
b. GAF Materials Corporation
2. Thickness: 5/16 inch nominal.
3. Width: 48 inch nominal.
4. Finish: Smooth texture with manufacturers standard acrylic paint system.
5. Color: As selected by Architect from manufacturers full range.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

C. Fasteners:
1. For fastening fiber cement, use siding manufacturers corrosion resistant fasteners and anchors of type, size, and spacing required to meet design loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.

B. Install siding and soffit and related accessories.

1. Install fasteners no more than 24 inches o.c.

C. Tolerances: Install siding and soffits to the following tolerance:
1. Deviation from level or plumb: ¼ inch in 20’ maximum, non-cumulative.

D. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074600

SECTION 074800 – RAINSCREEN ATTACHMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes thermally broken Rainscreen attachment system for support of exterior siding over continuous exterior insulation.

B. Related Requirements:
   1. Division 07 Section "Modified Bituminous Sheet Air Barriers" for weather-resistive barriers installed as part of Rainscreen assembly.
   2. Division 07 Section “Siding” for exterior siding installed as part of Rainscreen assembly.

1.3 COORDINATION

A. Coordinate Rainscreen attachment system installation with flashings, sheathing, framing and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Manufacturer is responsible for designing the system, including anchorage to the structural system. Employ registered professional engineer, licensed to practice in Connecticut, to design Rainscreen attachment system.

B. Structural Performance: Provide Rainscreen attachment system capable of withstanding design loads within limits and under conditions indicated. Design framing systems to provide for movement of framing members without damage or overstressing, siding failure, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to the following Project requirements:

   1. Design Loads:

      a. Dead Loads: As calculated by Manufacturer for supported Rainscreen components.
      b. Wind Loads: As indicated on structural drawings.

2. Thermal Movement: Temperature Change (range) of 120 degrees Fahrenheit, ambient.

3. Deflection Limits: Horizontal deflection of 1/360 of the wall height.

4. Coordinate lateral load transfer from exterior wall elements supported by Rainscreen attachment system.

5. Design Rainscreen attachment system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1/2".

C. Thermal Performance:

1. Comply with ANSI/ASHRAE 90.1-2010 definition of continuous insulation.
2. No framing component may penetrate the layer of continuous exterior insulation other than fasteners. Continuous framing profiles (including C- or Z- shaped sections or furring) that penetrate the insulation are not allowed.

D. Fasteners:

1. Minimum Safety Factor: 3 for both tension and shear values.
2. Combined tension and shear shall be evaluated according to an interaction formula. Sum of terms shall not exceed 1.0.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Shop Drawings: Show layout, spacings, fasteners sizes, thicknesses, and types of Rainscreen attachment.. Show opening framing, connection details, and attachment to adjoining work.

1. Include structural analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples: Submit Two (2) 12 inch long samples of horizontal stiffened girts.

1.7 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.

2. Coordinate materials and requirements with other Sections.
   a. Include outside corner on one end of mockup.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 QUALITY CONTROL

A. Single source responsibility:

1. Furnish engineered rainscreen attachment system components under direct responsibility of single manufacturer.
2. Field Measurements: Verify actual supporting and adjoining construction before fabrication.
3. Record field measurements on project record shop drawings.
4. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rainscreen attachment system corresponding to established dimensions.
5. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter, and protect from damage due to weather or construction activities.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter, and protect from damage due to weather or construction activities.

1.11 WARRANTY

A. Special Manufacturer's Warranty:

1. Attachment System: Ten (10) year Limited Warranty.
   a. Covers components of the attachment system, including structural failure of components when all the materials and components are supplied and installed per manufacturer's requirements.
   b. Includes labor and material for removal and replacement of defective material.
   c. Includes labor to remove and reinstall façade finish panels, finish closures and façade finish accessories necessary to access defective material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 RAINSCREEN ATTACHMENT/SUPPORT FRAMING SYSTEM

A. Basis of Design Product: Subject to compliance with requirements, provide Knight Wall Systems ThermaZee (horizontal girts) or an equal system by the following:
   1. Advanced Architectural Products; SMARTci.
   2. Northern Facades; ISO Clip with galvanized angle girts.

B. General: Comply with ANSI/ASHRAE 90.1-2010 definition of continuous insulation.

C. Coating Material: ASTM A1046, Zinc-Aluminum-Magnesium, minimum thickness ZM40.

D. Spacing: Comply with manufacturer's Professional Engineer's calculations.

E. Horizontal Girt: Stiffened horizontal girt with pre-punched drainage holes, directly attached on top of rigid insulation at regular spacing, with engineered thermally isolated washer assembly and fasteners.

   1. Steel Thickness: Minimum 0.046-inch thick (18 gauge).
   2. Profile Depth: 0.75 inches.
   3. Girt Fastening Face: 2-inches.
   4. Overall Girt Profile: As indicated.
   5. Finish: Painted black at open joint panel assemblies.

F. Hat Channels:
   1. Finish: PVDF coated.
      a. Color: Black.

G. Fasteners:

1. Provide fasteners of sufficient length to provide solid attachment to structure thru rigid insulation.
2. Thermal Isolating Washers: Minimum 0.125 inch thick Polyoxymethylene copolymer (POM) washers with integral centering lip to act as a thermal break between wall anchor fasteners and girt.

    a. Tensile Yield Strength: 9.57 ksi per ISO 527.
    b. Melting Temperature: 329 degrees Fahrenheit per ISO 3146.

3. Steel stud framing substrate: Self-drill hex-washer-head stainless steel with 1,000 hour salt-spray rated thermoset polyester coating.

    a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
    b. Minimum ultimate pull-out capacity from 18 gauge steel: 450 pounds.

H. Accessories: Manufacturer’s standard accessories that separate and prevent contact between dissimilar metals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Field verify architectural details and mechanical and electrical requirements.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Verify horizontal girt does not cantilever past rigid insulation.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Use laser or chalk line to mark starting height of horizontal girt.
3. Do not use shims to plumb the wall between the horizontal girt and insulation.
4. Minimum length of installed cut girt is 24-inches and shall be attached with at least two (2) fasteners.

5. Mount stiffened horizontal girts, fastened up to 36 inches on center (as determined by the manufactures engineering calculations) over installed rigid insulation, using one self-tapping screw with thermal isolator, for each pre-punched attachment hole at spacing indicated on engineering calculations.

    a. Check plumb of horizontal girts both parallel and perpendicular to the structure.
    b. Tighten screws that attach horizontal girt through insulation to substructure to a snug tight condition and not stripped. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes.
    c. Where obstructions are present and unavoidable (i.e. window openings), use laser or chalk line to restart girt.
    d. Use shearing instruments (i.e. snips, nibbler.) for cutting metal framing components. Saws are not recommended, as the sparks produced during cutting will damage the anti-corrosion coating. If sparks are generated during cutting, be sure the portion of the component to be installed on the building is protected from sparks and that any stockpile near the cutting station is also protected.
    e. The systems components should not be cut while installed on the building, unless using a shearing instrument.
    f. Replace thermal isolator pieces that break during installation.
    g. Provide a 3/8" – 1/2" gap between girts for expansion when multiple lengths of horizontal girts are installed.

END OF SECTION 074800

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing system materials.
3. Roof insulation and accessories.
4. Cover board.
5. Walkways.

B. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels and sound-absorbing insulation strips.
2. Section 061053 "Misc. Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for roof edge fasciae.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's " Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Crickets, saddles, and tapered edge strips, including slopes.
7. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings, of color required.
2. Walkways, of color required.

D. Wind-Uplift-Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.

E. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

1. Protect stored liquid material from direct sunlight.
2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.

1. Store in a dry location.
2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 year NDL, non-prorated, with wind rider.
3. Wind Speed: 80 MPH.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain components for roofing system from roofing membrane manufacturer or manufacturer approved by roofing membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.

1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.

2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1 (Roof Area Field): 44 lbf/sq. ft..
2. Zone 2 (Roof Area Perimeter): 58 lbf/sq. ft..

3. Zone 3 (Roof Area Corners): 58 lbf/sq. ft..

D. Exterior Fire-Test Exposure: Class A; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.

1. Identify products with appropriate markings of applicable testing agency.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

A. TPO Roofing Membrane Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, self-adhering TPO sheet.

B. Basis-of-Design Manufacturer: GAF Materials Corporation

1. Acceptable Manufacturers: Subject to compliance with requirements, products by one of the following is acceptable:
   a. Elevate; Holcim Building Envelope
   b. Carlisle Syn Tec Systems
   c. Johns Manville
2. Thickness: 80 mil nominal.
3. Exposed Face Color: Gray.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.

C. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.

D. Roof Vents: As recommended in writing by roofing membrane manufacturer.

1. Size: Not less than 4-inch diameter.

E. Bonding Adhesive: Roofing membrane manufacturer's standard, water based.

F. Slip Sheet: Manufacturer's standard, of thickness required for application.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.

I. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.

J. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.5 ROOF INSULATION AND ACCESSORIES

A. General: Preformed roof insulation boards manufactured or approved by roofing membrane manufacturer, approved for use in SPRI's "Directory of Roof Assemblies" listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1 felt facer on both major surfaces.
   1. Compressive Strength: Grade 2, 20 psi.
   2. Size: 48 by 96 inches.
   3. Thickness:
      a. Base Layer: 1-1/2 inches.
      b. Upper Layer: 4 inches.
   4. R-Value: LTTR of 5.6 per inch of thickness.

C. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   2. Minimum Thickness: 1/4 inch.
   3. Slope:
      a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
      b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

D. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.
   1. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.6 COVER BOARD

A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

B. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Roofing System Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEM, GENERAL

A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, SPRI's "Directory of Roof Assemblies" listed roof assembly requirements.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under Section 072713 "Modified Bituminous Sheet Air Barriers." Provide slip sheet between roofing system and air barriers.

3.4 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.

C. Install each layer of insulation with end joints staggered not less than 12 inches in adjacent rows] and offset not less than 12 inches from previous layer.

1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
2. Make joints between adjacent insulation boards not more than 1/4 inch in width.
3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
4. Trim insulation, so that water flow is unrestricted.
5. Fill gaps exceeding 1/4 inch with insulation.
6. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
7. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
8. Place plates on insulation in required fastening patterns and secure in accordance with manufacturer's instructions.

    a. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch minimum into roof deck; do not overdrive fasteners.

3.5 INSTALLATION OF COVER BOARD

A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

    a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate in accordance with SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity.

3.6 INSTALLATION OF TPO ROOFING MEMBRANE

A. Install roofing membrane over roof area for adhered application method in accordance with roofing system manufacturer's written installation instructions.

B. Unroll roofing membrane and allow it to relax before installing.

C. Start installation in presence of roofing system manufacturer's technical personnel.

D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.

1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.

F. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashings to ensure a watertight installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.

G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

3.7 INSTALLATION OF BASE AND SHEET FLASHINGS

A. General: Install and adhere base and sheet flashing and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.

B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners.

D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.

E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products in accordance with manufacturer's written installation instructions.

1. Install flexible walkways at the following locations:
   a. Locations indicated on Drawings.
   b. As required by roofing membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. \Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING SYSTEM INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:

1. Owner: <**Insert name of Owner**>.
2. Owner Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.

4. Building Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: Two years from date of Substantial Completion.
8. Date of Substantial Completion: _____.

B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding 72 MPH;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become

null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.

6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 018110 “Sustainable Design Requirements” for LEED Requirements and Procedures.

2. Section 061053 "Misc Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 074113 "Standing Seam Metal Roof Panels" for materials and installation of sheet metal flashing and trim integral with roofing.
4. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
5. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
6. Section 079500 "Expansion Control" for manufactured expansion-joint cover assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of edge conditions, including eaves, rakes, flashings, and counterflashings.
9. Details of special conditions.
10. Details of connections to adjoining work.
11. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

F. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, eave, including fascia, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   1. Surface: Smooth, flat.
   2. Exposed Coil-Coated Finish:

      a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   3. Colors: Match Architect's samples.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed.
   1. Surface: Smooth, flat.
   2. Exterior Finish: ASTM A480/A480M, No. 2B (bright, cold rolled).

2.3 UNDERLAYMENT

A. Synthetic Underlayment for Fascias: Laminated or reinforced, woven polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.

B. Self-Adhering, High-Temperature Sheet Underlayment for Gutters: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

   1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.
   3. Compatibility: Compatible with standing seam roofing underlayment.

C. Slip Sheet for Gutters: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners: Series 300 stainless steel.

C. Solder:
1. For Stainless Steel: ASTM B32, Grade Sn96, with acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Material: Aluminum, 0.024 inch thick.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Accessories:
a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

4. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form fascia expansion joints of butt panels with 6” back-up plate.

2. Form gutter expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Seams:
1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

2. Seams for Stainless Steel: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Built-in Gutters:

1. Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
2. Fabricate in minimum 96-inch- long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
3. Fabricate gutters with built-in expansion joints.
4. Fabricate from the following materials:

    a. Stainless Steel: 0.0156 inch thick.

2.7 ROOF SHEET METAL FABRICATIONS

A. Roof Fascia: Fabricate in minimum 96-inch-long, but not exceeding 12 ft. long sections. Furnish with 6-inch- wide, joint back-up plates. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
2. Fabricate from the following materials:
    a. Aluminum: 0.080 inch thick.

B. Counterflashing: Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to profiles indicated. Fabricate from the following materials:
1. Aluminum: 0.040 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.
2. Lap end joints not less than 12 inches.

B. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches between courses.
5. Roll laps and edges with roller.
6. Cover underlayment within 14 days.

C. Install slip sheet, wrinkle free, over Self-Adhering underlayment before installing sheet metal gutters.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
7. Do not field cut sheet metal flashing and trim by torch.
8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting

contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints at gutters of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Lapped expansion joints are not permitted.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches.
2. Do not solder aluminum sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

a. Fill joint completely.
b. Completely remove flux and spatter from exposed surfaces.

5. Stainless Steel Soldering:

a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
b. Promptly remove acid-flux residue from metal after tinning and soldering.

c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Built-in Gutters:

1. Join sections with soldered joints.
2. Provide for thermal expansion.
3. Slope to downspouts.
4. Provide end closures and seal watertight with sealant.
5. Install underlayment layer in built-in gutter trough and extend to under underlayment on roof sheathing.

    a. Lap sides minimum of 2 inches over underlying course.
    b. Lap ends minimum of 4 inches.
    c. Stagger end laps between succeeding courses at least 72 inches.
    d. Install slip sheet over underlayment.

6. Anchor and loosely lock back edge of gutter using SMACNA raw edge style.
7. Install gutter with expansion joints at locations indicated on Drawings. Install expansion-joint caps.

3.5 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Fascias:

1. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

    a. Interlock bottom edge of fascia with continuous cleat anchored to substrate at 16-inch centers.
    b. Anchor top edge with washers and screw fasteners through slotted holes at 16-inch centers.

3.6 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings unless otherwise indicated.

3.7 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.10 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Pad-type, seam-mounted metal snow guards for all standing seam roofing areas..

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

C. Samples:

   1. Pad-Type Snow Guards: Full-size unit with installation hardware.

      a. For units with factory-applied finishes, submit manufacturer's standard color selections.

D. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.

   1. Include calculation of number and location of snow guards.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the state in which the Project is located.

1.5 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:

1. Roof snow load.
2. Snow drifting
3. Roof slope.
4. Roof type.
5. Roof dimensions.
6. Snow guard type.
7. Snow guard fastening method and strength.
8. Snow guard spacing.
9. Coefficient of Friction Between Snow and Roof Surface: 0.
10. Factor of Safety: 2.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: 35 psf.

2.2 PAD-TYPE SNOW GUARDS

A. Pad-Type, Seam-Mounted Cast-Metal Snow Guards:

1. Subject to conformance with requirements, provide model ASG33G by Alpine SnowGuards or equal from, but not limited to, the following manufacturer:
   a. TRA Snow and Sun, Inc.

2. Material: ASTM B26/B26M cast aluminum; factory powder coat finish

   a. Color: As selected from manufacturers standard colors..

3. Attachment: Manufacturer's tested system, capable of resisting design loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

1. Space rows as indicated on Shop Drawings.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.

2. Pad-Type, Seam-Mounted Snow Guards:

a. Install snow guards in straight rows.
b. Secure in place using stainless steel set screws, incorporating round nonpenetrating point.
c. Torque set screw according to manufacturer's instructions.

END OF SECTION 077253

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 07 Section "Fire-Resistive Joint Systems."

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. Walls: F-Rated Systems: Provide through-penetration firestop systems with minimum F-ratings of 1 hour, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and

follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

      1) UL in its "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated that are produced by one of the following manufacturers:

1. Hilti, Inc.
2. 3M; Fire Protection Products Division.
3. Carboline.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Through-penetration firestop system designation of applicable testing and inspecting agency.
3. Through-penetration firestop system manufacturer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner may engage a qualified, independent inspecting agency to inspect through-penetration firestops.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestop Systems with No Penetrating Items:

1. Available UL-Classified Systems: C-AJ-0001-0999.
2. Available UL-Classified Systems: W-L-0001-0999.

C. Firestop Systems for Metallic Pipes, Conduit, or Tubing:

1. Available UL-Classified Systems: C-AJ-1001-1999.
2. Available UL-Classified Systems: W-L-1001-1999.

D. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. Available UL-Classified Systems: C-AJ-2001-2999.
2. Available UL-Classified Systems: W-L-1001-1999.

E. Firestop Systems for Electrical Cables:

1. Available UL-Classified Systems: C-AJ-3001-3999.
2. Available UL-Classified Systems: W-L-1001-1999.

G. Firestop Systems for Insulated Pipes:

1. Available UL-Classified Systems: C-AJ-5001-5999.
2. Available UL-Classified Systems: W-L-5001-5999.

H. Firestop Systems for Miscellaneous Electrical Penetrants:

1. Available UL-Classified Systems: C-AJ-6001-6999.
2. Available UL-Classified Systems: W-L-6001-6999.

I. Firestop Systems for Miscellaneous Mechanical Penetrants:

1. Available UL-Classified Systems: C-AJ-7001-7999.
2. Available UL-Classified Systems: W-L-7001-7999.

J. Firestop Systems for Groupings of Penetrants:

1. Available UL-Classified Systems: C-AJ-8001-8999.
2. Available UL-Classified Systems: W-L-5001-5999.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:

1. Head-of-wall joints.
2. Wall-to-wall joints.

B. Related Sections include the following:

1. Division 07 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, indicated as determined by UL 2079 or ASTM E1966.

C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

E. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, OPL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:

a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the fire-resistive joint systems indicated for each application in the Fire-Resistive Joint System Schedule at the end of Part 3.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

B. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspections are completed and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Head-of-Wall Fire-Resistive Joint Systems:

1. Available UL-Classified Systems: HW-D-0000-1999.
2. Assembly Rating: Equal to the rating of the wall.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II – 50 percent compression or extension.

C. Wall-to-Wall Fire-Resistive Joint Systems:

1. Available UL-Classified Systems: WW-D-0000-0999.
2. Assembly Rating: Equal to the rating of the wall.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II - 25 percent compression or extension.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:

B. This Section includes sealants for the following applications:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
   a. Joints between different materials.
   b. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:
   a. Joints between different materials.
   b. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Perimeter joints of exterior openings where indicated.
   b. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   d. Acoustical sealant.
   e. Other joints as indicated.

C. Related Sections include the following:
1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

2. Division 07 Section "Through-Penetration Firestop Systems" for fire-resistant building joint-sealant systems.
3. Division 08 Section "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Sustainable Design Submittals:

1. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.4 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or

harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Single-Component Silicone Sealant: For miscellaneous joints between exterior materials provide:

1. Products:

    a. Dow Corning Corporation; 790.

    b. GE Silicones; SilPruf SCS2000.
    c. Pecora Corporation; 864.
    d. Polymeric Systems Inc.; PSI-641.
    e. Sonneborn, Division of ChemRex Inc.; Omniseal.
    e. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).

5. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.

B. Latex Sealant: For miscellaneous joints between interior materials provide:

1. Products:
    a. Bostik Findley; Chem-Calk 600.
    b. Pecora Corporation; AC-20+.
    c. Tremco; Tremflex 834.

2. Type and Grade: P and NF.
3. Use Related to Exposure: NT (nontraffic).

C. Multicomponent Pourable Urethane Sealant: For joints in horizontal traffic surfaces provide:

1. Products:

a. SL 2; Sonneborn Building Products Div., ChemRex Inc.
b. THC-900; Tremco.
c. THC-901; Tremco.

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.

D. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant: Interior joints between plumbing fixtures or kitchen equipment and adjoining walls and floors.

1. Available Products:

a. Pecora Corporation; 898.
b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).

E. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, non-staining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Available Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

END OF SECTION 079200

SECTION 080671 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “All-Glass Entrances”.
2. Division 08 Section “Door Hardware”.

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service

representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a

hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. NO - Norton Rixson
7. OT - Other

Hardware Sets

Set: 1.0

Doors: A137.2, A137.3, B020A, C102, C103, C104, V100.1

2	Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE	087100
1	Mullion	CR910BKM		RU	087100
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU	087100
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU	087100
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100
2	Pull	P12	630	RU	087100
2	Surface Closer Stop Arm	DC6210 A11	689	RU	087100
1	Mullion Gasketing	5110BL		PE	087100

1	Rain Guard	346C x Width of Frame Head		PE 087100	
1	Threshold	273x224AFGT x Length Required		PE 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 2.0

Doors: C106

2	Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE 087100	
1	Mullion	CR910BKM		RU 087100	
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU 087100	
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Pull	P12	630	RU 087100	
2	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	
1	Mullion Gasketing	5110BL		PE 087100	
1	Gasketing	322CSPK		PE 087100	
1	Rain Guard	346C x Width of Frame Head		PE 087100	
2	Door Bottom	434APKL		PE 087100	
1	Threshold	273x224AFGT x Length Required		PE 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	

1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Coordinate sound seals with Aluminum Door Manufacturer

Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 3.0

Doors: S001, S004

1	Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE 087100	
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
1	Pull	P12	630	RU 087100	
1	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	
1	Rain Guard	346C x Width of Frame Head		PE 087100	
1	Threshold	273x224AFGT x Length Required		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.

3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 4.0

Doors: V100.2, V100.3

2 Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE	087100	
1 Mullion	CR910BKM		RU	087100	
2 Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU	087100	
1 Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100	
2 Pull	P12	630	RU	087100	
2 Surface Closer Stop Arm	DC6210 A11	689	RU	087100	
1 Mullion Gasketing	5110BL		PE	087100	
1 Rain Guard	346C x Width of Frame Head		PE	087100	
1 Threshold	273x224AFGT x Length Required		PE	087100	
2 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	
2 ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	
2 Position Switch	DPS-M-BK		SU	087100	
1 Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.

Set: 5.0

Doors: A150E

1 Continuous Hinge	CFM__SLF-HD1		PE	087100	
1 Rim Exit Device, Exit Only	PED5201 [A] EO	630	RU	087100	
1 Surface Closer Stop Arm	DC6210 A11	689	RU	087100	

1	Gasketing	322CSPK		PE	087100
1	Rain Guard	346C x Width of Frame Head		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	273x224AFGT x Length Required		PE	087100

Notes: Coordinate sound seals with Aluminum Door Manufacturer

Set: 6.0

Doors: S002.1, S003.1

2	Continuous Hinge	CFM__HD1 EL-CEPTx32D		PE	087100
1	Mullion	CR910BKM		RU	087100
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU	087100
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU	087100
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100
2	Pull	P12	630	RU	087100
2	Surface Closer Stop Arm	DC6210 A11	689	RU	087100
1	Gasketing	290APK x 2891APK		PE	087100
1	Mullion Gasketing	5110BL		PE	087100
1	Rain Guard	346C x Width of Frame Head		PE	087100
1	Threshold	273x224AFGT x Length Required		PE	087100
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
2	Position Switch	DPS-M-BK		SU	087100
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 7.0

Doors: A147.1, B004B, B203B

1 Continuous Hinge	CFM__HD1 EL-CEPTx32D		PE	087100	⚡
1 Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU	087100	
1 Pull	P12	630	RU	087100	
1 Surface Closer Stop Arm	DC6210 A11	689	RU	087100	
1 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100	
1 Gasketing	290APK x 2891APK		PE	087100	
1 Rain Guard	346C x Width of Frame Head		PE	087100	
1 Threshold	273x224AFGT x Length Required		PE	087100	
1 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1 ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1 Position Switch	DPS-M-BK		SU	087100	⚡
1 Card Reader	By Security		OT		⚡
1 Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 8.0

Doors: A121.1, A121.2, B020

2 Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE	087100	⚡
1 Mullion	CR910BKM		RU	087100	
1 Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU	087100	
1 Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU	087100	

1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Pull	P12	630	RU 087100	
2	Concealed Overhead Holder/Stop	6-x36	630	NO 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by key. Exit device latches can be electrically held retracted for open access allowing for push/pull access during set hours.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss or lockdown. Keyed cylinder override for emergency access.

Set: 9.0

Doors: V100.4

2	Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE 087100	
1	Mullion	CR910BKM		RU 087100	
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU 087100	
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Pull	P12	630	RU 087100	
2	Concealed Overhead Holder/Stop	6-x36	630	NO 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
1	Threshold	to architect detail		PE 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as		SU 087100	

	Required)				
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 10.0

Doors: V100.5, V100.6

2 Continuous Hinge	CFM__SLF-HD1 EL-CEPTx32D		PE	087100	
1 Mullion	CR910BKM		RU	087100	
2 Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU	087100	
1 Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100	
2 Pull	P12	630	RU	087100	
2 Concealed Overhead Holder/Stop	6-x36	630	NO	087100	
2 Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100	
1 Threshold	to architect detail		PE	087100	
2 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	
2 ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	
2 Position Switch	DPS-M-BK		SU	087100	
1 Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.

Set: 11.0

Doors: B041, B041A, B138.1, B138.2

1	Continuous Hinge	CFM__SLF-HD1		PE	087100	
1	Classroom Intruder Lock w/ Indicator	ML2052 PSA V01 CT6B ACP	626	RU	087100	
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100	
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100	
1	Gasketing	322CSPK		PE	087100	
1	Door Bottom	434APKL		PE	087100	
1	Threshold	175A x Length Required		PE	087100	

Notes: Coordinate sound seals with Aluminum Door Manufacturer

Set: 12.0

Doors: A147

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100	
2	Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1	Mullion	CR910BKM		RU	087100	
1	Rim Exit Device, Exit Only	PED5201 [A] EO M92	630	RU	087100	
1	Rim Exit Device	PED5247 [A] MELR PR847PT M92	630	RU	087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100	
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100	
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100	
2	Silencer	608-RKW		RO	087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
2	Position Switch	DPS-M-BK		SU	087100	⚡
1	Card Reader	By Security		OT		⚡
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.

3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 13.0

Doors: A121.3, A121.4

2	Continuous Hinge	CFM__HD1 EL-CEPTx32D		PE 087100	
1	Mullion	CR910BKM		RU 087100	
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU 087100	
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Pull	P12	630	RU 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
2	Silencer	608-RKW		RO 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by key. Exit device latches can be electrically held retracted for open access allowing for push/pull access during set hours.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss or lockdown. Keyed cylinder override for emergency access.

Set: 14.0

Doors: A133.2, A134.1, A135.1

2	Continuous Hinge	CFM__HD1 EL-CEPTx32D		PE 087100	⚡
1	Mullion	CR910BKM		RU 087100	
1	Rim Exit Device	PED5257T [A] MELR x Less Pull M92 CT6B ACP	630	RU 087100	
1	Rim Exit Device, Exit Only	PED5201 [A] MELR EO M92	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Pull	P12	630	RU 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	
1	Threshold	175A x Length Required		PE 087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	⚡
1	Position Switch	DPS-M-BK		SU 087100	⚡
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by key. Exit device latches can be electrically held retracted for open access allowing for push/pull access during set hours.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss or lockdown. Keyed cylinder override for emergency access.

Set: 15.0

Doors: A122.2

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Mullion	CR910BKM		RU 087100	
1	Rim Exit Device, Exit Only	PED5201 [A] EO	630	RU 087100	
1	Rim Exit Device Classroom w/ Pushbutton	PED5267 [A] M47 PR967PT CT6B ACP	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	

2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
2	Silencer	608-RKW		RO	087100

Notes: Note:
1. Door normally closed and unlocked during use.
2. Push button on the inside (Secure side) locks the outside latchbolt.
3. Pushpad / key releases both the button and the latchbolt
4. Indicator provides clear indication of the shelter in place status.
5. Always free egress.

Set: 16.0

Doors: A140.1, A140.2, A140A, A140B

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Mullion	CR910BKM		RU	087100
1	Rim Exit Device, Exit Only	PED5201 [A] EO	630	RU	087100
1	Rim Exit Device Classroom w/ Pushbutton	PED5267 [A] M47 PR967PT CT6B ACP	630	RU	087100
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Astragal	351C		PE	087100
1	Gasketing	322CSPK		PE	087100
2	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Notes: Note:
1. Door normally closed and unlocked during use.
2. Push button on the inside (Secure side) locks the outside latchbolt.
3. Pushpad / key releases both the button and the latchbolt
4. Indicator provides clear indication of the shelter in place status.
5. Always free egress.

Set: 17.0

Doors: A139.2

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Mullion	CR910BKM		RU	087100
1	Rim Exit Device, Exit Only	PED5201 [A] EO	630	RU	087100

1	Rim Exit Device Classroom w/ Pushbutton	PED5267 [A] M47 PR967PT CT6B ACP	630	RU	087100
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Note:
1. Door normally closed and unlocked during use.
2. Push button on the inside (Secure side) locks the outside latchbolt.
3. Pushpad / key releases both the button and the latchbolt
4. Indicator provides clear indication of the shelter in place status.
5. Always free egress.

Set: 18.0

Doors: C105

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Mullion	CR910BKM		RU	087100
2	Rim Exit Device Classroom	PED5255 [A] PR855PT CT6B ACP	630	RU	087100
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU	087100
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
2	Silencer	608-RKW		RO	087100

Set: 19.0

Doors: A133.1, A134.2, A135.2

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Rim Exit Device Classroom w/ Pushbutton	PED5267 [A] M47 PR967PT CT6B ACP	630	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Note:
1. Door normally closed and unlocked during use.
2. Push button on the inside (Secure side) locks the outside latchbolt.
3. Pushpad / key releases both the button and the latchbolt
4. Indicator provides clear indication of the shelter in place status.
5. Always free egress.

Set: 20.0

Doors: A150

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Rim Exit Device Classroom w/ Pushbutton	PED5267 [A] M47 PR967PT CT6B ACP	630	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Notes: Note:
1. Door normally closed and unlocked during use.
2. Push button on the inside (Secure side) locks the outside latchbolt.
3. Pushpad / key releases both the button and the latchbolt
4. Indicator provides clear indication of the shelter in place status.
5. Always free egress.

Set: 21.0

Doors: S001.1

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Rim Exit Device Classroom	PED5255 [A] PR855PT CT6B ACP	630	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Electromagnetic Holder	998M	689	NO	087100
3	Silencer	608-RKW		RO	087100
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Doors normally held open via electromagnetic hold open.
2. Upon loss of power, fire alarm activation or Lockdown, magnets to release allowing doors to close and positively latch.
3. Always free egress.

Set: 22.0

Doors: S002, S003, S102, S103, S201.1, S201.2, S202, S203

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Mullion	CR910BKM		RU 087100	
2	Rim Exit Device Classroom	PED5255 [A] PR855PT CT6B ACP	630	RU 087100	
1	Cylinder Kit	CRMCK_ C6 CT6B	626	RU 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
2	Electromagnetic Holder	998M	689	NO 087100	⚡
1	Gasketing	S88BL (Head & Jambs)		PE 087100	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Doors normally held open via electromagnetic hold open.
2. Upon loss of power, fire alarm activation or Lockdown, magnets to release allowing doors to close and positively latch.
3. Always free egress.

Set: 23.0

Doors: B108A, B109A, B110A, B111A

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	⚡
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO 087100	
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	⚡
1	Surface Overhead Holder/Stop	10-x36	630	NO 087100	
1	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	

2	Silencer	608-RKW		RO 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 24.0

Doors: B009A, B010A, B011A, B012A, B030A, B031A, B032A, B033A, B130A, B131A, B132A, B133A, B204A, B205A, B206A, B207A, B224A, B225A, B226A, B227A

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO 087100	
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	
1	Surface Overhead Holder/Stop	10-x36	630	NO 087100	
1	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	
1	Astragal	351C		PE 087100	
1	Gasketing	322CSPK		PE 087100	
2	Door Bottom	434APKL		PE 087100	
1	Threshold	175A x Length Required		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
2	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as		OT	

Specified

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 25.0

Doors: A138, B004A

6 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100	
1 Dust Proof Strike	570	US26D	RO	087100	
1 Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100	
1 Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU	087100	⚡
1 Coordinator	2600 Series x Mtg Brackets (size to opening)	Black	RO	087100	
2 Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100	
2 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100	
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100	
2 Silencer	608-RKW		RO	087100	
1 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1 ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1 Position Switch	DPS-M-BK		SU	087100	⚡
1 Card Reader	By Security		OT		⚡
1 Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 26.0

Doors: B005

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Dust Proof Strike	570	US26D	RO 087100	
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO 087100	
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	
1	Coordinator	2600 Series x Mtg Brackets (size to opening)	Black	RO 087100	
2	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
1	Astragal	351C		PE 087100	
1	Gasketing	322CSPK		PE 087100	
2	Door Bottom	434APKL		PE 087100	
1	Threshold	175A x Length Required		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Position Switch	DPS-M-BK		SU 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 27.0

Doors: A100, A100A, A100B, A100C, A113, A118, A144, B002, B005B, B024, B126A, B215, B215A, B220A, B220B, B229B, C108

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 28.0

Doors: A130A, A139A, A150B, B018, B121

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Card Reader	By Security		OT	

1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 29.0

Doors: B123

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.

4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 30.0

Doors: A125A, A141A, A149, B034A, B038B, B121A, B202

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	⚡
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	⚡
1	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
3	Silencer	608-RKW		RO 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	⚡
1	Card Reader	By Security		OT	⚡
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 31.0

Doors: A134B, A135B, A141B, A142B, B102

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	⚡
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	⚡
1	Surface Closer Stop Arm	DC6210 A11	689	RU 087100	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
1	Gasketing	322CSPK		PE 087100	
1	Door Bottom	434APKL		PE 087100	

1	Threshold	175A x Length Required		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 32.0

Doors: B107, B217

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
1	Gasketing	S88BL (Head & Jambs)		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into

security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 33.0

Doors: B203A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	⚡
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	⚡
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100	
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100	
1	Gasketing	322CSPK		PE 087100	
1	Door Bottom	434APKL		PE 087100	
1	Threshold	175A x Length Required		PE 087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK 087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK 087100	⚡
1	Card Reader	By Security		OT	⚡
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU 087100	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 34.0

Doors: A122B, A147C, A147D, M121, M140

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100	
1	Electric Power Transfer	EL-CEPT	630	SU 087100	⚡
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU 087100	⚡

1	Surface Closer Stop Arm	DC6210 A11	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Gasketing	S88BL (Head & Jambs)		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:
1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 35.0

Doors: B035A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100
1	Fail Secure Lock	ML20906-SEC PSA CT6B ACP	626	RU	087100
1	Surface Closer Stop Arm	DC6210 A11	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Card Reader	By Security		OT	
1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Operation:

1. Door normally closed and secured.
2. Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
3. Built in request to exit switch to allow authorized egress, integrated door position switch to be tied into security system to monitor status of door.
4. Upon loss of power door to remain locked.
5. Always free egress.

Set: 36.0

Doors: A123, A126

3 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1 Deadbolt	DL4117 ACP CT6B	626	RU	087100
1 Push Plate	70C-RKW	US32D	RO	087100
1 Door Pull	BF 110	US32D	RO	087100
1 Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 37.0

Doors: A131, A132, A145, A146, B007, B008, B034, B035, B116, B117, B124, B125, B212, B213, B218, B219

3 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1 Deadbolt	DL4117 ACP CT6B	626	RU	087100
1 Push Plate	70C-RKW	US32D	RO	087100
1 Door Pull	BF 110	US32D	RO	087100
1 Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1 Door Stop & Holder	494-RKW	US26D	RO	087100
1 Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 38.0

Doors: A150D

6 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Flush Bolt	555 / 557 (As Required)	US26D	RO	087100
1 Storeroom Lock	ML2057 PSA CT6B ACP	626	RU	087100

2	Surface Overhead Holder/Stop	10-x36	630	NO	087100
2	Silencer	608-RKW		RO	087100

Set: 39.0

Doors: A150C

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Storeroom Lock	ML2057 PSA CT6B ACP	626	RU	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 40.0

Doors: B228A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Storeroom Lock	ML2057 PSA CT6B ACP	626	RU	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 41.0

Doors: B003, B126

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Storeroom Lock	ML2057 PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 42.0

Doors: A101, A102, A103, A104, A105, A106, A107, A108, A109, A114, A129A, A138A, A147B, B025

3	Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1	Office Lock	ML2054 PSA CT6B ACP	626	RU	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 43.0

Doors: A124, A125, A127, A128, A129

3	Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK 087100
1	Office Lock	ML2054 PSA CT6B ACP	626	RU 087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
3	Silencer	608-RKW		RO 087100

Set: 44.0

Doors: A121A, A121B, A122A, A134A, A135A, A140C

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100
1	Dust Proof Strike	570	US26D	RO 087100
1	Flush Bolt	555	US26D	RO 087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU 087100
2	Surface Overhead Holder/Stop	10-x36	630	NO 087100
2	Silencer	608-RKW		RO 087100

Set: 45.0

Doors: A122C

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100
1	Dust Proof Strike	570	US26D	RO 087100
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO 087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU 087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU 087100
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO 087100
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
2	Silencer	608-RKW		RO 087100

Set: 46.0

Doors: A117, A118A, A138C, A138D, A141C, A142A, A143A, B019A, B105A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK 087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU 087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO 087100
3	Silencer	608-RKW		RO 087100

Set: 47.0

Doors: A124.1, A125.1, A136, B001A, B038A, B040, B135A, B137, B220, B232

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 48.0

Doors: B103

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 49.0

Doors: A139.1, B026A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Classroom Lock	ML2055 PSA CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Set: 50.0

Doors: A122.1, A130, B101A, B108, B109, B110, B111, B113, B114, B201A, B229A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100

1	Classroom Intruder Lock w/ Indicator	ML2052 PSA V01 CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 51.0

Doors: A141, A142, A143, B001, B009, B010, B011, B012, B014, B015, B016, B019, B027, B028, B030, B031, B032, B033, B036, B038, B101, B104, B105, B118, B127, B128, B130, B131, B132, B133, B134, B135, B201, B203, B204, B205, B206, B207, B209, B210, B211, B214, B221, B222, B224, B225, B226, B227, B228, B229

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Classroom Intruder Lock w/ Indicator	ML2052 PSA V01 CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 52.0

Doors: B026, B115

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Classroom Intruder Lock w/ Indicator	ML2052 PSA V01 CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Sound Seals	Including Seals, Door bottoms etc. to be provided by STC Door Manufacturer		OT	

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Set: 53.0

Doors: A123A, A126A, A138B

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Privacy Lock	ML2060 PSA V21	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 54.0

Doors: A110, A118B, A136A, A147A, A148, B105B, B232A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Privacy Lock	ML2060 PSA V21	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 55.0

Doors: A132A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Privacy Lock	ML2060 PSA V21	626	RU	087100
1	Surface Closer Stop Arm	DC6210 A11	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Gasketing	S88BL (Head & Jambs)		PE	087100

Set: 56.0

Doors: A111, B006, B017, B039, B119, B122, B136, B216, B230

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Institutional Privacy Lock w/ Indicator	ML2069 PSA V21 CT6B ACP	626	RU	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 57.0

Doors: B105D

6	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Flush Bolt	555	US26D	RO	087100
1	Passage Latch	ML2010 PSA	626	RU	087100
2	Surface Overhead Holder/Stop	10-x36	630	NO	087100
2	Silencer	608-RKW		RO	087100

Set: 58.0

Doors: A115, A116, A120, B105C

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Passage Latch	ML2010 PSA	626	RU	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 59.0

Doors: B021, B022, B023

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Passage Latch	ML2010 PSA	626	RU	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 60.0

Doors: B037, B106, B231

3	Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1	Magnetic Lock	M32FB		SU	087100
1	Push Pull	111x73C/73CL	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100
1	Pushbutton	PB5		SU	087100

1	Power Supply	AQL-E1 Series (Amps & Relays as Required)		SU	087100
1	Bracket	ZA-32/62CL		SU	087100

Notes: Coordinate hinge requirements with STC 50 Assembly Provider

Constant pressure must be applied to PB5 in order to secure mag lock. Door must be not able to be locked unless PB5 is depressed. System is Fail Safe

Set: 61.0

Doors: A140.3, A150A

3	Hinge, Full Mortise, Hvy Wt	T4A3786-MCK [NRP-HVY]	US26D	MK	087100
1	Push Bar & Pull	BF15747	US32D	RO	087100
1	Surface Closer	DC6200 A10 / DC6210 A3	689	RU	087100
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
1	Gasketing	322CSPK		PE	087100
1	Door Bottom	434APKL		PE	087100
1	Threshold	175A x Length Required		PE	087100

Set: 62.0

Doors: A137.5, A147.2, B041B, C101

1	Interchangeable Core	CR8000	626	RU	087100

Notes: Balance of hardware by assembly provider

END OF SECTION 080671

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Custom hollow metal doors and frames.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for LEED Requirements and Procedures.
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
4. Division 09 Sections "Painting" for field painting hollow metal doors and frames.
5. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door Products.
2. Curries Company.
3. Fleming Door Products Ltd.
4. Steelcraft

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[**and temperature-rise limits**] indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

   2. Temperature-Rise Limit: [**Where indicated on Drawings**] [**At vertical exit enclosures and exit passageways**], provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 CUSTOM HOLLOW METAL DOORS

A. General: Provide doors not less than 1-3/4 inches thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861.

B. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.053 inch thick.

C. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet, minimum 0.042 inch thick.

D. Core Construction: Provide thermal-resistance-rated cores for exterior doors.

1. Steel-Stiffened Core: 0.026-inch- thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart, spot welded to face sheets a maximum of 5 inches o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.

a. Thermal-Rated (Insulated) Doors: For all exterior doors, provide with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

E. Thickness: 1-3/4 inch unless otherwise indicated.

F. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches.

G. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.

H. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch thick, of same material as face sheets and spot welded to both face sheets.

I. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

2.5 CUSTOM HOLLOW METAL FRAMES

A. General: Fabricate frames of construction indicated. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth. Comply with ANSI/NAAMM-HMMA 861.

1. Door Frames for Openings 48 Inches Wide or Less: Fabricated from 0.053-inch- thick steel sheet.
2. Door Frames for Openings More Than 48 Inches Wide: Fabricated from 0.067-inch-thick steel sheet.
3. Sidelight and Transom Frames: Fabricated from same thickness material as adjacent door frame.
4. Borrowed-Light Frames: Fabricated from 0.053-inch- thick steel sheet.

B. Exterior Frames: Formed from metallic-coated steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.

E. Head Reinforcement: Provide minimum 0.093-inch- thick, steel channel or angle stiffener for opening widths more than 48 inches.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/NAAMM-HMMA 861.

2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with HMMA 840.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    b. Install frames with removable glazing stops located on secure side of opening.
    c. Install door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
2. Fire-Rated Openings: Install frames in accordance with NFPA 80.

3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.

2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:
1. Division 01 Section “Sustainable Design Requirements” for LEED Requirements and Procedures.
2. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc3: Certified Wood: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.
4. Indicate fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For factory-finished doors.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

    a. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

C. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Graham; an Assa Abloy Group company
2. Marshfield Door Systems, Inc.
3. Mohawk Flush Doors, Inc.; a Masonite company.
4. VT Industries.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

A. Acoustic Doors: Sound control assemblies match those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with ASTM E90 and ASTM E413.

2.3 DOOR CONSTRUCTION, GENERAL

A. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

    a. Screw Withdrawal, Face: 700 lbf.
    b. Screw Withdrawal, Edge: 400 lbf.

2. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

3. Thickness: 1-3/4 inch unless otherwise indicated.

B. Composite Sound-Core Doors:

1. Edge Construction: Structural composite lumber (SLC) with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2. Thickness: 1-3/4 inch unless otherwise indicated.

2.4 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: WDMA Premium with Grade A faces.
2. Performance Level: Extra Heavy Duty.

3. Species: Select white maple.

4. Cut: Plain sliced.

5. Match between Veneer Leaves on Door Faces: Balance match.

6. Exposed Vertical Edges: Same species as faces or a compatible species.

7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors:

        1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
        2) Provide formed-steel edges and astragals with intumescent seals.

            a) Finish steel edges and astragals to match door hardware (locksets or exit devices).

c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.

d. Acoustic Doors:

1) STC: 45

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.

2. Profile: Flush rectangular beads.

B. Metal Beads for Light Openings in Acoustic Wood Doors: Provide manufacturer's standard metal beads as follows unless otherwise indicated.

1. Profile: Flush rectangular beads.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Unless otherwise indicated, locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Custom.

a. TR-8 UV Cured Acrylated Polyester/Urethane.

2. Staining: Match Architects sample.

3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors and frames in accordance with NFPA 80.

2. Install smoke- and draft-control doors in accordance with NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, as indicated on the Sustainable Matrix. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
2. Division 09 Section "Acoustical Panel Ceilings " for suspended acoustical tile ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

D. Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 for horizontal access doors and frames.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.
5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.

8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Latch: Cam latch operated by screwdriver with interior release.

C. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by ring turn with interior release.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 inch wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Show locations of locking devices, and other accessories.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: Uniform pressure (velocity pressure) of 50 lbf/sq. ft., acting inward and outward.
2. Testing: According to ASTM E330/E330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20-lbf/sq. ft. wind load, acting inward and outward.

B. Seismic Performance: Overhead coiling doors are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Provide Cornell “Thermiser Max – Low U Door” model ESD40 or approved equal.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.

D. Insulated Door Assembly U-Factor: 0.60 Btu/deg F x h x sq. ft. maximum.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats:
   1. Insulated-Slat Interior Facing: Plastic.
   2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from aluminum extrusions and finished to match door.

H. Curtain Jamb Guides: Steel with exposed finish matching curtain slats.

I. Hood: Galvanized steel.
   1. Mounting: Face of wall.

J. Locking Devices: Equip door with chain lock keeper.

K. Manual Door Operator: Chain-hoist operator.

L. Curtain Accessories: Equip door with weatherseals.

M. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range (Cornell Spectra Shield).
   2. Interior Curtain-Slat Facing: Manufacturer’s standard.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
   3. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 75 and smoke-developed index of 450, according to ASTM E84 or UL 723.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

   1. Thresholds: Equip pass doors with integral thresholds that comply with the accessibility standard of authorities having jurisdiction.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.108-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2.6 LOCKING DEVICES

A. Chain Lock Keeper: Suitable for padlock.

2.7 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

2.8 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 30-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 083326 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Self supporting open-curtain overhead coiling grilles.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for LEED Requirements and Procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: or each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

4. For exterior components, include details of provisions for assembly expansion and contraction.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Open-curtain grille with full-size components consisting of rods, spacers, and links as required to illustrate each assembly.
2. Guides.
3. Mounting frame.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 WARRANTY

A. Manufacturers 2 year warranty against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Cornell VisionAire Model ESG10. Subject to compliance with requirements, provide named product or equal product by one of the following:

1. Atlas Door; Div. of Clopay Building Products Company, Inc.
2. McKeon Rolling Steel Door Company, Inc.
3. Overhead Door Corp.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Operation Cycles: Grille components and operators capable of operating for not less than 10,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position

B. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with straight lattice pattern.
2. 5/16” minimum rod diameter.
3. Space rods at approximately 2 inches o.c.
4. Space links at approximately 9 inches o.c.

C. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.

D. Bottom Bar: Continuous tubular shape, fabricated from aluminum extrusion and finished to match grille.

E. Grille Curtain Jamb Guides and Tubes for Self Supporting Installation:

1. Tube mounted guides: Heavy duty extruded aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent over-travel of curtain.

2. Tubes: Provide structural steel tubes that are attached to the floor slab and braced to the structure above, sized by the manufacturer to support grille, and factory prepared for the attachment of all grille components.. Provide floor saddles and hardware required for a complete installation.

a. Finish: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.

F. Locking Devices: Keyed cylinder lock.

1. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

2.4 COUNTERBALANCING SHAFT ASSEMBLY

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.5 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.

C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 110513 "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 115 V.
c. Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

D. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

E. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

F. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

G. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

H. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling grilles, and operators at the mounting locations indicated for each grille.

C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

SECTION 083513 – ACCORDION FOLDING FIRE DOORS

PART 1 – GENERAL

1.01 SUMMARY OF WORK

A. Division 0 and 1, as indexed, apply to this section.

A. Furnish and install all horizontal sliding, accordion folding fire doors shown on the drawings and specified herein.

1.02 RELATED SECTIONS

A. All headers, support structures, fire protection of support structures, surrounding insulation, jambs, storage pockets, blocking and trim shall be furnished and installed by other sections.

B. All electrical wire, wiring, conduit and electrical boxes shall be furnished and installed by electrical section including connections to smoke detectors and building fire alarm panels.

C. Drilling/placement of anchorage points into pre or post tensioned decks, welding/ punching/drilling steel members and all drywall work by other sections.

D. Interface to the fire doors shall be accomplished using a MODBUS gateway (by others) configured for RS485 communications. Use 18-gauge single twisted pair communication wire from the MODBUS gateway and daisy chain connections to each fire door (maximum of 32 doors per gateway). Terminate the end-of-line with a load resistor as specified by the MODBUS gateway manufacturer.

Communication lines are daisy chained from the MODBUS gateway to each fire door. The communications line is connected to a USOC RJ11, 6 Position, 4 Contact wall plate at each door. The [COM+]/[COM-] wires are connected to the center pins (Red and Green wires respectively). The plate is then mounted to a j-box centrally located on the back wall of the fire door pocket. All wiring, conduit, j-boxes and wall plates are provided by the Electrical Contractor. Connection from the wall plate to the fire door controller is accomplished by a modular plug data cable provided by the manufacturer.

1.03 QUALITY ASSURANCE

A. Installation shall be performed by factory trained and certified installers with a minimum of three years' experience installing electrically operated accordion folding fire doors.

B. Fire partition shall be listed by Underwriters Laboratories for ratings as indicated, when tested in accordance with the requirements of UL 263 and ASTM E-119.

C. Automatic closing system shall be listed by Underwriters Laboratories in accordance with the requirements of UL 864 and be listed for use with the assembly in compliance with NFPA 80.

1.04 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's technical literature, include UL listing data.

C. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stack depth, height of header above finished floor, and requirements for anchorage and support of each door.

D. Operation and Maintenance Data: Operating procedures, troubleshooting and repair methods, and wiring diagrams.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver to the job site in manufacturer's original, unopened package.

1.06 COORDINATION BY CONTRACTOR

A. Coordinate with the following:

1. Fire Alarm system.
2. Electrical.
3. Pocket cover doors (if required).
4. Floor and ceiling finish.

B. Assure accurate installation of header, jamb, and trim. Provide “As-Built” dimensions for opening and storage pocket. Supervise unloading and handling of materials.

C. Store boxes flat (not more than three high) in a protected dry area.

D. Permanent power shall be in-place and ready for final connection when fire doors are installed. Assure access to and proper clearance for motor operators.

E. After testing the fire alarm system, automatic-closing fire doors shall be re-set to the original position.

1.07 WARRANTY

A. Materials and installation shall be warranted against defects in workmanship for a period of two (2) year from the date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Horizontal sliding accordion folding fire doors shall be Won-Door FireGuard Moveable Fire Wall model MFW 2 or equal.

2.02 ACCORDION FIRE DOORS – GENERAL

A. Provide electrically powered self-closing fire doors of configurations indicated on the drawings.

B. Fire Rating – Fire doors shall be listed by Underwriters Laboratory as special purpose fire doors having a 120 minute fire protection rating in accordance with the requirements of UL 263 and ASTM E-119..

C. Closing and Opening Operation: Automatic Closing System including motor operator and releasing devices shall be a Microprocessor-based system rated to UL864 (Releasing Device Control Unit) and shall commence closing upon activation by fire alarm system and/or by low battery voltage.

1. Obstruction Detection: Contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition.

2. Constant pressure to the leading edge while not under motor power shall prevent motor operation and allow the door to be opened manually.

D. Exit Hardware Operation: Provide fire exit hardware on both sides of door.

1. In emergency mode, a slight pressure on the hardware will cause the door to open a minimum of 32 inches, pause for 3 seconds, and then automatically close.

2. The open distance shall be field programmable, up to the entire opening width.

3. The pause before re-close shall be field programmable up to 30 seconds.

4. The exit hardware shall have the ability when not in the emergency (fire) mode to be used to open the door and move it back into the storage pocket.

2.03 COMPONENTS

A. Door Construction: Two parallel, accordion-type walls independently suspended with no floor tracks, pantographs, or interconnections.

1. Panels: 24 gauge steel, V-grooved; modular in design; capable of in-place repair.

2. Perimeter Seals**:** shall consist of continuous extruded sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.

3. Hanging Weight: 6.5 pounds per sq. ft. when extended across opening.

4. Finish: All steel panels shall have factory-applied protective coatings.

5. Color: Manufacturer's standard platinum.

B. Suspension System: Two tracks, on 8 inch centers, attached to overhead structural support.

1. Tracks: 0.125 aluminum or 14 gauge cold rolled steel.

2. Panel Hangers: Panels shall be suspended by a steel hanger pin and ball bearing roller system.

3. Narrow Lead Post Hangers: 8 wheel ball bearing trolley.

C. Power Supply: 120 volt power source to power supply for main power. On loss of AC power, the 12v/24v secondary power source shall provide full operation capability.

D. Automatic Closing System shall be listed to UL864 including capability to send and receive signals from the Fire Control Panel, and shall consist of the following:

1. Microprocessor based Electronic Control box with the ability to:

a. Monitor dual power sources continually for peak performance including:

1) Detect a missing battery, bad battery, or low battery condition.

2) Detect if the charging circuit is bad.

3) Detect fuse failures.

4) Detect high or low AC conditions.

b. Monitor the health of the drive train.

c. Monitor inputs including faults associated with: door block, exit hardware, patron hardware, and key switches.

d. Run a “watch dog” monitoring circuit which will force a software restart in the event the software hangs, including tracking the number of resets that occur for diagnostic purposes.

e. Withstand voltages up to 120 volts AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, “no voltage” circuit when errant voltages are applied to the circuit.

f. Communicate with other microprocessors on the system via an internal bus system.

g. Indicate faults or supervised information both locally and at a remote location.

2. Motor Operator Assembly including a DC gear-motor, drive sprocket, clutch, and position sensors. The motor shall drive the fire door by means of a chain attached to a stabilizer bar trolley.

3. A door control momentary rocker switch shall be mounted on one side of the door and shall function as follows:

a. Pressing the upper portion shall close the door and/or clear fault conditions.

b. Pressing the lower portion of the switch shall open the door and/or temporarily mute the local horn.

4. Leading Edge shall be pressure sensitive such that contact with an obstruction shall cause the door to stop, pause for 3 seconds, then re-close when in alarm mode.

5. Exit Hardware will be located on both sides of each fire door.

The header shall be provided as an integrated part of the door assembly and shall Include track, threaded rods and mechanical attachment hardware. A Key Switch shall be provided, (In place of the momentary rocker switch), located as directed by the Architect

E. Remote Operation and Monitoring. Fire doors shall be remotely monitored and controlled through a building monitoring system (BMS) and interface with the BMS using MODBUS communication.

MODBUS Door Controls shall include: Open, Close, Reset, Lock (with Access Control Option), Unlock (with Access Control Option).

MODBUS Monitor Status: Door position across opening width, Door Status (OPEN, CLOSED, OPENING, CLOSING), Errors, Battery Voltage, AC Voltage.

F. Provide an additional auxiliary relay module (XRM) with two additional relays to indicate specific status and fault conditions including any two of the following: Open, Opening, Closed, Closing, Stopped, Locked, Exit Hardware Access, Secure Access, Forced Entry, TLS Failure, Key Switch Failures, Stuck switches, Power Failures, Communication Errors.

2.04 RELATED CONSTRUCTION

A. Track Support Construction: Provide supports attached to structure and mounting surface for track including drilling/placement of anchorage points into pre or post tensioned decks, welding/punching/drilling steel members, and all drywall work; comply with door manufacturer’s instructions and recommendations.

B. Pocket Construction: Provide rated pocket as specified for storage of accordion door when open; comply with door manufacturer’s instructions and recommendations.

C. Protection: Protect installed work from damage.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for installation of door.

B. Verify that electrical utilities have been installed and are accessible.

A. Verify that door opening is plumb and header is parallel with the finished floor.

B. Verify clear opening dimensions.

C. Notify Architect of any unacceptable conditions or varying dimensions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, shop drawings and NFPA 80.

B. Install fire doors plumb and parallel with the finished floor.

C. Installation shall be performed by factory trained and certified installers with a minimum of three years' experience installing electrically operated accordion folding fire doors.

3.03 ADJUSTING

A. Adjust door installation to provide uniform clearances and smooth, quiet, non-binding operation.

B. Test that all operations are functional and meet the requirements of local codes.

3.04 CLEANING

A. Clean surfaces using manufacturer's recommended means and methods.

3.05 STORAGE OF WASTE AND RECYCLING

A. Store and recycle waste in accordance with Section 01 74 19 Construction Waste Management and Disposal

END OF SECTION 082513

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:
1. Metal for door sections.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design, ICC A117.1 and 521 CMR applicable to sectional doors.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Basis of Design: Provide Overhead Door “426 Series” or a comparable product from another manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: Uniform pressure (velocity pressure) of 50 lbf/sq. ft., acting inward and outward.
2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

    a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
    b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

2.3 SECTIONAL-DOOR ASSEMBLY

A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

B. Operation Cycles: Door components and operators capable of operating for not less than 10,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration for Exterior Doors: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value at Exterior Openings: Less than 0.15 Btu/sq. ft. x h x deg F.

E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.
1. Door-Section Thickness: 2 inches.
2. Section Faces:
    a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
    b. Exterior Face: Fabricated from single sheets, not more than **24 inches** high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted,

shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
1) Steel Sheet Thickness: 0.028-inch nominal coated thickness.
2) Surface: Manufacturer's standard, grooved.

c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.022 inch.

3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch nominal coated thickness and welded to door section.
4. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
a. Board Insulation: Polystyrene, secured to exterior face sheet.
b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.

F. Track: Manufacturer's standard, galvanized-steel, low-headroom track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: 2 inches.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
a. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

H. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

a. Roller-Tire Material: Manufacturer's standard.

I. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

    a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

J. Manual Door Operator:
1. Push-Up Operation: Lift handles and pull rope for raising and lowering doors located on inside and outside of bottom section; with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.

K. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
    a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, as indicated on the Sustainable Matrix. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:

1. Exterior and Interior storefront framing.
2. Exterior manual-swing entrance doors and door-frame units.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. Division 08 Section "Glazed Aluminum Curtain Walls" for curtain-wall systems that mechanically retain glazing on four sides.
3. Division 08 Section “Door Hardware” for door hardware installed in storefront systems.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

2. Dimensional tolerances of building frame and other adjacent construction.

3. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    d. Noise or vibration created by wind and by thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Sealant failure.
    g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
    1. Detail fabrication and assembly of aluminum-framed systems.
    2. Include design calculations.
        a. Include calculations that each door and frame system and their connections to the structure meet a "Low Hazard" rating in accordance with ASTM F 1642.
    3. Structural Loads: As indicated on Drawings.

C. Deflection of Framing Members:

    1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

    2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

    1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
    2. When tested at 165 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
    3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 8.0 lbf/sq. ft.

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures.

Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 65 (frame) when tested according to AAMA 1503.

I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.35 Btu/sq. ft. x h x deg F when tested according to AAMA 1503 with a glazing with center of glass U value of .29.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Glazing.

3. Flashing and drainage.

G. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of aluminum-framed systems.
2. Include design calculations.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

C. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by

dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water leakage through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Exterior Storefront:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide EFCO 2"– Series 406X THERM Thermal Storefront Framing or comparable product*s* by one of the following:

      a. Kawneer North America
      b. Oldcastle Building Envelope

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.

   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced to support imposed loads.
   1. Glazing System: Retained mechanically with gaskets on four sides.
   2. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2 inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 6-inch nominal width.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High performance organic finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

1. Color and Gloss: To match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.

1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

a. Perform a minimum of three tests in areas as directed by Architect.

2. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design requirements.

1.2 SUMMARY

A. Section includes:

1. Conventionally glazed aluminum curtain walls.
2. Misc. aluminum closure angles attached to curtain walls and storefronts.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.
2. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
3. Division 07 Section “Sheet Metal Flashing and Trim” for storefront flashing furnished by the Roofing and Flashing field sub-bidder, installed by the Metal Windows Filed Sub-bidder.
4. Division 08 Section Aluminum-Framed Entrances and Storefronts".
5. Division 10 Section “Exterior Sun Shades”.

1.3 CURTAIN WALL PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.

c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Loads from exterior metal sunshades where shown on Drawings.

D. Structural-Test Performance: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

F. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. Component Importance Factor: As shown on the Structural Drawings.

G. Story Drift: Accommodate design displacement of adjacent stories indicated.

H. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than

condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F.
3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

J. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.35 Btu/sq. ft. x h x deg F when tested according to AAMA 1503 with a glazing with center of glass U value of .29.
2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Provide glazed aluminum curtain wall systems that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified testing agency.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For glazed aluminum curtain walls and aluminum windows installed in curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification:

1. Exposed Finishes: For each type required, in manufacturer's standard sizes.
2. Exposed Hardware: Full-size units.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

H. Seismic Qualification Certificates: For glazed aluminum curtain walls and sloped glazing systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

I. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls and aluminum windows, indicating compliance with performance requirements.

K. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

L. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls and windows that meet or exceed energy performance requirements indicated, and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

F. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Faulty operation of movable sash and hardware.

f. Failure of operating components.
g. Failure of insulating glass.

2. Warranty Period: Provide 10 year extended warranty from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for glazed aluminum curtain-wall systems is based on EFCO Series 5600 2 1/4" Thermal Curtain Wall System w/ fiberglass pressure plate. Subject to compliance with requirements, provide the named product or an approved equal product manufactured to the aluminum frame dimensions shown on the drawings by one of the following manufacturers:

1. Kawneer North America; an Alcoa Company.
2. Oldcastle Building Envelope.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced to support imposed loads.

1. Construction: Thermally isolated.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing Sealants: Manufacturer's standard sealants.

2.4 GLAZING

A. Glazing: Comply with Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

1. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 DOORS

A. Doors: Comply with Division 08 Section "Aluminum-Framed Entrances and Storefronts."

2.6 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

B. Closure Angles: Provide aluminum closure angles where indicated or required to seal curtain wall to floor or wall.

1. Size: As indicated.

2.7 CURTAIN WALL FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM WINDOW FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.11 ALUMINUM FINISHES.

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

F. High performance organic finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.

1. Color and Gloss: To match Architect’s sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, to produce weathertight construction.
8. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

E. Install components plumb and true in alignment with established lines and grades.

F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

G. Install glazing as specified in Division 08 Section "Glazing."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.

1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

a. Perform a minimum of three tests in areas as directed by Architect.

2. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.5 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing curtain wall and windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect curtain wall and window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 084413

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section "Sustainable Design Requirements”.
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Operations and Maintenance”.
5. Division 08 Section “Hollow Metal Doors and Frames”.
6. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
7. Division 08 Section “All-Glass Entrances”.
8. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

D. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. Hager Companies (HA) - BB Series, 5-knuckle.
b. Ives (IV) - 5BB Series, 5-knuckle.
c. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
2. Manufacturers:.

a. Ives (IV).
b. Pemko (PE).
c. Stanley

2.4 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko (PE) - EL-CEPT Series.
    b. Securitron (SU) - EL-CEPT Series.
    c. Von Duprin EPT-10 Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).
    b. Ives.

c. Burns.

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturers:

    a. Corbin Russwin (RU) - Access 3 AP.
    b. No Substitution.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
b. Corbin Russwin Hardware (RU) - ML2000 Series.
c. Sargent Manufacturing (SA) - 8200 Series.

2.9 DEADLOCKS AND LATCHES

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 350 Series.
b. Corbin Russwin Hardware (RU) - DL4000 Series.
c. Sargent Manufacturing (SA) - 4870 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Commercial Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 1 with minimum holding force strength of 600 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

    a. Security Door Controls (SD) - EMLock 1500 Series.
    b. Securitron (SU) - M32/M38 Series.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
c. No catch points: addition of applied deflectors or other added components are not allowed.
d. No visible plastic.
e. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
f. Constructed of all stainless steel.
g. Stainless steel pullman type latch with deadlock feature.
h. Narrow or wide style exterior trim as specified in the hardware sets.
i. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
j. Ten-year limited warranty for mechanical features.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
b. Sargent Manufacturing (SA) - PE80 Series.
c. Von Duprin (VD) - 35A/98 XP Series.

2.13 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - DC6000 Series.
b. Norton Rixson (NO) - 7500 Series.
c. Sargent Manufacturing (SA) - 351 Series.

2.14 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15, Grade 1 electromagnetic door holder/releases with a minimum 25 to 40 pounds holding power and fail-safe operation; power failure releases door to close.

1. Manufacturers:

a. Norton Rixson (NO) - 900 Series.
b. Sargent Manufacturing (SA) - 1560 Series.

2.15 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

a. Meets ADA requirements for smooth bottom door surfaces.
b. UL Classified options for use on fire-rated doors up to 3 hours.
c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
f. Fasteners included; adhesive-backed options available for select models.
g. Ten-year limited warranty.

2. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

2.16 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (NO).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

2.17 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Reese Enterprises, Inc. (RE).
3. Zero (ZE).

2.18 ELECTRONIC ACCESSORIES

A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.

1. Manufacturers:

a. Alarm Controls (AK) - TS Series.
b. Securitron (SU) - PB Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Alarm Controls (AK) - CP1-1026 Series.
b. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
c. Enhanced surge immunity for input/output protection
d. Separate, dedicated battery charging circuit to keep locks cooler.

e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
f. Instant auto-switch to battery on AC loss.
g. Expandable up to 16 outputs in the standard enclosure
h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.19 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate

as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed curtain walls.
4. Storefront framing.
5. Glazed entrances.
6. Interior borrowed lites.

B. Related Sections:

1. Section 088300 "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2003 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Retain first subparagraph below if sloped glazing is exposed to snow loads. The IBC requires that the flat-roof snow load be indicated on the Construction Documents if the ground snow load exceeds 10 lbf/sq. ft. (0.479 kN/sq. m).
3. Design Snow Loads: As indicated on Drawings.

4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
6. Concentrated Live Loads at skylight glazing: 250lbf applied to the glazing at locations that will produce the greatest stress or deflection.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Sustainable Design Submittals:
1. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

D. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch lengths.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

F. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass and insulating glass.

C. Preconstruction adhesion and compatibility test report.

D. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Source Limitations for Glass: Obtain ultraclear float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

H. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

C. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.

1. Glass: Clear float.

2. Ceramic Coating Pattern: As indicated.
3. Ceramic Coating color: As selected by Architect from manufacturers full range.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

1. Glass: Clear float.

2. Ceramic Coating Color: As selected by Architect from manufacturer's full range.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.

2. Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.10 LAMINATED-GLASS

A. Typical Interior Glazing: Where indicated, provide the following:

1. Thickness of Each Glass Ply: 3.0 mm.
2. Interlayer Thickness: 0.060 inch.

3. Provide safety glazing labeling.

B. Typical Exterior Door Glazing: Clear laminated insulating glass with interlayer.

Performance Criteria: Provide laminated glass tested per 5-aa1, failure time greater than 5 minutes.

a. Basis of Design: Provide glass by Oldcastle Building Envelope “ArmorGarde” or approved equal.

2.11 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Interspace Content: Argon.
4. Low-E Coating: Sputtered on second surface.
5. Visible Light Transmittance: 70 percent minimum.
6. Winter Nighttime U-Factor: 0.26 maximum.
7. Summer Daytime U-Factor: 0.22 maximum.
8. Solar Heat Gain Coefficient: 0.38 maximum.

9. Provide safety glazing labeling.

B. Glass Type: Ceramic-coated, low-e, insulating spandrel glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Interspace Content: Argon.

4. Low-E Coating: Sputtered on second surface.
5. Opaque Coating Location: Fourth surface.
6. Winter Nighttime U-Factor: 0.26 maximum.
7. Summer Daytime U-Factor: 0.22 maximum.

2.12 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating laminated glass.

1. Overall Unit Thickness: 1-inch.
2. Thickness of Outdoor Lite: 6.0 mm.
3. Interspace Content: Argon.
4. Indoor Lite: Clear laminated glass with two plies of float glass.

a. Thickness of Each Glass Ply: 3.0 mm.
b. Interlayer Thickness: 0.060 inch.

5. Low-E Coating: Sputtered on second surface.
6. Visible Light Transmittance: 70 percent minimum.
7. Winter Nighttime U-Factor: 0.27 maximum.
8. Summer Daytime U-Factor: 0.23 maximum.
9. Solar Heat Gain Coefficient: 0.36 maximum.

10. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: 4 inches.

2. Minimum Base-Metal Thickness: 0.033 inch.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

E. Room-Side Finish: Gypsum board or cementitious backer units.

F. Shaft-Side Finish: Gypsum shaftliner board, Type X.

G. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. American Gypsum; Shaft Liner.
b. CertainTeed Corp.; ProRoc Shaftliner.
c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
d. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
e. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
f. PABCO Gypsum; Pabcore Shaftliner Type X.
g. USG Corporation; Sheetrock Brand Gypsum Liner Panel.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.

C. Gypsum Board: As specified in Section 092900 "Gypsum Board."

D. Cementitious Backer Units: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

F. Acoustical Sealant: As specified in Section 079200 "Sealant."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits).
3. Stage acoustic reflector framing.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Design Requirements”.
2. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing framing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.0312 inch.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base Metal Thickness: 0.0179 inch.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; 660-C Drywall Furring System.
c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Provide the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0296 inch.

D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.
2. Depth: 7/8 inch.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2. Hardboard (Masonite): AHA A135.4

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. 16 inches o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.

b. Where control joints are indicated, install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

2. Tile backing panels.
3. Acoustical sealant.

B. Related Requirements:

1. Division 01 Section “Sustainable Design Requirements”.

2. Division 05 Section “Cold Formed Metal Framing” for structural framing that supports gypsum board.

3. Division 06 "Sheathing" for gypsum sheathing for exterior walls.
4. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
5. Division 09 “Gypsum Board Shaftwall Assemblies”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units (at all toilet rooms): ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch.
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. Expansion (control) joint.
e. Z-Bead: Z-shaped reveal.
f. F-Molding; Armstrong 7913.
g. Other shapes where noted on drawings.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at toilet rooms.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints where shown and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. L-Bead, LC-Bead, Z-Bead, Control: Use where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.

3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

4. Level 5: Where indicated.

E. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

F. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

G. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 – TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Metal edge strips.

B. Related Sections:
1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.
2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Material Test Reports: For each tile-setting and -grouting product.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Metal edge strips.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceramic Tile Products:

a. American Marrazzi Tile, Inc.
b. American Olean Tile Company.
c. Buchtal Corporation USA.
d. Crossville Ceramics Company.
e. Daltile Corporation
f. Interceramic.
g. Lone Star Ceramics Company.
h. Seneca Tiles, Inc.
k. Stone Source.

m. United States Ceramic Tile Company.

2. Tile-Setting and -Grouting Materials:

a. American Olean Tile Company.
b. Daltile Corporation.
c. Laticrete International, Inc.
d. Mapei Corporation.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Architect with selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

2.3 CERAMIC TILE PRODUCTS

A. Glazed Ceramic Tile:

1. Basis of Design: American Olean
2. Size and Shape: 3 inches by 6 inches, nominal.
3. Colors: 3 colors to be selected from Manufacturer’s price groups 1 thru 3.

B. Trim Units: Provide tile trim units to match characteristics of adjoining tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:

a. Internal Corners: Field-butted square corners, except with cap angle pieces designed to member with stretcher shapes.
b. Cap: Bullnose, 3 inches by 6 inches.
c. Cap inside/outside corner: Bullnose corner.
d. Outside corner: Bullnose, 3 inch high.

C. Transition Strip: Subject to compliance with requirements, provide the following product, or an approved equal.

1. Manufacturer: Schluter.
2. Product: Jolly for Ceramic tile to Resinous cove transition.
3. Finish: Anodized Aluminum.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, composed as follows:

2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

a. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.6 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

2. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:

a. Unsanded grout mixture for joints 1/8 inch and narrower.
b. Sanded grout mixture for joints 1/8 inch and wider.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

1. Provide cleaner that Complies with Contractor's IAQ Management Plan specified in Division 01 Section "Construction IAQ Management."

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.9 STONE THRESHOLDS

A. General: Provide stone thresholds that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces. Provide basis of design "Thassos White" by Dal Tile or equal.

1. Fabricate thresholds to heights indicated, but not more than 1/2 inch above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A.

D. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Provide manufacturer’s standard trim shapes where necessary to eliminate exposed tile edges.

F. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, and align joints on floor and base, unless otherwise indicated.

E. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts, comply with ANSI A108.10.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Wall Tile: 1/16 inch.

3.6 STONE THRESHOLD INSTALLATION

A. Install stone thresholds in latex-portland cement mortar (thin set).

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Compliy with Contractor’s IAQ Management Plan specified in Division 01 Section “Construction IAQ Management” for cleaning procedures.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 CERAMIC TILE WALL INSTALLATION SCHEDULE

A. Ceramic Tile Installations Over Metal Studs with Cementitious Backer Board: Where interior wall installations of this designation are indicated, comply with the following:

1. Installation Method: TCA W244.
2. Setting Bed and Grout: ANSI A118.6 with the following mortar and grout:

a Latex-portland cement mortar.
b Unsanded latex-portland cement grout.

B. Ceramic Tile Installations Over Masonry: Where interior wall installations of this designation are indicated, comply with the following:

1. Installation Method: TCA W2021.
2. Setting Bed and Grout: ANSI A118.6 and A118.1 with the following mortar and grout:

c Latex-portland cement mortar.
d Unsanded latex-portland cement grout.

END OF SECTION 093000

SECTION 095000 – LINEAR WOOD CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions 01 Specification sections apply to work of this section.

B. Sustainable Design Intent: Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:
   1. Wood linear veneered planks.
   2. Suspension system.
   3. Cable hangers and fasteners.

B. Related Sections:
   1. Division 06 Section “Interior Architectural Woodwork”
   2. Division 09 Section “Acoustical Panel and Wire Ceilings”

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot- Dip Process.
   3. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   4. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   5. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E 580 Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.

B. International Code Council Evaluation Service
   AC156 - Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

A. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc3: Include submittal documentation requirement for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

1.2 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.

C.

1. Surface Burning Characteristics: Tested per ASTM E 84:
2. Flame Spread: 25 or less

D. Woodworking standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

E. Seismic Performance: System seismic performance verified through full-scale testing in accordance with ICC-ES – AC-156 Acceptance Criteria for Seismic Qualification Testing of Non-Structural components.

F. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to light fixtures, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store ceiling components in a dry interior location in their cartons prior to installation to avoid damage. Store cartons in a flat, horizontal position. The protectors between the panels should not be removed until installation.

B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.7 PROJECT CONDITIONS

A. Wood veneer ceiling materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to climatize).

B. The wood veneer panels should not be installed in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.

1.8 WARRANTY

A. Wood Plank Ceiling: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Defects in materials or factory workmanship.

B. Warranty Period:

1. Wood Plank Ceiling: Standard - One (1) year from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: The design for the wood panel ceiling canopy is based on WoodWorks Linear Veneered Planks, Armstrong World Industries. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. WoodCeilings, Inc.
2. Rulon Company.
3. Norton Industries
4. 9Wood

2.3 WOOD PANEL CEILINGS

A. Wood Panels:
1. Type: WoodWorks Linear Veneered Planks
2. Composition: Wood – Fire retardant particle board with face-cut veneer
3. Plank Reveal: ¾" Factory Applied Acoustical Fleece
4. Plank Width: 3-3/4 inch
5. Plank Length: as shown on drawings
6. Surface Finish:
    a. Veneer Species: Plain Slice Light Cherry
7. Edge Banding and Trim: Panel edges finished to match panel surface.
8. Access Panels: Access panels to be built in field per architectural details
9. Accessories:
    a. Linear Wood Panel Splice # 5843
    b. BioAcoustic Infill Panels, 24 x 24 x 5/8-inch thick, color Black (matte)
10. Performance Requirements:
    a. NRC: min. 0.60
    b. Fire Performance: Class A
    c. Recycled Content: 92%

2.4 SUSPENSION SYSTEM

A. Basis of Design Product: Armstrong WoodWorks HD Linear Carrier with integral clips (concealed)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.

3.2 PREPARATION

A. Examine construction and conditions under which the system will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. Install suspension system and panels in compliance with ASTM C636, with the authorities having jurisdiction, and in accordance with the manufacturer's shop drawings and installation instructions.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.
B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to LEED Requirements and minimum required sustainable strategies, as indicated on the Sustainable Matrix. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section includes:
1. Acoustical panels and exposed suspension systems for ceilings.
2. Metal edge moldings and trim.
3. Metal panel closures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

A. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class B materials.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

D. Acoustical Panel Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – ACT 1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong; ULTIMA High-NRC or a comparable product by one of the following:
1. BPB USA.
2. USG.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type A, mineral base with membrane-faced overlay; Form A2.2, water felted; with vinyl overlay.
2. Pattern: E.

C. Color: White.

D. LR: Not less than 0.85

E. NRC: Not less than 0.80

F. CAC: Not less than 35.

G. Edge/Joint Detail: FLB - Reveal sized to fit flange of exposed suspension system members.

H. Thickness: 7/8 inch.

2.4 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – ACT 2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Health Zone; or a comparable product by one of the following:
1. BPB USA.
2. USG.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type A mineral base with membrane faced overlay, Form 2.1 and 2.2 water felted, smooth texture with scrubbable face.
2. Pattern: E (lightly textured).

C. Surface: Washable, USDA approved.

D. NRC: Not less than 70

E. LR: Not less than 0.85

F. CAC: Not less than 35.

G. Edge/Joint Detail: Square.

H. Thickness: 3/4 inch

H. Color: White.

I. Location: Rms, A138, A138C, A138D and A143.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS.

A. Manufacturers: Subject to compliance with requirements, Basis of Design USG Donn DX/DXL typical, at general areas designated ACT-1, DXLA at ACT-2 areas, or provide one of the following:
1. BPB USA
2. Armstrong World Industries, Inc.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Cap Material: Steel cold-rolled sheet.
4. Cap Finish: Painted white.

2.8 METAL EDGE MOLDINGS AND TRIM

A. Ceiling Cloud Trim Channel: Subject to compliance with requirements, provide Armstrong Axiom or a comparable product by one of the following:
1. BPB USA.
2. USG.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
4. Height: 6” above finish face of adjacent panel.

C. Color: White

2.9 METAL PANEL CLOSURE

A. Formed, Sheet-Metal Closure: Profile indicated; formed from aluminum of same finish and color as that used for exposed flanges of suspension system runners.

1. Thickness: 0.032 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of

suspension-system runners and moldings.

2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Rubber molding accessories.
3. Rubber stair treads.

B. Related Sections:

1. Division 09 Section "Resilient Sheet Flooring".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 60 deg F or more than 90 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 90 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 5 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RB)

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Tarkett/Johnsonite
   b. Flexco
   c. Mannington

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, thermoset).
2. Manufacturing Method: Group I (solid, homogeneous)
3. Style: Cove (base with toe) at resilient flooring, straight (flat or toeless) at carpet.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed

G. Inside Corners: Job formed

H. Colors and Patterns: As selected by Architect from full range of manufacturer colors.

2.2 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Mannington
   b. Tarkett/Johnsonite
   c. Flexco, Inc.

B. Resilient Stair Treads Standard: ASTM F 2169.

1. Material Requirement: Type: TS Thermoset Resilient Rubber
2. Surface Design:

   a. Class 1, Hammered Finish

3. Manufacturing Method: Group 1, tread with visually impaired rubber insert (integral).

C. Thickness: 1/4 inch and tapered to back edge.

D. Size: Lengths and depths to fit each stair tread in one piece.

E. Risers: Smooth, flat, toeless, height and length to cover risers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: 0.125 inch.

F. Nosing Style at Exit Stairs: Square, adjustable to cover angles between 60 and 90 degrees.

G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RESILIENT MOLDING ACCESSORIES

A. Resilient Molding Accessories:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Flexco, Inc.
   b. Mannington
   c. Tarkett

B. Description: Carpet edge for glue-down applications, reducer strip for resilient floor covering, and joiner for tile and carpet.

C. Material: Rubber.

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from full range of manufacturer colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

E. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096466 - WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. This Section includes wood athletic flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood athletic flooring.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc3: Include submittal documentation requirement for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include the following:

1. Expansion provisions and trim details.
2. Layout, colors, widths, and dimensions of game lines, markers and center court artwork.
3. Locations of floor inserts for athletic equipment installed through flooring assembly.

D. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:

1. Floor finish.

2. Game-line and marker paint.

E. Samples for Verification: For each type of wood athletic flooring and accessory required; approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include Sample sets showing finishes and game-line and marker paint colors applied to wood flooring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wood athletic flooring and finish systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.

1. Installer responsibilities include installation and field finishing of wood athletic flooring components and accessories, and application of game lines and markers.

B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver assembly materials in unopened cartons or bundles.

B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.7 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive wood athletic flooring during the conditioning period.

2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.

    a. Do not install wood athletic flooring until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
    b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install wood athletic flooring after other finishing operations, including painting, have been completed.

1.8 COORDINATION

A. Coordinate layout and installation of wood athletic flooring systems with floor inserts for gymnasium equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Robbins Sports Surfaces; Bio Cushion Classic or comparable product by one of the following:

1. Aacer Flooring, LLC.
2. Action Floor Systems, LLC.
3. Connor Floor; Subsidiary of Connor Sport Court International.
4. Horner Flooring Company, Inc.
5. WD Flooring, LLC.

2.2 DESCRIPTION

A. System Type: Anchored resilient.

B. Overall System Height: 2-1/8 inches.

2.3 PERFORMANCE REQUIREMENTS

A. Provide wood athletic flooring systems tested by a qualified testing agency according to DIN V 18032-2 and shown to meet the following requirements:

1. Shock Absorption: Minimum 53 percent.
2. Vertical Deflection: Minimum 0.09 inch.

3. Area of Deflection: Maximum 15 percent.
4. Ball Bounce: Minimum 90 percent.
5. Surface Friction: Not less than 0.5 or more than 0.7.
6. Rolling Loads: No damage when subjected to 337 lbf applied through a single wheel.

B. Low-Emitting Materials: Wood athletic flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FLOORING MATERIALS

A. Certified Wood: Provide wood flooring produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Random-Length Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.

1. Grade: MFMA-RL First.

2. Cut: Flat.

3. Thickness: 25/32 inch.
4. Face Width: 2-1/4 inches.

2.5 SUBFLOOR MATERIALS

A. Plywood Underlayment: APA rated, C-D plugged, exterior glue, tongue and groove, 15/32 inch thick.

B. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.

1. Type: Manufacturers standard.
2. Thickness: As required to achieve performance requirements.

2.6 FINISHES

A. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.

1. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
2. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.

a. Type: MFMA Group 5, Water-Based Finishes.

3. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.

4. Finish system materials, game-line, and marker paint shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 ACCESSORIES

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.

B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.

1. Color: As selected by Architect from manufacturers full range.

C. Thresholds: As specified in Section 087100 "Door Hardware."

D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood athletic flooring manufacturer.

F. Adhesives: Manufacturer's standard for application indicated that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood athletic flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.

a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with wood athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.

B. Pattern: Lay flooring parallel with long dimension of space to be floored unless otherwise indicated.

C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.

1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.

D. Vapor Retarder: Cover entire slab area beneath wood flooring. Install with joints lapped a minimum of 6 inches and sealed.

E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.

F. Strip Flooring: Mechanically fasten perpendicular to supports.

G. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

A. Allow installed flooring to acclimate to ambient conditions before sanding.

B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide no fewer than four coats total and no fewer than two finish coats.

1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
2. Game-Line and Marker Paint: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.

    a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
    b. Where game lines cross, break minor game line at intersection; do not overlap lines.
    c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
    d. Provide center court artwork indicating the letter “G” as directed by Architect.
    e. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

A. Protect wood athletic flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096466

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linoleum tile flooring.
2. Linoleum sheet flooring.

B. Related Requirements:

1. Section 018110 "Sustainable Design Requirements".

2. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with linoleum flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation instructions for each type of substrate.

B. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of linoleum flooring indicated.

D. Samples for Verification: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern required.

E. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.
2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

3. Product certification for Credit MRc5: For products and materials required to comply with requirements for Regional Materials including location and distance to Project from point of material manufacture and extraction, harvest or recovery for each raw material. Include

statement indicating cost of reach regional materials and the fraction by weight that is considered regional.

4. Product certificates for Credit MRc6: For products and materials required to comply with requirements for rapidly renewable material. Include statement with cost and percentage of each rapidly renewable material.

5. Credit IEQc4.1: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. List each product including manufacturer's name, product name, specific actual VOC data and corresponding allowable VOC from list identified in 018113.

6. Credit IEQc4.3: Manufacturer's product data for interior flooring system (including adhesive) documentation including printed statement of VOC content and compliance with the FloorScore Standard.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For linoleum flooring, for tests performed by a qualified testing agency.

B. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run**,** to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile Flooring: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for linoleum flooring installation and seaming methods indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.

1. Tile Flooring: Store on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F, in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LINOLEUM FLOORING

A. Linoleum Tile Flooring:

1. Provide Forbo Flooring Systems “Marmoleum Modular” or approved equal.
2. Classification: ASTM F2195, Type I, linoleum floor tile with fibrous backing.
3. Nominal Floor Tile Size: 20 by 20 inches.
4. Thickness: 0.10 inch.
5. Colors: 5 colors as selected from manufacturers full range.

2.3 ACCESSORY MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of linoleum flooring products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates in accordance with flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare in accordance with ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install linoleum flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION OF LINOLEUM FLOORING, GENERAL

A. Comply with manufacturer's written instructions for installing linoleum flooring.

B. Scribe and cut linoleum flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on linoleum flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install linoleum flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere linoleum flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 INSTALLATION OF LINOLEUM TILE FLOORING

A. Lay out linoleum tile flooring from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay floor tiles square with room axis in pattern indicated.

B. Match linoleum floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

1. Lay floor tiles with grain direction alternating in adjacent floor tiles (basket-weave pattern).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 096543

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. High-performance resinous flooring systems.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for LEED Requirements and Procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Sustainable Design Submittals:

1. Laboratory Test Reports for Credit IEQ 4: For flooring systems, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each resinous flooring component, from manufacturer.

B. Material Test Reports: For each resinous flooring system.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 48-inch- square floor area selected by Architect.

a. Include 48-inch length of integral cove base with inside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dur-A-Flex, Inc; Hybri-Flex EC or comparable product by one of the following:
   1. PPG Industries, Inc.
   2. Sherwin-Williams Company; General Polymers.
   3. Stonhard, Inc.
   4. Tamms Industries, Inc.; a division of The Euclid Chemical Company.
   5. Tnemec Company, Inc.
   6. Valspar Flooring.

2.2 MATERIALS

A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 INDUSTRIAL RESINOUS FLOORING

A. Resinous Flooring: Abrasion, impact, moisture and chemical-resistant, industrial-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

   1. Color and Pattern: As selected by Architect from manufacturer's full range.
   2. Wearing Surface: Manufacturer's standard wearing surface.
   3. Overall System Thickness: 1/4 inch.

C. Topping:

   1. Resin: Urethane.

   2. Application Method: Self-leveling slurry with broadcast aggregates.

      a. Thickness of Coats: 1/8 inch.
      b. Number of Coats: One.

   3. Aggregates: Manufacturer’s standard chip aggregates.

D. Broadcast/Grout:

   1. Resin: Epoxy.

   2. Application Method: Self-leveling slurry with broadcast aggregates.

      a. Thickness: 100 SF/gal

3. Aggregates: Manufacturer's standard chip aggregates.

E. Topcoat: Sealing or finish coats.

1. Resin: Urethane.

2. Type: Clear.
3. Finish: Gloss.
4. Number of Coats: Two.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 12,000 psi per ASTM C 579.
2. Tensile Strength: 2,500 psi per ASTM C 307.
3. Indentation: 0.03 maximum per MIL-D-3134.
4. Flammability: Self-extinguishing per ASTM D 635.

5. Hardness: 75-80, Shore D per ASTM D 2240.
6. Moisture: Provide system capable of performing on concrete slabs with RH up to 99% per ASTM F-2170.

2.4 ACCESSORIES

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

   a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 4 inches high.

D. Apply self-leveling slurry body coats in thickness indicated for flooring system.

1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

E. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.

F. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.

G. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.
2. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product. (MRc2)
2. Provide product IEQc2 for paints and coatings.
3. Laboratory Test Reports: For paints, coatings, adhesives and sealants indicating compliance with applicable emissions criteria. (IEQc2)

C. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Pile direction.
7. Type, color, and location of insets and borders.

8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

D. Samples for Initial Selection: For each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

E. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

F. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

G. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. No cut ends or scraps.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Product Basis of Design: Subject to compliance with requirements, provide Mannington Mills – Style: Stock Brights Modular Tile; or an equal product from one of the following manufacturers:

1. Interface Carpet Mills, Atlanta, GA
2. Mohawk Carpet, LLC, Calhoun, GA
3. Shaw Contract Group; a Berkshire Hathaway company, Dalton, GA.

B. Color: As selected by Architect from Manufacturer’s full range

C. Pattern: Monolithic, Brick.

D. Backing: Infinity 2 Modular.

E. Pile Characteristic: Textured-loop pile.

F. Size: 24” x 24” (61cm x 61cm).

G. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

H. Sustainable Design Requirements:

1. Sustainable Product Certification: Minimum Silver level certification according to ANSI/NSF 140.
2. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. CRI Green Label Plus Certification

I. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch-wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, non-staining marking device.

H. Install pattern parallel to walls and borders.

I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 098413 - FIXED ACOUSTIC PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-absorbing wall panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

3. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
4. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

D. Samples for Initial Selection: For each type of fabric facing.

E. Samples for Verification: For the following products:
1. Assembled Panels: Approximately 24 by 24 inches, including joints and mounting methods.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of unit.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall units and ceiling units from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel (AWP-1): Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Panel Shape: Flat.

2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
3. Core: Glass-fiber board.

4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
5. Edge Profile: Square.
6. Facing Material: Fabric selected from manufacturers full range.
7. Acoustical Performance: Sound absorption NRC of 1.05 according to ASTM C423 for mounting according to ASTM E795.
8. Nominal Thickness: 2 inches.
9. Panel Width: 48 inches.
10. Panel Height: As indicated on Drawings.

B. Sound-Absorbing Wall Panel (AWP-2): Manufacturer's standard exterior panel construction consisting of galvanized perforated steel sheet facing material.

1. Panel Shape: Flat.

2. Mounting: Back mounted with manufacturer's standard “Z” and “J” channels, secured to substrate.
3. Core: Acoustical panel core insulation shall be flexible, resilient, noncombustible mineral wool or glass fiber, complying with ASTM C665.

4. Edge Construction: Manufacturer's standard.
5. Edge Profile: Square.
6. Facing Material: 22 gage perforated galvanized steel per ASTM A525
7. Acoustical Performance: Sound absorption NRC of 0.90.
8. Nominal Thickness: 2 inches.
9. Panel Width: 24 inches.
10. Panel Height: 9’-0”.
11. Finish: Manufacturer's standard high performance Polyester Powder coating.
12. Color: As selected from manufacturers standard colors.

2.4 MATERIALS

A. Core Materials:

1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Fabric Facing Material: From same dye lot; color and pattern as selected by Architect from manufacturer's full range.

C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
   1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

   1. Square Corners: Tailor corners.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

   1. Thickness.
   2. Edge straightness.
   3. Overall length and width.
   4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098413

SECTION 099120 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface. If a color is not indicated, Architect will select colors. The painter should assume that different items will be different colors, e.g. exposed metal deck and exposed structural steel. Also, the painter should assume each space will have one accent wall that is a different color from the other walls.

1. Painting includes field painting of all exposed bare and covered pipes, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Metal toilet enclosures.
c. Metal lockers.
d. Elevator entrance doors and frames.
e. Elevator equipment.
f. Finished mechanical and electrical equipment.
g. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums, unless visible from below.
d. Pipe spaces.

3. Finished metal surfaces, with the exception of piping, conduit, and exposed metal deck, include the following:

    a. Aluminum.
    b. Stainless steel.
    c. Chromium plate.
    d. Copper and copper alloys.
    e. Bronze and brass.
    f. Zinc coated steel (galvanized).

4. Operating parts include moving parts of operating equipment and the following:

    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 01 Section “Sustainable Design Requirements” for Sustainability Requirements and Procedures.
2. Division 05 Section "Structural Steel" for shop priming structural steel.
3. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
4. Division 08 Section "Hollow Metal Doors and Frames" for factory priming steel doors and frames.
5. Division 09 Section "Gypsum Board" for surface preparation of gypsum board.
6. Division 09 Section “High Performance Coatings” for painting of exterior structural steel.
7. Division 32 Section "Asphalt Paving" for traffic-marking paint.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.
3. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Samples for Initial Selection: For each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

D. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall Surfaces: Provide samples on at least 100 sq. ft.
b. Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

   a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:

    a. 1 gal. of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: The schedule of paint types names the products of Sherwin-Williams as the standard of quality.

B. Manufacturers' Names: Provide products from one of the following manufacturers:

1. Benjamin Moore & Co. (Benjamin Moore).
2. Akzo Nobel Paints, LLC (Glidden Professional).
3. PPG Industries, Inc. (Pittsburgh Paints).
4. Sherwin-Williams Co. (Sherwin-Williams).
5. California Paints.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match Architect's samples.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
1. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
1. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils.

2.5 INTERIOR PRIMERS

A. Interior Concrete Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
   1. Latex System:
      a. Prime Coat: Primer, latex, interior.
         1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
   1. Latex System:
      a. Prime Coat: Primer, latex, interior:
         1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.

C. Interior Metal Primer: Factory-formulated quick-drying rust-inhibitive water-based metal primer.
   1. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.

2.6 EXTERIOR FINISH COATS

A. Exterior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss alkyd enamel for exterior application.
   1. Sherwin-Williams; A-100 Semi-Gloss A82 Series: Applied at a dry film thickness of not less than 1.3 mils.

B. Exterior Flat Acrylic Enamel: Factory-formulated flat acrylic-emulsion latex paint for exterior application.

   1. Sherwin-Williams; S-W Loxon Self-Cleaning Acrylic, LX13 Series: Applied at a dry film thickness of not less than 2.0 mils per coat.

C. Exterior Flat Latex: Factory-formulated flat latex-based paint for exterior application.
   1. Sherwin-Williams; S-W Loxon Vertical Concrete Stain, LX31W Series. Applied at 50-250 SF/Gal.

2.7 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
   1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils.

B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
   1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Egg-Shell Enamel B20-2200 Series: Applied at a dry film thickness of not less than 1.6 mils.

C. Interior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel for interior application.

1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31-2200 Series: Applied at a dry film thickness of not less than 1.5 mils.

D. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Gloss Enamel B21 Series: Applied at a dry film thickness of not less than 1.5 mils.

E. Interior Dry-Fall System:
1. Water-Based Dry-Fall System:

a. Top Coat: Dry-fall latex, flat:
1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils wet, 1.5 mils dry.
b. Top Coat: Dry-fall latex, eggshell:
1) S-W Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, at 6.0 mils wet, 1.9 mils dry.

F. Interior Satin Polyurethane: Factory formulated satin super-hydrophobic polyurethane anti-graffiti coating.
1. Sherwin-Williams; 2K Waterbased Urethane Clear Anti-Graffiti Coating: Applied at a dry film thickness of not less than 2.0 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: SSPC-SP13. Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special

attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

a. Primer: Exterior ferrous-metal primer.
b. Finish Coats: Exterior semi-gloss alkyd enamel.

B. Exterior Soffit Board: Provide the following finish systems over exterior fiber cement soffit board.

1. Flat Acrylic Latex Finish: Two finish coats.
a. Finish Coats: Exterior flat acrylic latex.

C. Concrete: Provide the following finish system over vertical concrete surfaces.
1. Solid Color Waterborne Coating; Two finish coats.
a. Finish Coats: Vertical Concrete Stain.

3.7 INTERIOR PAINT SCHEDULE

A. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:

1. Semi-gloss Water Based Epoxy Finish: Two coats over block filler.

a. Block Filler: Concrete unit masonry block filler for epoxy coating.
b. Primer: Interior Semi-Gloss Epoxy Coating.
c. Finish Coat: Interior Semi-Gloss Epoxy Coating.

B. Ground Faced Concrete Unit Masonry: Provide the following finish at all ground faced CMU:
   1. Interior Satin Polyurethane Finish: Two finish coat*s*.

C. Gypsum Board: Provide the following finish systems over interior gypsum board ceilings (except Toilet Room ceilings) and soffits:

   1. Flat Acrylic Finish: Two finish coats over a primer.

      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior flat acrylic paint.

D. Gypsum Board: Provide the following finish systems over gypsum board ceilings in Toilet Rooms, and gypsum board walls (except corridor walls);

   1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior low-luster acrylic enamel.

E. Gypsum Board: Provide the following finish systems over gypsum board corridor walls;

   1. Acrylic-Enamel Finish: Two finish coats over a primer.

      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior semi-gloss acrylic enamel.

F. Ferrous and Non-Ferrous Metal: Provide the following finish systems over non-ferrous metal:

   1. Latex Finish: Two finish coats over a primer.

      a. Primer: Interior non-ferrous-metal primer.
      b. Finish Coats: Interior semi-gloss or as selected by the Architect.

3.8 Mockups: Paint mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Paint mockup of each type of color installation.

   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

END OF SECTION 099120

SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Markerboards.
2. Tackboards.
3. Visual Display Wallcoverings.
4. Whiteboard Accessories.

B. Related Requirements:

1. Division 01 Section “Sustainable Design Requirements” for Sustainable Requirements and Procedures.

1.2 SUBMITTALS

A. Product Data: For each type of visual display board and accessory indicated.

B. Sustainable Design Submittals:
1. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

D. Samples: For each exposed finish.

1.3 WARRANTY

A. Porcelain Enamel Markerboard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within specified warranty period, provided manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 PORCELAIN ENAMEL MARKERBOARDS (WB)

A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work, but are not limited to, the following:

1. PolyVision Corporation
2. Aarco Products, Inc
3. Claridge Products and Equipment, Inc

B. Face Sheet Thickness: 0.024-inch.

C. Face Sheet Material: Enameling grade steel. Coat exposed face and edges with three-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with two-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.

D. Face Sheet Cover Coat: Light-colored, special writing surface with high gloss finish, intended for use with erasable dry markers.

E. Core: Manufacturers standard.

F. Backing Sheet: 0.015-inch- thick, aluminum sheet.

G. Laminating Adhesive: Moisture-resistant, thermoplastic-type adhesive.

H. Special-Purpose Graphics: Fuse or paint music staff lines graphic onto surface of porcelain-enamel visual display unit, in Music rooms 116 and 119.

I. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; slim size and standard shape.

1. Aluminum Finish: Clear anodic finish.

J. Chalktray: Manufacturer's standard; continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

K. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.

1. Size: 2 inches full length of visual display unit.
2. Flag Holder: One for each room.

3. Aluminum Color: Match finish of visual display assembly trim.

L. One-Track Units (Rms A133; A134; and A135): Fabricate unit with fixed rear panel covering entire rear surface. Provide one sliding panel, equal to one-half of overall length of unit. Fuse music staff lines into the surface of porcelain-enamel visual display unit. Surface should be magnetic.

1. Sliding Panels: Fabricated from not less than 3/8-inch thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.

   a. Fabricate sliding panels with 0.021-inch uncoated thickness, porcelain-enamel face sheets.

2. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.

2.3 DRY ERASE WALLCOVERING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Write Walls Product #WWPC-MAG60-WHITE, 60” wide; or comparable product by one of the following manufacturers:

1. Walltalkers
2. Marsh Industries, Inc.; Visual Products Group.

B. Magnetic Visual Display Wall Covering: Type II Weight, wallcovering backing. Designed for projection, writing, and attracting magnets.
1. Color and Pattern: As selected by Architect from manufacturer's full range.

C. Adhesive: Heavy duty clay-based adhesive.

D. Primer/Sealer: White pigmented acrylic/latex base primer specifically formulated for use with vinyl wallcoverings; Roman or equal are recommended.

E. Map rails are used at heads of chalkboards, markerboards, and tackboards and as dividers between panels. Coordinate with information shown on Drawings. Revise first paragraph and subparagraphs below to suit Project.

F. Map Rail: Furnish map rail at top of each “Writing Surface” complete with the following accessories:
1. Map Rail: Basis of Design Product: Claridge 2” H, tan cork insert, includes snap-on clips, end caps & end cap screws.

2. Map Rail Clips: Basis of Design Product: Claridge Map Holder/Winder for 2" maprail. Satin anodized aluminum. (6 clips per map rail location)
3. Flag Holder: Claridge Flag Holder for 2" maprail (1 per maprail location)

2.4 TACKBOARDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work, but are not limited to, the following:

1. PolyVision Corporation
2. Aarco Products, Inc
3. Claridge Products and Equipment, Inc

B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout; with surface-burning characteristics indicated.

1. Facing: 1/4-inch- plastic-impregnated cork.

2. Core: Manufacturer's standard.

C. Field-Applied Trim: Screw-on trim with Phillips flat-head screws.
1. Aluminum Finish: Clear anodic finish.

2.5 FABRICATION

A. Fabricate frames and trim of not less than 0.062-inch- thick, extruded-aluminum alloy. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated.

B. Factory-assembled chalkboard and tackboard units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board.
2. Provide vertical joint system between abutting sections of chalkboards.
3. Provide mullion trim at joints between chalkboards and tackboards.

2.6 ALUMINUM FINISHES

A. Anodized Finish: Class II, clear anodic coating complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in with perimeter lines level, straight, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precise fit.

C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls. Do not use adhesives.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.

a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

END OF SECTION 101100

SECTION 101200 - DISPLAY CASES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Illuminated bulletin boards.
2. Illuminated display cases.

B. Related Sections:

1. Section 101100 "Visual Display Units" for tackboards.

1.3 DEFINITIONS

A. Bulletin Board: Tackable visual display surface or tackboard enclosed in a display case.

B. Display Case: Glazed cabinet with adjustable shelves.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.4: For composite wood products used in display cases, documentation indicating that product contains no urea formaldehyde.

2. Laboratory Test Reports for Credit IEQ 4: For adhesives and composite wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For display cases. Include plans, elevations, sections, details, and attachments to other work.

1. Show location of seams and joints in visual display surfaces.
2. Include sections of typical trim members.

3. Wiring Diagrams: For power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes, and as follows:

1. Actual sections of visual display surfaces.

E. Samples for Verification: For each type of product indicated.

1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch- long sections of each trim profile.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces, operating hardware, and illuminated units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain display cases from single source from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install display cases until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings for display cases by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardboard: ANSI A135.4, tempered.

B. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

C. Fiberboard: ASTM C 208.

D. Hardwood Plywood: HPVA HP-, made with adhesive containing no urea formaldehyde.

E. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.

F. Extruded-Aluminum Bars and Shapes: ASTM B 221, Alloy 6063.

G. Aluminum Tubing: ASTM B 429, Alloy 6063.

H. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering, and 6 mm thick unless otherwise indicated.

I. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless-steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

J. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 TACKBOARD ASSEMBLIES

A. Natural-Cork Tackboard: 1/4-inch- thick, natural cork sheet factory laminated to 1/4-inch-thick particleboard or hardboard backing.

2.3 BULLETIN BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Illuminated Bulletin Boards:
    a. AARCO Products, Inc.
    b. ASI Visual Display Products
    c. Claridge Products and Equipment, Inc.
    d. Tecno Display
    e. Waddell
    f. United Visual Products

B. Aluminum-Framed Cabinet: Extruded aluminum; with clear anodic finish.

C. Cabinet Corners: Square.

D. Glazed Hinged Doors: Tempered glass; set in frame matching cabinet material and finish. Equip each door with full-height continuous hinge and cylinder lock with two keys.

1. Thickness: Not less than 6 mm thick.
2. Number of Doors: One.

E. Illumination System: Concealed top-lighting system consisting of LED fixtures. Include internal wiring with single, concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.

F. Tack Surface: Natural-cork tackboard assembly.

G. Width: As indicated on Drawings.

H. Height: As indicated on Drawings.

I. Depth: 3 inches.

J. Mounting Height: As indicated on Drawings.

K. Mounting: As indicated on Drawings.

2.4 DISPLAY CASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AARCO Products, Inc.
   b. ASI Visual Display Products
   c. Claridge Products and Equipment, Inc.
   d. Tecno Display
   e. Waddell
   f. United Visual Products

B. Factory-fabricated cabinet; with tackboard assembly on back inside surface, and operable glazed doors at front.

1. Cabinet Box: Extruded aluminum, top, bottom, and side panels..

2. Aluminum Finish: Clear anodic.

C. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Thickness: Not less than 6 mm thick.
2. Number of Doors: Two.

D. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.

1. Shelf Width: 6 inches.
2. Number of Shelves: Two.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface Provide standards full height of display case.

F. Tack Surface: Natural-cork tackboard assembly.

G. Illumination System: Concealed top-lighting system consisting of LED strip fixtures. Include internal wiring with single concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.

H. Width: 48 inches As indicated on Drawings.

I. Height: As indicated on Drawings.

J. Depth: 10 inches.

2.5 FABRICATION

A. Fabricate bulletin boards and display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing to produce flat surfaces, free of oil-canning, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power system to verify actual locations of connections before installation of illuminated units.

C. Examine walls and partitions for proper backing for bulletin boards and display cases.

D. Examine walls and partitions for suitable framing depth if recessed units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Bulletin Boards: Attach units to wall surfaces with manufacturer's standard concealed hardware.

C. Display Cases: Attach units to wall surfaces with concealed clips, hangers, or grounds fastened at not more than 16 inches o.c. Secure both top and bottom of display cases to walls.

D. Comply with requirements specified elswhere for connecting illuminated bulletin boards and display cases.

E. Install display case shelving level and straight.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 101200

SECTION 101423 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design requirements and minimum required sustainable strategies. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:

1. Panel signs.
2. Room-identification signs with slide-in changeable insert.
3. Dimensional characters (letters and numbers) for exterior use
4. Cast metal plaque
5. Window number decals.

B. Related Requirements:

1. Division 01 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
3. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
4. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
5. Division 26 Section "Interior Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. MRc3: Regional Materials: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for regional materials indicating the extraction and manufacturing distances of the product or material as they relate to the project site.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Not less than 12 inches (300 mm) square, including corner
2. Room-Identification Signs: Full-size Sample with slide-in changeable insert.
3. Exposed Accessories: Full-size Sample of each accessory type.
4. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.

F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. APCO Graphics

2. ASI Sign Systems, Inc.
3. Best Sign Systems
4. Takeform.
5. Mohawk Sign Systems.
6. Vista System.

B. Room-Identification Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Acrylic-Backed Photopolymer Sheet: Provide photopolymer face layer bonded to an acrylic base layer to produce a composite sheet with overall, face layer, and base-layer thicknesses, respectively, of 0.040, and 0.118 inch.

2. Tactile Characters: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

3. Graphics: Provide an owner provided school symbol graphic on each sign

4. Sign-Panel Perimeter: Finish edges smooth.

   a. Edge Condition: Square cut
   b. Corner Condition in Elevation: Radius

5. Mounting: two-face tape

6. Subsurface Graphics: Slide-in changeable insert for names at all teaching spaces (including small group rooms and special education rooms), and offices.

   a. Provide 500 inserts.

7. Color: As selected by Architect from manufacturer's full range.

8. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
   a. Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 DIMENSIONAL CHARACTERS FOR EXTERIOR USE

A. Manufacturers:
   1. APCO Graphics
   2. ACE Sign Systems

   3. ASI Sign Systems, Inc.
   4. Impact Signs.
   5. Southwell Co. (The).
   6. Vista System

B. Fabricated Characters: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.
   1. Building Mounted Characters:

      a. Description: Cast Metal
      b. Material: Aluminum
      c. Finish: As selected by Architect from full range of industry finishes.

      d. Character Height: 15-inch.
      e. Character Depth: 1-inch
      f. Typeface: As selected by Architect.
      g. Text: “HILLCREST MIDDLE SCHOOL”
      h. Mounting: Concealed Studs

   2. School Site Sign Characters:

      a. Description: Precision Cut Metal
      b. Material: Aluminum
      c. Finish: As selected by Architect from full range of industry finishes.

      d. Character Height: 4-1/2-inch and 2-1/2 inch.
      d. Character Depth: 1/2-inch
      e. Typeface: As selected by Architect.
      f. Text: “HILLCREST MIDDLE SCHOOL”
      g. Mounting: Concealed Studs

   3. Finishes:

      a. Integral Aluminum Finish: Clear anodized.

2.5 CAST METAL PLAQUE

A. Commemorative plaque. 36” x 60” brushed aluminum, with etched and filled letters

B. Mounting Methods:
   1. Mount plaque using standard concealed fastening method recommended in writing by the manufacturer.

2.7 WINDOW NUMBER DECALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Avery Dennison LW Series Retroreflective Window Sticker Films or equal:
   1. Characters:
      a. Height: 4”
      b. Style: Sans Serif - Arial
      c. Color: White, reflective
      d. Provide opaque backer of 3M Scotchcal, 6” high and as wide as the glass pane. Color to be selected by Architect from manufacturer’s standard range.
   2. Location: Applied to interior side of glass at the upper right hand corner of two windows per wall of every teaching space.
   3. Rooms to be numbered with the room number where the window is located.

2.9 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace signs for stability and for securing fasteners.
   6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.10 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

1. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

TRUMBULL HILLCREST MIDDLE SCHOOL

END OF SECTION 101423

SECTION 101453 – TRAFFIC CONTROL SIGNAGE

PART 1 – GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. U.S. Department of Transportation, Federal Highway Administrations “Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

C. Connecticut Department of Transportation (CTDOT) Standard Specifications, latest edition.

D. American Association of State Highway and Transportation Officials (AASHTO) “Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals”, latest edition.

E. American Disabilities Act (ADA) regulations, latest edition

F. Municipality Requirements

G. Contract Drawings and Documents

1.2 SCOPE OF WORK

Installation of Traffic Control Signage.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project’s environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the

Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 SUBMITTALS

Product data for each item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method and finishes.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Signs shall be manufactured in accordance with MUTCD and CTDOT Standards. Designations shall be as shown on Contract Documents.

B. Non-standard signs shown on the Contract Documents shall be manufactured and constructed in accordance with Manufacturer's recommendations and the Municipality Standards. Contractor to submit cut-sheets for all non-standard signs to the Owner's Engineer for review and approval.

2.2 POSTS

"U" Channel galvanized steel posts with galvanized sign-mounting hardware for each sign. Posts shall have a weight of 4-lb per ft or as required by CTDOT Specifications. All sign posts shall have breakaway features that meet AASHTO requirements contained in the current "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals".

PART 3 - EXECUTION

3.1 SIGN INSTALLATION

All traffic signs shall be constructed, located and installed in accordance with the MUTCD, recognized standards published by the Institute of Traffic Engineers and ADA regulations as shown on the Contract Documents. Locate signs at all areas required to provide traffic control and handicap parking identification as shown on the Contract Documents.

END OF SECTION

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-polymer toilet compartments configured as toilet enclosures.

B. Related Sections:

1. Division 01 Section “Sustainable Design Requirements” for Sustainability Requirements and Procedures.
2. Division 10 Section "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.

2. Show locations of centerlines of toilet fixtures.

D. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

E. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 and NFPA 286, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the 2010 Americans with Disability Act (ADA) and ICC/ANSI A117.1-2009 for toilet compartments designated as accessible.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221.

C. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.

1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z.
2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvannealed.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

E. Stainless-Steel Castings: ASTM A 743/A 743M.

F. Zamac: ASTM B 86, commercial zinc-alloy die castings.

G. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASI - Accurate Partitions Corporation.
2. Ampco, Inc.
3. Bradley Corporation; Mills Partitions.
4. Capitol.
5. Comtec Industries/Capitol Partitions.
6. General Partitions Mfg. Corp.
7. Hadrian Manufacturing Inc.
8. Knickerbocker Partition Corporation.
9. Rockville Partitions Incorporated.
10. Santana Products, Inc.
11. Sanymetal; a Crane Plumbing company.
12. Weis-Robart Partitions, Inc.

B. Toilet-Enclosure Style: Overhead braced.

C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.

D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

E. Urinal-Screen Construction:

F. Urinal-Screen Style: Wall hung, Floor anchored.

G. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's standard integral hinge for solid-polymer doors.

2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

    a. Pilasters and Panels: 1/2 inch.
    b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

    a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102123 - CUBICLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Curtain tracks and curtain carriers.
2. Cubicle curtains.

1.3 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:

1. Fabrics are launderable to a temperature of not less than 160 deg F.

2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

A. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.

1. Include data on each type of applied curtain treatment.

B. Sustainable Design Submittals:
1. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

D. Samples for Initial Selection: For each type of curtain material indicated.

E. Samples for Verification: For each type of product required, prepared on Samples of size indicated below.

1. Curtain Fabric: 12-inch- square swatch or larger to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Mesh Top: Not less than 4 inches square.
3. Curtain Track: Not less than 4 inches long.
4. Curtain Carrier: Full-size unit.

F. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 CURTAIN TRACKS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ADC Hospital Equipment; Division of Automatic Devices Company.
2. Alderman Acres Mfg, Inc.
3. Barjan Manufacturing Ltd.
4. Coldraco, Inc.
5. Covoc Corporation.
6. Cubicle Curtain Factory, Inc.
7. Diamond Drapery Co.
8. Erwin and Associates, Inc.
9. General Cubicle Company, Inc.
10. Imperial Fastener Company, Inc.
11. InPro Corporation.
12. Nelson, A. R. Co.
13. Pryor Products.
14. Salsbury Industries.
15. Tubular Specialties Manufacturing, Inc.

B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.058 inch.

1. Curved Track: Factory-fabricated, 12-inch- radius bends.
2. Finish: Satin anodized.

C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. End Stop: Nonremovable.

D. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel or aluminum hook.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Hot-dip galvanized.

2.2 CURTAINS

A. Cubicle Curtain Fabric: Curtain manufacturer's standard, 97 percent polyester, 3 percent silver anti-microbial fiber, inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Available Products: Basis of Design: ArcCom Fabrics: Ebb X 72”w Privacy curtain fabric. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Architex International.
b. Carnegie Fabrics
c. Designtex (A Steelcase company)
d. Maharam

2. Color: As selected by Architect from manufacturer's full range.

B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Mesh Top:
1. No. 50 nylon mesh.
2. Color: As selected by Architect from manufacturer's full range.

2.3 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.

2. Length: Equal to floor-to-ceiling height, with 16-inch mesh top, and minus distance above the finished floor at bottom as follows:

a. Cubicle Curtains: 16 inches.

3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced, and double lock stitched.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with triple turned edges, and single lock stitched.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Provide track fabricated from 1 continuous length.

1. Curtain Track Mounting: Surface.

C. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:

1. Mechanically fasten to suspended ceiling grid with screws.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories for a secure and operational installation.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track.

END OF SECTION 102123

SECTION 102239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable acoustical panel partitions.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 092900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.

1.2 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Operable acoustical panel partitions.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for certified wood.>
3. <Double click to insert sustainable design text for certified wood.>
4. <Double click to insert sustainable design text for composite wood.>

C. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, attachment details.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

D. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
   1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
   2. Panel Edge Material: Not less than 3 inches long.
   3. Hardware: One of each exposed door-operating device.

F. Delegated Design Submittals: For operable panel partitions.

   1. Include design calculations for seismic restraints that brace tracks to structure above.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Partition track, track supports and bracing, switches, turning space, and storage layout.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for acoustical tile.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

C. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:

   1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, in accordance with ASCE/SEI 7.
   2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of operable panel partition.

   1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.

E. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

F. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 QUALITY ASSURANCE

A. <Double click to insert sustainable design text for manufacturer qualifications.>

B. <Double click to insert sustainable design text for vendor qualifications.>

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.

B. Seismic Performance: Operable panel partitions are to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. The term "withstand" means "the partition panels will remain in place without separation of any parts when subjected to the seismic forces specified."

C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.

D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2.2 OPERABLE ACOUSTICAL PANEL PARTITIONS

A. Operable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturer: Subject to compliance with requirements, provide Modernfold “Premier” partition or approved equal.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Equal widths.

E. STC: Not less than 50.

F. Panel Weight: 10 lb/sq. ft. maximum.

G. Panel Thickness: Nominal dimension of 3 inches.

H. Panel Materials:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for certified wood.>
3. <Double click to insert sustainable design text for laminating adhesive.>
4. <Double click to insert sustainable design text for composite wood products.>
5. Steel Frame: Steel sheet, manufacturer's standard.
6. Medium-Density Fiberboard: ANSI A208.2.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

K. Finish Facing: Wood veneer on corridor side, marker board on room side.

2.3 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.

B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous, resilient acoustical seal.

C. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track or resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

D. Horizontal Bottom Seals:

1. Manufacturer's standard continuous-contact seal exerting uniform constant pressure on floor.
2. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
    a. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 1-1/2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with invisible seams complying with Shop Drawings for

location, and with no gaps or overlaps. Horizontal are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

B. Marker Board: White enamel bonded to the face of full height steel work surface without exposed fasteners.

C. Wood Veneer: Laminated to fire-retardant-treated wood core with moisture-resistant adhesive.

1. Species and Cut: White maple, plain sliced.
2. Matching of Adjacent Veneer Leaves: Pleasing (Random) match.
3. Veneer Matching within Panel Face: Balance match.
4. Panel-Matching Method: No matching between panels is required. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
5. Wood-Veneer Finish: Transparent finish over wood variety indicated

D. Trimless Edges: Fabricate exposed panel resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

A. Work Surfaces: Quantities, placement, and size indicated.

1. Surface: Porcelain steel marker/projection surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF OPERABLE PANEL PARTITIONS

A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

B. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

C. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

D. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.

B. Related Sections:

1. Section 093000 "Tiling" for toilet room wall finishes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. Kimberly Clark
6. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
7. Tubular Specialties Manufacturing, Inc.

B. Grab Bar:

1. Basis-of-Design Product: Bobrick; B-5806 Series.
2. Material: Stainless steel, 18 gage.
3. Mounting: As shown on Drawings, Concealed mounting flanges.
4. Gripping Surfaces: Slip-resistant texture.
5. Outside Diameter: 1-1/4 inches

C. Sanitary-Napkin Disposal Unit (wall mounted):

1. Basis-of-Design Product: Bobrick; B-270.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Capacity: 1.0 gal.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Sanitary-Napkin Disposal Unit (partition mounted):

1. Basis-of-Design Product: Bobrick; B-4354.
2. Mounting: Partition mounted, dual access.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Capacity: 0.7 gal.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Waste Receptacle:
1. Basis-of-Design: Bobrick B-43644
2. Mounting: Semirecessed.
3. Minimum Capacity: 12.8-gal.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Liner: Reusable vinyl liner.

F. Surface Mounted Toilet Tissue Dispenser: Furnished by Owner, Installed by Contractor.

G. Paper Towel Dispenser: Furnished by Owner, Installed by Contractor.

H. Mirror with Frame:
1. Basis-of-Design: Bobrick; B-290 series.
2. Material:
   a. Stainless steel frame.
   b. ¼ inch float glass on 3/16-inch thick polyethylene padding.
3. Provide special order or custom sizes to match drawings.

G. Baby Changing Station:
1. Basis-of-Design Product: Bradley; 9631
2. Material: High density polyethylene.
3. Mounting Type: Surface mounted.
4. Size: 17-1/2” W x 34” L.

2.3 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

B. Utility Shelves (one per custodial room):

1. Basis-of-Design Product: Bobrick; B-239x34.
2. Material: Stainless steel.
3. Length: 34 inches.
4. Shelf: 0.05-inch- thick stainless steel.
5. Hooks: Four.
    a. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 – FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Mounting brackets for fire extinguishers.

B. Related Requirements:

1. Division 01 Section “Sustainable Design Requirements” for LEED Requirements and Procedures.

1.3 SUBMITTALS

A. Product Data: Include rating and classification.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. Fire End & Croker Corporation.
2. General Fire Extinguisher Corporation.
3. JL Industries, Inc.
4. Kidde Fyrnetics.
5. Larsen's Manufacturing Company.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

D. Purple-K Dry-Chemical Type in Aluminum Container (Kitchen A138): UL-rated 10-B:C, 2.5-lb (1.1-kg) nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.3 MOUNTING BRACKETS

A. Manufacturers:

1. Fire End & Croker Corporation.
2. General Fire Extinguisher Corporation.
3. JL Industries, Inc.
4. Larsen's Manufacturing Company.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1. Color: Black.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Double Tier Welded lockers.
   2. Locker benches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker[**and bench**].

B. Sustainable Design Submittals:

   1. <Double click to insert sustainable design text for recycled content.>
   2. <Double click to insert sustainable design text for EPDs and HPDs.>
   3. <Double click to insert sustainable design text for composite wood.>

C. Shop Drawings: For metal lockers.

   1. Include plans, elevations, sections, and attachment details.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Samples for Verification: For the following products, in manufacturer's standard size:

   1. Lockers and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Locks.
b. Blank identification plates.
c. Hooks.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver [**master and control keys**] [**combination control charts**] to Owner by registered mail or overnight package service**.**

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete masonry bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 WELDED LOCKERS

A. Products: Subject to compliance with requirements, provide lockers from one of the following manufacturers:
1. DeBourgh Mfg. Co.
2. Lyon Workspace Products
3. Penco Products, Inc., Subsidiary of Vesper Corporation
4. List Industries
5. Republic

B. Location and Sizes:
1. Custodial and Kitchen:
   a. Size: 12-inch deep x 72-inch high (36-inch each).
   b. Base: Legs.
2. Corridors:
   a. Size: 12-inch deep x 72-inch high (36-inch each).
   b. Base: Zee base.
3. Changing Rooms:
   a. Size: 12-inch deep x 48-inch high (24-inch each).
   b. Base: Zee base.

C. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Door Style: Vented panel as follows:

   a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier and three louver openings at top and bottom for double-tier lockers.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
2. Backs: 0.048-inch nominal thickness.

3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Continuous Hinges: Manufacturer's standard, steel, full height.

G. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

H. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching: Nonmoving latch hook [**designed to engage bolt of built-in combination or cylinder lock**] [**with steel padlock loop that projects through recessed cup and is finished to match metal locker body**].

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

I. Door Handle and Latch for Box Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

J. Locks: [**Combination padlocks**] [**Built-in combination locks**] [**Cylinder locks**].

K. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

L. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

M. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.

N. Continuous Zee Base: Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.

1. Height: 4 inches.

O. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical-end type.

P. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

Q. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

R. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

S. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.

T. Finish: Baked enamel or powder coat.

1. Color: 6 colors to match Architect's samples.

2.4 LOCKER BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches.

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 20- to 24-inch- wide x 42-inch tops.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel:

a. 1-1/2-inch- diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
b. Color: As selected by Architect from manufacturer's full range.

D. Materials:

1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
2. Extruded Aluminum: ASTM B221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
3. Steel Tube: ASTM A500/A500M, cold rolled.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:
1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

H. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

I. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

J. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

K. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

E. Fixed Benches: Provide no fewer than two pedestals for each bench. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.[**Verify that integral locking devices operate properly.**]

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 107113 - EXTERIOR SUN SHADES (Metal Windows Filed Sub-Bid)

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish and install exterior sunshade device and related components as shown on drawings and specified in this section.

1.2 RELATED SECTIONS:

A. Division 8, Section “Glazed Aluminum Curtain Walls” for curtain walls to receive exterior sun shades.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior sun shades capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.

2. Design sun shade systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

1.4 SUBMITTALS

A. Product Data: For each type of exterior sun shade and accessory indicated.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of exterior sun shade framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Warranties: Sample of special warranties.

1.5 WARRANTY

A. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum
1. Extruded aluminum shall be 6063-T6 alloy and temper.

B. Fasteners
1. All exposed fasteners shall be aluminum, stainless steel, or zinc plated steel.

C. Anchors
1. Aluminum or steel. All steel anchors shall be properly insulated from the aluminum.

2.2 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

D. Unless otherwise indicated, fabricate units from aluminum shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

E. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color: Match curtain wall.

PART 3 EXECUTION

3.1 INSPECTION

A. Job Conditions
   1. All openings shall be prepared by others to the proper size and shall be plumb, level, and in the proper location and alignment as shown on the architect's drawings.

3.2 INSTALLATION

A. Use only skilled tradesmen with work done in accordance with approved shop drawings and established specifications, and erect all components to all building bench marks and column center lines.

B. Plumb and align exterior sun shades in a single plane for each wall plane, and erect materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, building movement, and specified wind loads.

C. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material, leave all exposed surfaces and joints clean and smooth.

3.3 ANCHORAGE

A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.4 PROTECTION AND CLEANING

A. The contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 107113

SECTION 107500 - FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ground-mounted flagpoles made from aluminum.

B. Related Sections:

1. Section 265600 "Exterior Lighting" for site lighting fixtures.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Wind Loads: Vult = 130 MPH; Exposure “C”, according to SEI/ASCE 7.

2. Base flagpole design on a polyester flag of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

1. Include section, and details of foundation system for ground-mounted flagpoles.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For qualified professional engineer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Concord American Flagpole.
   2. Ewing Flagpoles.
   3. Gettysburg Flag Works
   4. Pole-Tech Company Inc.
   5. Valley Forge Flagpoles

2.2 FLAGPOLE

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.

   2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
   3. Provide self-aligning, snug-fitting joints.

B. Exposed Height: 30 feet.

C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Provide flashing collar of same material and finish as flagpole.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum**,** finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16-inch- diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Provide two **stainless-steel** swivel snap hooks per halyard.

a. Provide with neoprene or vinyl covers.

2.4 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C 33, fine aggregate.

D. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Section 079200 "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place sleeve, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level sleeve and allow concrete to cure. Install flagpole, plumb, in sleeve.

END OF SECTION 107500

SECTION 11000 SPECIAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sound Isolation Enclosure
2. Accessories

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of sound isolation enclosure.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of stage-curtain systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND ISOLATION ENCLOSURE

A. Description: Complete sound isolation enclosure systems, with necessary accessories for support and operation.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Whisper Room Inc. Model MDL 7296E Double Wall Sound Booth with door and wall window.
   b. Dimensions – Exterior: 6’-2” x 8’-2” x 7’-1”; Interior: 5’-5 ½” x 7’-5 ½” x 6’-8”.
   c. Includes (2) Ventilation systems and (4) Cable Passageways.
   d. Standard with Acoustical Foam Sheets, qty 5, 2’x4’ sheets.
   e. Assembled Weight 2330lbs.
   f. Wall Thickness and Layers: 1” MDF barrier + 1.25” air gap + 1” MDF barrier. + 2”Foam.
   g. Door Window: 3 1/8”th. Dual laminated glass sets with central air gap, 16” x 30”.
   h. Lighting: 18” LED light and remote switch.

2. Additional Features:
   a. Wall Windows (WDO): 16”x30” standard windows.
   b. ADA Package that includes Wide Access Door (WA) with ramp system and elevated interior floor.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system according to manufacturer's written instructions.

END OF SECTION 11000

SECTION 111300 - LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Stationary loading dock lifts (scissor lifts).
   2. Loading dock bumpers.

1.3 COORDINATION

A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation

B. Coordinate installation of cast-in-place items. Furnish setting drawings and templates.

C. Electrical System Roughing-in: Coordinate layout and installation of loading dock equipment with connections to power supplies.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for stationary loading dock equipment.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For stationary loading dock equipment.

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of anchors and each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each dock leveler, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Indicate compliance of dock levelers with requirements in MH 30.1 for determining rated capacity based on comprehensive testing within last two years of current products.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For stationary loading dock equipment to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with stationary loading dock equipment by field measurements before fabrication.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace dock levelers that fail in materials or workmanship within one year after Substantial Completion.

PART 2 - PRODUCTS

2.1 STATIONARY LOADING DOCK LIFTS.

A. General: Stationary, scissors-type, single-leg, hydraulic dock lift of capacity, size, and construction indicated; complete with controls, safety devices, and accessories required.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Standard: MH 29.1.

D. Rated Capacity: Lifting capacity of not less than 5,000 lb.

E. Platform: Nonskid**,** heavy steel deck plate.

1. Platform Size: Nominal 6 ft x 8 ft.

F. Function: Dock lifts shall compensate for differences in height between truck bed and loading platform.

G. Hydraulic Operating System: Self-contained, electric, hydraulic power unit for raising and lowering lift; of size, type, and operation needed for capacity of lift indicated; controlled from a remotely located push-button station.

1. Power Unit: Consisting of continuous-duty 6-1/2 HP motor, high-pressure gear pump, valve manifold, oil-line filters, and oil reservoir.

a. Equip manifold with relief valve, check valve, pressure-compensated flow-control valve, and solenoid valve and with provisions for lowering lift manually if power fails.
b. Equip reservoir, valve manifold, and pressure line with oil-line filters.

2. Cylinders: Equip lift with not less than two heavy-duty, high-pressure, hydraulic, ram-type cylinders. Rams shall be manufacturer's standard, either direct-displacement-plunger or rod-and-piston type with positive internal stops. Cylinder rods shall be chrome plated and polished.

a. Rate of Descent Protection: Pressure-compensated flow control or hydraulic velocity fuse to limit down speed for each cylinder.

3. Remote-Control Station: Multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA 4 pendant box.

a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.

H. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.

1. Scissors Mechanism: Fabricate leg members from heavy, steel-formed tube or plate members to provide maximum strength and rigidity.
2. Bearings: Pivot points with permanently lubricated antifriction bushings or sealed ball-bearings for minimum maintenance.
3. Maintenance Leg: Removable, safety maintenance leg or hinged, safety maintenance bars.
4. Mounting: Pit.

I. Materials:

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from steel plate complying with ASTM A572/A572M, Grade 55.

3. Steel Tubing: ASTM A500/A500M, cold formed.

J. Dock Lift Finish: Manufacturer's standard baked-on factory finish unless otherwise indicated.

2.2 LOADING DOCK BUMPERS

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.
1. Source Limitations: Obtain from single source from single manufacturer.

B. Laminated-Tread Loading Dock Bumper: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch-diameter, steel supporting rods that are welded at one end to 1/4-inch- thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.

1. Thickness: 6 inches.
2. Horizontal Style: 10 inches high by 24 inches..

C. Anchorage Devices: Galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.

D. Materials: ASTM A36/A36M for steel plates, shapes, and bars. Hot-dip galvanize according to ASTM A123/A123M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Set curb angles in concrete edges of truck-leveler recessed pits with tops flush with driveway. Fit exposed connections together to form hairline joints.

3.3 INSTALLATION, GENERAL

A. Install loading dock equipment as required for a complete installation.

1. Rough-in electrical connections.

3.4 INSTALLATION OF STATIONARY LOADING DOCK LIFTS

A. Attach dock lifts securely to floor of recessed pit.

B. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.

C. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

3.5 INSTALLATION OF DOCK BUMPERS

A. Loading Dock Bumpers: Attach loading dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

END OF SECTION 111319

SECTION 113000 – PLANETARIUM DOME AND COVE TROUGH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Planetarium Dome and Cove Trough.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer.

B. Product Certificates: For each type of appliance, from manufacturer.

C. Field quality-control reports.

D. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of projection domes and with products indicated for this project.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project. Installer shall have installed a minimum of five domes by the proposed manufacturer in the last two years.

C. Manufacturer shall provide the following to ensure the quality of the product:

1. Provide design and 3D modeling of the dome in the planetarium chamber.

2. Provide manufacturing, shop, and installation drawings, including bills of material, shipping documentation, owner's product book, and maintenance manual. Provide documentation in both paper and electronic formats as required.
3. Provide support from a Project Engineer in coordinating all technical issues with the contractor.

D. Source Limitations: Obtain planetarium domes and cove troughs from a single source and manufacturer.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include fabrication and installation layouts of planetarium dome, details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, and accessories; and special details.

2. Stamped and approved by a Connecticut-licensed PE.

3. Submit finish samples and gain curves (zero degree and multi-degree reflectance measurements.)

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches (305 mm) long by 12” wide. Include clips, fasteners, closures, and other accessories.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Material shall be stored indoors in a dry, secure environment to prevent damage

B. Handle material in strict compliance with manufacturer’s instructions to prevent damage.

1.9 CHAMBER CONDITIONS

A. Before installation of the projection dome, the entire room in which the installation is to be made must be clean, free of dust and dust-producing surfaces, and free of debris or other obstacles. Additional completed work shall include, but not be limited to:
   1. Load-bearing support steel and identification of Dome Center point and 0° forward benchmark.
   2. HVAC and filtration systems purged and operational.
   3. Exposed concrete surfaces sealed.
   4. Sound insulation installed.
   5. Electrical work.
   6. All surfaces and equipment behind the dome painted flat, matte black.
      Theater doors installed and kept closed to avoid dirt from entering the chamber.

1.10 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLANETARIUM DOME

A. Planetarium dome consisting of perforated aluminum dome panels supported by an aluminum frame and suspended from the building structural steel. Basis-of-Design Product: “40-foot diameter 180-degree NanoSeam projection dome” by Spitz, Inc., A Cosm Company.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) Pacific Domes
      2) Astro-Tec
      3) Emerald

2.2 SUPPORT FRAME

A. The support frame of the dome shall consist of primary longitudinal members that divide the dome into 36 gores, and primary latitudinal members that divide the dome into five (5) zones. Primary members shall be 6061-T6 aluminum tubing measuring 1.75x1.25x0.125in rolled to an inner radius of 240.00±0.50in. Secondary 1.00in tubular, Grade 1008 steel chord members shall be employed to maintain the desired geometry of the frame. 5/16-18 Grade 5 hardware shall be used in conjunction with 9.00in diameter, 0.125in thick, 5052-H32 aluminum hubs, having 1.875x0.125in flanges, to secure member junctures.

B. The frame's structural integrity shall allow the dome to maintain its desired geometry and be self-supported when suspended.

C. The dome shall be suspended via twelve (12) chains. Chains and suspension hardware shall be provided, and shall attach to building anchors. The dome shall be tied laterally via three (3) pairs of “V” chains. Lateral tie chains and hardware shall be provided, and shall attach to building anchors.

D. Frame members shall be degreased and finished matte, flat black prior to installation. Hardware shall be painted matte, flat black during installation.

E. The depth of the frame shall be no more than 8.00in from the projection surface, resulting in a clearance envelope of 248.00±0.50in.

F. The frame shall be capable of supporting at least one person without causing plastic deformation to the frame or panels, or visible projection surface distortion.

G. The frame shall be capable of supporting a reasonable amount of theater equipment. Equipment may include speakers, projectors, catwalks, ladders (both fixed and rolling), lights, and insulation.

2.3 DOME PANELS

A. The inner skin shall consist of 133 stretched-formed, perforated, 0.040in thick, 5052-H32 aluminum panels. Panels shall be stretched-formed over a compoundly curved die. An array of 0.0625in diameter holes on 0.125in staggered centers shall render the panels 23% void. A powder-coated finish shall supply the desired optical characteristics as described below. Panel edges shall be coincident with primary frame members, permitting attachment with 0.125in blind fasteners on 3.00in centers.

B. Panels shall butt on the center of primary frame members and shall be backed with a black material of negligible thickness. The black material shall have a zero-degree incident gain of no more than 0.01 before and after installation. Seams between panels shall be no more than 0.02in.

C. Panels shall be degreased and powder coated prior to installation. Panel fasteners shall be pre-finished to match the panel gain, and touched up with computer-matched paint during installation.

D. Supply a minimum of two (2) full-size, powder coated, spare panels per zone for replacement purposes. Panels shall be factory pre-finished with all other dome panels for exact finish and gain characteristics. All spare panels not used during dome installation shall become the property of the owner.

2.4 COVE TROUGH

A. The cove trough shall be 360 degrees in plan and consist of a base plate and fascia. The fascia shall be spaced 8.00in from the inner surface of the dome. Both the inner and outer surfaces of the trough shall be finished flat black.

B. The base plate of each segment shall be made from 0.090in thick 6061-T6 aluminum sheet, with an inner radius of 232.00in and an outer radius of 241.75in. The fascia shall be 5.00in tall and shall be made from 0.063in thick 6061-T6 aluminum sheet. The fascia shall be attached to the base plate via rolled 1.00x0.50x0.125in aluminum tube and 3/32in round head rivets on 6.00in centers.

C. The outer radius of the trough shall be coincident with the outer radius of the dome base ring, permitting attachment to the bottom side of the dome base ring using 3/16in round head rivets on 12.00in centers. Each trough segment shall be machined at both ends so as to permit attachment to each other via a lap joint and 3/32in round head rivets on 3.00in centers. The lap joint shall render the base plate and fascia joints light tight.

D. The trough shall weigh 310±10lb.

2.5 MISCELLANEOUS

A. Dome parts shall be manufactured and packaged so that they may be carried through standard double door openings.

B. The dome shall weigh 3100±100lb. Contractor to verify supporting structure and building anchorage is sufficient to carry dome load. Contractor to verify total load including trough, speakers, and any other dome-mounted equipment.

2.6 PROJECTION SURFACE OPTICAL CHARACTERISTICS

A. The projection surface shall be suitable for viewing bright projected scenes with high resolution, true color, and high contrast. The surface shall maintain specified reflectance values and exhibit no gloss characteristics when subjected to a projected image and viewed under typical viewing angles.

B. The projection surface shall be pre-finished with a powder-coated, achromatic finish, and shall have an overall reflectance of 0.45, or a mutually agreed upon finish.

C. Any disfigurement to the factory-applied projection surface finish (soiling, marring, scratching, burnishing, etc.) occurring during installation shall be corrected.

D. Original spare panels provided with the dome shall match those initially installed.

2.7 PROJECTION SURFACE FIRE-RESISTANCE CHARACTERISTICS

A. ASTM E84-11A flame spread tests shall be conducted on powder coated perforated panel samples. Tests shall return a Flame Spread Index of 0, and a maximum Smoke Developed Index of 170, resulting in NFPA Class A or UBC Class 1 ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of planetarium dome and projectors.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. The completed dome shall be examined with a bright light to evaluate installation workmanship prior to the removal of the scaffolding. Any workmanship issues shall be corrected. When the dome appears satisfactory to the owner, the owner shall accept and sign off on the dome.

3.2 INSTALLATION, GENERAL

A. Install the dome in accordance with manufacturer's instructions.

B. In addition to the engineering design, all labor and materials required for, or reasonably incident to, the manufacture, on-site supervision, and installation of an accurately shaped projection dome shall be included. Upon completion, the dome shall require no further treatment and shall be ready for immediate use.

C. Connect suspension hardware to eyebolts in structure above dome.

D. Install the dome basering in its entirety, connecting the ring to the suspension chains with appropriate hardware.

E. Install dome structural framing members, starting at the bottom and working toward the dome zenith, connecting the framing members to the dome basering at designed locations.

F. Install speakers, cove trough, and any other dome-mounted equipment.

G. Paint hardware matte, flat black during frame installation.

H. Install lateral tie members and adjust the dome to the final position relative to the dome center point and 0° forward benchmark.

I. Insure the front surface of the dome frame is smooth and ready to accept panels. Clean the frame of all dust, and paint black any exposed metal surfaces.

J. Install dome panels according to a proprietary method to achieve a NanoSeam surface with tolerances noted above.

3.3 MAINTENANCE RECOMMENDATIONS

A. ROOM CONDITIONS

1. Temperature: The dome and its powder-coated projection surface are tolerant of varying temperature conditions, therefore no restrictions are noted. See projection equipment for temperature range requirements.

B. The dome shall not be mechanically altered, drilled, modified, or climbed without prior consultation with the dome manufacturer.

3.4 DOME AND PROJECTION SURFACE CLEANING

A. Clean dome panels of dust using a vacuum cleaner with a soft brush attachment from both sides of the panels. Dirt and grease stains can be cleaned from the panels using a soft cloth and a cleaning solution such as Windex or Fantastic. In lieu of these cleaners, a mild soap solution in warm water can be used. Extra care should be taken when cleaning stains that are directly over the black material at panel laps. This material can hold moisture and lint resulting from the cleaning process. Excessive water or fluid should be avoided to prevent dirt from the back of the panel streaking its front.

END OF SECTION 113000

SECTION 113100 - RESIDENTIAL APPLIANCES & MISC. EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Microwave: Counter model: Qty: 13
2. Refrigerator w/ Ice: Qty: 6
3. Refrigerator w/o Ice: QTY: 4
4. Refrigerator (undercounter): Qty: 4
5. Dishwasher: Qty: 2
6. Kiln: Qty: 1
7. Therapy Rope Swing Connection: Qty: 1
8. Clothes Washer: Qty 2
9. Clothes Dryer: Qty 2
10. Stove/Range: Qty: 6
11. Recirculating Hood: Qty: 6

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

B. LEED BUILDING Schools Submittals:

1. Product Data: For appliances indicated, documentation that products are ENERGY STAR rated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of appliance, from manufacturer.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

B. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Refrigerator/Freezer Icemaker, Sealed System: Full warranty including parts and labor for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Two years from date of Substantial Completion.
2. Warranty Period for Other Components: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 APPLIANCES

A. Microwave

1. Countertop Microwave. Basis-of-Design Product: GE Profile# PES7227SLSS
   a. Type: Countertop
   b. Coordinate "Dimensions" and "Storage Capacity" subparagraphs below. If retaining both dimension and capacity requirements, verify availability with manufacturers.
   c. Capacity: 2.2 CF
   d. Controls: ADA Compliant, Electronic Touch

e. Power: 100 w
f. Dimensions: 14 H x 24 1/8 W x 19 3/4 D
g. Front Panel: Stainless Steel
h. Warranty: 1 year limited

B. Refrigerator/freezers

1. Refrigerator w/ Ice: Full Size French Door refrigerator with freezer drawer and complying with AHAM HRF-1. Basis-of-Design Product: GE Energy Star # GNE25JYKFS
   a. Type: Freestanding.
   b. Storage Capacity: 24.7 cu ft (ref & freezer)
   c. Dimensions: 69 7/8 H x 32 3/4 W x 37 1/2 D
   d. Accessories: Icemaker
   e. Power: 120v; 60Hz; 15A
   f. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
   g. Front Panels: Stainless Steel

2. Refrigerator w/o Ice: Full Size French Door refrigerator with freezer drawer and complying with AHAM HRF-1. Basis-of-Design Product: GE Energy Star # GBE21DYKFS.
   h. Type: Freestanding.
   i. Storage Capacity: 20.8 cu ft
   j. Dimensions: 69 7/8 H x 29 3/4 W x 34 D
   k. Power: 120v; 60Hz; 15A
   l. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
   m. Front Panels: Stainless Steel

2. Undercounter Refrigerator:
   a. Type: Freestanding.
   b. Storage Capacity: 5.5 cu ft
   c. Dimensions: 32 H x 23 3/4 W x 23 D
   d. Power: 120v; 60Hz; 1.4A
   e. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
   f. Front Panels: Stainless Steel

C. Dishwasher

1. ADA Compliant Dishwasher: Basis-of-Design Product: GE # GDT226SSLSS
   a. Type: Flush Cabinet Built-in
   b. Controls: Top, pushbutton
   c. Dimensions: 32 1/4 H x 23 3/4 W x 23 1/2 D
   d. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
   e. Power: 120V; 60 Hz; 8.9 A
   f. Front Panel: Stainless Steel
   g. Warranty: 1 year limited

D. Clothes Washer: Complying with AHAM HLW-1.

1. Basis of Design Product: Whirlpool Model CAE2793BQ
    a. Type: Freestanding, top-loading unit.
    b. Capacity: 2.9 cu.ft.
    c. Dimensions: 27 W x 25 1/2 D x 40 3/4 H
    d. Power: 120 V, 60 Hz, 1 phase, 15A
    e. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
    f. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
    g. Finish: Enamel.
        1) Color: White.

E. Clothes Dryer: Complying with AHAM HLD-1.
1. Basis of Design: Whirlpool Model CEM2793BQ
    a. Type: Freestanding, front-loading, electric unit.
    b. Capacity: 7.4 cu.ft.
    c. Dimensions: 27 W x 29 1/4 D x 40 3/4 H
    d. Power: 240/208 V, 60 Hz, 1 phase, 30A
    e. Features:
        1) Removable lint filter.
        2) Electronic tempature and moisture-level sensor controls.
        3) End-of-cycle signal.
        4) Interior drum light.
        5) Self-leveling legs.
    f. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
    g. Finish: Enamel.
        1) Color: White.

F. Stove/Range: Range with Oven.
1. Basis-of-Design: Whirlpool WSES3130SS with power cord.
    a. Type: Electric.
    b. Dimensions: 30”W x 25.4”D x 34.6”H
    c. Power: 208 V, 60Hz, 40A.
    d. Features:
        1) Automatic oven shut-off.
        2) Power on indicator light.
        3) ADA compliant.
    e. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

G. Recirculating Hood: Undercabinet model.
1. Basis-of-Design: GE JVX5305SJSS.
    a. Type: Recirculating, 270-CFM.
    b. Dimensions: 30”W x 20”D x 5-1/2”H
    c. Power: 120 V, 60Hz, 1.0A.
    d. Features:
        1) Two-speed.
        2) Front controls.
        3) Dual LED lighting

e. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

2.2 KILN

A. Top loading electric kiln
1. Basis-of-Design Product (or equal product by another manufacturer) LL Kilns – Easy Fire Top Loading Kilns, Model #E23T-3 or equal product by another manufacturer. (Qty of 1)
a. Inside dims: 23.2 Diam x 27” High
b. Outside dims: 30”W x 68” H x 40”D
c. Cubic feet: 7 cubic feet
d. Electrical Req.: 208 V, 3 Phase/40A w/ 15/50 Cord (6 ft) and Plug
e. Firebrick Thickness: 3”
f. L&L Kilns: Vent-Sure Downdraft Vent
i. Power: 120V, 1.37A
ii. Cord: 120V/15A w/plug
g. L&L Kilns: Vent Sure Automatic Vent Controller (factory install recommended)
1) Power: 120V
2) Cord: 120V w/plug
h. L&L Kilns: Furniture Kit: Cone 11 Furniture Kit, All half shelves, H-E-K23T/3H

2.3 THERAPY ROPE SWING ATTACHMENT

A. Manufacturer: Southpaw Enterprises, or approved equivalent.
1. 10 foot, Ceiling hung therapy rope swing with eye splice and height adjuster. Includes safety snap, rotational device. Product: #410001.
2. Eye Bolt Package for steel beam: Kit includes one ½" x 2" forged steel eyebolt, one ½" washer and one ½" positive lock nut. Product: #7000-I
3. Platform Swing/accessories: NIC

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Comply with plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 113100

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Sections, apply to this Section.

1.2 SCOPE

A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.

B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.

C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.

D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.

E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.

F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.

G. Work in this Section shall include but shall not be limited to the following:
   1. Catalog items of equipment.
   2. Fabricated equipment other than catalog items.
   3. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
   4. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

H. Sustainable Design Intent: Comply with project requirements intended to achieve a rating, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Division 01 Section "Sustainable Design Requirements" for Sustainable Requirements and Procedures.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.

B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.

C. Rough plumbing including, but not limited to shut-off valves and thermostatic mixing valves at hand washing sinks furnished hereunder: SECTION 220001-PLUMBING.

D. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.

E. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.4 SUBMITTALS

A. Submit Shop Drawings for approval in accordance with the General Conditions.

B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
   1. Hand drawn scale: 1/2 in. = 1 ft., 0 in.
   2. CAD drawn scale: 1/4 in. = 1 ft., 0 in.
   3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
   4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
   5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
   6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned.

C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.

D. Drawings for custom fabrication, refrigerated rooms, exhaust ventilators, and stub-in drawings shall each be individually submitted in separate drawing packages.

E. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.

F. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.

G. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.

H. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.5 SAMPLES

A. If the bidder’s proposed equipment fabricator is unknown to the Consultant’s office, immediately after award of contract, submit the following samples for selection and approval.
   1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
   2. Drawer assembly (will be returned for use on this project).

B. Work delivered to the job shall match approved samples.

1.6 GUARANTEES AND WARRANTIES

A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.

B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner will have the option of full use of the defective equipment until a replacement has been delivered and completely installed.

C. Furnish manufacturer's warranty for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.7 REGULATORY AGENCIES

A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.

B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.

C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).

D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).

E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.

F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.

1.8 EQUALITY OF MATERIALS AND EQUIPMENT

A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

A. General
   1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
   2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.

B. Stainless Steel
   1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.

C. Galvanized (Galvannealed) Steel
1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. Plastic Laminate Materials
1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.2 CONSTRUCTION

A. General
1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding
1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.
2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing
   1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.
   2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
   3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.
   4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.3 BUY-OUT COMPONENTS

A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal by Kason, or PDI Atlanta.

B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal by Kason, or PDI Atlanta.

C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal by Kason, or PDI Atlanta.

D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002 or equal by Kason, or PDI Atlanta.

E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal by Kason, or PDI Atlanta.

F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal by Kason, or PDI Atlanta.

G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 (with B-0425-M connection kit) or B-0321-NPL, or equal by Component Hardware, Chicago, or Fisher.

H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-0290 or equal by Component Hardware, Chicago, or Fisher.

I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231-CC or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.

J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal by Kason, or PDI Atlanta.

K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal by Kason, or PDI Atlanta.

L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal by Kason, or PDI Atlanta.

M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal by Kason, or PDI Atlanta.

N. SEALANT: Sealant for sealing equipment to walls or filling crevices between components. All materials listed below that are used in the building interior must not exceed the following requirements:
   1. South Coast Air Quality Management District (SCAQMD) Rule #1168
   2. For interior adhesives and sealants applied within the weatherproof barrier, submit a printed statement of VOC content.

O. SOUND DEADENING BASINS: Component Hardware Q75-1366 or equal by Kason, or PDI Atlanta

P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225, or equal by Kason, or PDI Atlanta, "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.

Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal by Kason, or PDI Atlanta.

R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000 or equal by Component Hardware, Chicago, or Fisher.

S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal by Kason, or PDI Atlanta.

T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.4 FABRICATED COMPONENTS

A. Box Type Cabinet Construction
1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards
1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails
1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly
   1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.
   2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.
   3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
   4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges
   1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
   2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
   3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
   4. Short (6 in.) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
   5. Tall (10 in.) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
   6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves
   1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.
   2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.

3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors
1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts
1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors
1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523 and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves
1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets
1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

L. Wall Shelves
1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.5 ELECTRICAL EQUIPMENT AND WIRING

A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.

B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.

C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.

D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.6 ITEM SPECIFICATION

Item 1
LOCKERS
Quantity - 4
No work in this Section. Units provided by General Contractor.

Item 2
FRONT LOAD VENTLESS DRYER
Make - Miele PDR-908-HP (11204490) *C166 or equal
Size - 24” x 28-1/4” x 33-1/2” high
Power - 1.2 KW - 208-240/1 - NEMA L6-30P cord and plug
Load capacity - Eighteen pounds
Description - Ventless dryer shall be standard construction per the manufacturer’s standard details with stainless steel exterior body and stainless steel honeycomb drum, a touchscreen interface with thirty-five programs, a partical surface filter and Energy Star rated heat pump.

Item 3
FRONT LOAD WASHER
Make - Miele PWM-908-EL (11204470) *C166 or equal
Size - 24” x 28-1/8” x 33-1/2” high
Power - 5 KW - 208-240/1 - NEMA L6-30P cord and plug
Load capacity - Twenty-pounds
Description - Washer shall be standard construction per the manufacturer’s standard details with stainless steel exterior body and stainless steel honeycomb drum, a touchscreen interface with fifty programs, high temperature disinfection programs and twenty-five-minute Express wash.

Item 4
MOP SINK
No work in this Section. Units provided by Plumbing Contractor.

Item 5
UTILTIY SHELF WITH MOP HANGER
Make - Advance Tabco K-245 or equal
Size - 24" x 8" x 7-1/2" high
Description - Unit shall be all standard construction of welded 18 gauge stainless steel type 430 polished satin finish, back and sides turned up 1-1/2”, mounted on two die formed wall brackets and furnished with two mop hangers and three rag hooks.

Item 6
STORAGE SHELVING, FIVE-TIER
Quantity - 2
Make - Metro Super Adjustable Super Erecta or equal by Eagle or Nexel
Size - (1) 48" x 24" and (1) 24” x 36” all 74-5/8" high; five tier with bottom shelf up 14" clear above floor
Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1" shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 7
DUNNAGE RACKS, STATIONARY
Quantity - 2
Make - Channel EXD or equal by Kelmax or New Age
Size - (1) 60” x 20” and (1) 36" x 20" x 12" high
Description - Dunnage platforms shall be all standard construction with fully welded extruded Type 6063-T5 aluminum "E" channel top, gusseted channel legs, and each unit capable of supporting 3,000 pounds. Unit shall be provided with a lifetime guarantee against rust and corrosion.

Item 8
WALK-IN COOLER
Make - American Panel, Bally, or Thermalrite
Size - 8’-1” x 13'-11" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor.
Power - 1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip.
Installation - The walk-in refrigerated room assembly shall be installed in a 7" deep ID recess (below finished floor). Recess depth allows 1" for use of leveling sand; 4" for the insulated floor panels; 2" for concrete topping slab and epoxy finished floor that shall be carried in from the adjacent room and level to same. The finished floor and topping slab shall be furnished and installed by the General Contractor and shall have sanitary cant joints at all interior and exposed exterior walls. The assembly shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.

Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated and Factory Mutual listed meeting FM Approvals Standard 4880.
- Cam type locking devices
- 34" x 76" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ (with dry contacts) or Modularm 75LC temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. This Cintractor to provide each system with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout with exception of buried floor panels
- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48" above finished floor. Hold diamond plating up 6" from the finish floor to accommodate the coved base.

Minimum Cooler Insulation R-Values
Wall and Roof Panels (4 in.): R-29
Floors: R-25
Doors: R-32

Minimum Freezer Insulation R-Values
Wall and Roof Panels (4 in.): R-32
Floors: R-28
Doors: R-32

Minimum materials - Interior wall surfaces shall be clad with white .038" pebble finished aluminum; the exterior surface shall be .038” pebble finish aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14-1/2" x 23" constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide five total extra Kason 1810LCT400 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Items 8 and 9
MECHANICAL REFRIGERATION SYSTEMS, WATER-COOLED
Make - Bally, Keeprite, Trenton, Heatcraft, Bohn, Larkin, Chandler, or Climate Control

Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4" larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8" Type L copper tubing, supported 36" on center maximum, in such a way that there will be 1" clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4" to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with mounted electronic controller with digital display. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of five hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year after date of acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The water-cooled condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control.

The condensing units shall be indoor water-cooled type. The compressor shall be serviceable semi-hermetic or scroll type per schedule, and fitted with anti-corrosion coated aluminum fin or micro-channel condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant enameled galvanized steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base.

The condensing units shall be mounted on 4" x 4" wood members, stretching full width of the cooler/freezer assembly in turn supported on 2" x 4" members located over each of the three walls. Secure in place.

Evaporator Coils - Each evaporator shall be provided with mounted electronic controller with digital display, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

The freezer shall be provided with an automatic electric defrost system consisting of one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

The cooler shall be provided with one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

Furnish and install 1/4" minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Item 8a
COOLER CONDENSING UNIT, WATER-COOLED
Make - Copeland FYWP-0115-TFC-520
Power - 8 amps - 208/60/3
Refrigeration type - R-454A

Item 8b
COOLER EVAPORATOR COIL
Make - Bohn BEL0095AY6AMAG0212
Power - 1.8 amps - 115/60/1
Refrigeration type - R-454A

Item 9
WALK-IN FREEZER
Make - American Panel, Bally, or Thermalrite
Size - 8’-1" x 23’-6" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor
Size - 7'-1" x 17'-7-1/2" x 7'-10" high minimum inside dimensions
Power - 2 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port.
Installation, Construction, Materials and Accessories - See Item 8.
Guarantee - See Item 8.

Item 9a
FREEZER CONDENSING UNIT, WATER-COOLED
Make - Copeland FYWP-0315-TFC-520
Power - 15.5 amps - 208/60/3
Refrigeration type - R-454A

Item 9b
FREEZER EVAPORATOR COIL
Quantity - 2
Make - Bohn BEL0045BY6EEAG0212
Power - 4.6 amps - 208/60/1
Refrigeration type - R-454A

Item 10
DUNNAGE RACKS, MOBILE
Quantity - 4
Make - Channel MD2036CA/052*C166 or equal by Kelmax or New Age
Size - (1) 60” x 20", (2) 48” x 20” and (1) 36”x 20” all 8-1/4” high
Description - Dunnage platforms shall be all standard construction with 1-1/2" x 1-1/2" x .070" thick wall extruded Type 6063-T5 aluminum tubing with five lateral tubes and heavy duty plate mounted 5" x 2" polyurethane casters with unit capable of supporting 2,000 pounds.
Accessories - All casters shall swivel. Provide each with an H24 push handle.

Item 11
MOBILESHELVING, FOUR-TIER
Quantity - 14
Make - MetroMax Q*C166 or equal by Eagle
Size - (5) 60” x 21”, (7) 48" x 21" and (2) 42" x 21" all 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 12
DUNNAGE RACKS, STATIONARY
Make - Channel EXD or equal by Kelmax or New Age
Size - (3) 48” x 12" high
Description - Dunnage platforms shall be all standard construction with fully welded extruded Type 6063-T5 aluminum "E" channel top, gusseted channel legs, and each unit capable of supporting 3,000 pounds. Unit shall be provided with a lifetime guarantee against rust and corrosion.

Item 13
STORAGE SHELVING, FIVE-TIER
Quantity - 5
Make - Metro Super Adjustable Super Erecta or equal by Eagle or Nexel
Size - (3) 60” x 24” and (2) 48" x 24" all 74-5/8" high; five tier with bottom shelf up 14" clear above floor
Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1" shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 14
MOBILE SHELVING, FOUR-TIER
Quantity - 4
Make - MetroMax Q*C166 or equal by Eagle
Size - (3) 48" x 21" and (1) 36" x 21", all 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 15
THREE-COMPARTMENT SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 10'-0" x 30" x 34" high plus 10" high splash at wall; 3" high raised open roll on three sides; three 21" x 27" x 12" deep integral sink basins
Construction - 14 gauge stainless steel drainboards, basins and splash, stainless steel channel reinforced, mounted on eight legs with gussets, adjustable feet, seven lengths of crossrail, and secured 3" off face of wall.
Accessories - Two splash mounted faucet sets, three 2" lever waste outlets. Mount on flanged feet.

Item 16
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 60" x 12" mounted 54" above floor
Construction - Wall shelf shall be fabricated of 16 gauge stainless steel with back and ends raised 1-1/2", front edges of ends angled back, all corners broken, and front turned down 1-1/2", and in 1/2" at 45°. Shelf corners shall be welded, ground and polished. Mount shelf 1" off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48" on center maximum. Flag brackets shall have a web angle of 30° measured from horizontal.

Item 17
UTILTIY CARTS
Quantity - 4
Make - Lakeside 521 or equal by Kelmax or Channel
Size - 32-5/8" x 19-3/8" x 34-1/2"
Description - Cart shall be all standard NSF construction, fully welded stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8" fixed and two 5" swivel casters. Capacity of cart to be 650 pounds.

Item 18
DETERGENT STORAGE CABINET
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 36 in. by 18 in. by 72 in. high
Construction - 16 gauge stainless steel sloped top at 104 degrees with edges turned down, 18 gauge stainless steel cabinet body, fixed bottom shelf, three adjustable intermediate shelves, and 63 in. high double pan hinged doors at front. Mount on 6 in. high stainless steel adjustable legs. Secure unit to wall and seal as required.
Accessories - Provide unit with two (2) three point "T" handles, one locking and barrel bolts mounted to inside top and bottom of door. Provide slotted "L" bracket a top rear for securing to wall.

Item 19
SOILED WARE TABLE WITH SCRAPPING SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 96" x 30" x 34" high plus 10" high splash at walls; 3" high raised open roll on working face and left end, 18" x 18" x 8" deep integral sink.
Construction - 14 gauge stainless steel top, sink basin and splash, channel frame, six legs with gussets, adjustable feet, and five crossrails. Secure 3" off wall. Turn end down into dishwasher and secure with stainless steel machine screws. Top of splash shall be fitted with integral flat spot for mounting of the pre-rinse fixture. Integral scrapping sink shall be provided with a 2" x 1/4" bar stock rack guide attached to the reinforced splash with stainless steel through bolts. Sink shall be provided with two 16 gauge perforated stainless steel scrapping baskets, 6" deep, on 1/2" high angle legs set back to clear the basin cove, and integral tubular handles flush with counter tops. Mount on flanged feet.

Item 20
HOSE REEL ASSEMBLY
Make - T&S Brass B-7102-U1JXS9E or equal by Fisher or Reel Craft
Size - 12 foot hose, 3/8" ID
Maximum Water Use - 1.07 Gallons per minute
Description - Unit shall be all standard construction with stainless steel open type reel, adjustable bumper, blue hose, B-107-J low flow spray valve, heat resistant spray valve handle, chrome risers, two wall brackets, continuous pressure vacuum breaker with integral check valve, 36" flexible water hose, control valve, and deck type base faucet, designed for wall mounting per plan up 7'-6" measured at the inlet.
Accessories - Provide with G019430-45 stainless steel wall mount swing bracket. Provide modified risers sized for assembled installation under an 10’-0” high ceiling.
Installation - The hose reel bracket for wall mounted units shall be rotated 90° downward and installed such that it allows the hose to hang straight down and parallel to the wall. Refer to T&S Brass instructions manual page four figure one for further details.

Item 21
VENTLESS WAREWASHER WITH BOOSTER HEATER
Make - Champion DH-6000T-VHR or equal by Hobart
Power - 20 amps - 480/60/3
Water consumption - 0.73 gallons per rack
Certification - Unit shall be Energy Star compliant
Description - Dishwasher shall be extended hood door type of all standard construction with 40 rack per hour capacity, standard and heavy duty wash cycles, stainless steel throughout with 16 gauge tank, 18 gauge hood and side panels, stainless steel frame and feet, front mounted control panel with magnetic motor starter, automatic timer, auto-start, "Rinse Sentry" to ensure 180˚F final rinse temperature, indicating pilot light, touch screen control, external thermometer, on-board service diagnostics, sleep programmable, and ventless heat recovery system. Machine shall be provided with, detergent/chemical connections, automatic tank fill, automatic drain valve, door interlock, thermostatically controlled electric tank heat with low-water cut-off, self-draining pump, interchangeable stainless steel upper and lower revolving wash arms, stainless steel refuse screens covering the total tank area, skimmer type overflow drain, and sloped top counterbalanced hood. Motor shall be drip proof with internal overload protection, stainless steel shaft and integrally mounted to the pump. Machine shall be provided with integral 7.5 KW hot water booster for 70°F rise complete with pressure regulating valve, shock arrestor and inlet temperature/pressure gauge.
Accessories - Provide machine with drain water tempering kit, ION scale prevention system, and two standard plastic racks; one peg, one flat.

Item 22
CLEAN DISH TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 63" x 30" x 34" high plus 10" splash at rear; 3" high raised roll at front and end
Construction - 14 gauge stainless steel top and splash over channel frame with raised roll front and right end, tall splash at rear, turned down into dishwasher and secured with stainless steel machine screws, and mounted on four legs with gussets, adjustable feet and undershelf. Secure table 3" off face of wall. Mount on flanged feet.

Item 23
MOBILE SHEET PAN RACKS
Quantity - 10
Make - Channel AXD1820 or equal by Kelmax or New Age
Size - 21" x 26" x 70" high
Capacity - Twenty 18" x 26" pans on 3" centers
Description - Rack shall be fabricated of welded extruded aluminum 1-1/4" x 1-1/4" tubular uprights and framing, and 1" x 1-1/2" x .10" angle pan slides with corners chamfered and deburred. Mount on platform type, 5" x 2" polyurethane tired swivel casters. Rack shall provided with a complete lifetime guarantee against corrosion and construction defects.

Item 24
Spare number

Item 25
Spare number

Item 26
WASTE CANS
Quantity - 2
No work in this Section. Units provided by Owner.

Item 27
HAND SINK WITH SIDE SPLASHES
Make - Advance 7-PS-70-CM*C166 or equal by Krowne
Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36" above floor
Accessories - Provide with a splash mounted faucet set with wrist handles (Item 27a), K-410 3" flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provided end splashes welded to each side.

Item 27a
FAUCET
Make - T&S Brass B-2443-F10 modified or equal by Fisher
Description - Units shall be all standard construction with mixing body, 8" center inlets, wrist blade handles, and swivel gooseneck. Modified unit shall be provided with a B-0199-07-N05, 0.5 gallons per minute aerator tip in lieu of the standard.

Item 28
ADA HAND SINK
Make - Advance 7-PS-25 modified or equal by Eagle or Krowne
Size - 20” x 24” x 13” high overall, 14” x 16” x5” deep sink bowl
Description - Unit shall be all standard stainless steel construction with wall mounting bracket. Mount on wall with rim at 34" above floor. Modify faucet holes to be two holes spaced 8" apart on center. Delete standard faucet.
Accessories - Provide with a deck mounted faucet set with wrist handles (Item 28a), deck mounted soap dispenser, 3" flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item 28a
FAUCET
Make - T&S Brass B-0322-04 modified or equal by Fisher or Encore
Description - Unit shall be all standard construction with deck mounted mixing body, 8" center inlets, and wrist blade handles. Modified unit shall be provided with B-0199-02F-12 aerator tip in lieu of the standard.

Item 29
FORTY-QUART MIXER
Make - Hobart HL400*C166 or equal by Globe
Power - (5.6 amps) 1-1/2 HP - 208/60/3 - NEMA L15-20P
Description - Mixer frame and body shall be fabricated of welded heavy gauge steel finished in Hybrid Powder coat finish, and provided with a stainless steel splash guard at the column, stainless steel bowl guard with electrical interlock, single point bowl installation with swing-out bowl support, manual bowl lift and an attachment hub with No. 12 taper. Transmission shall be gear driven constant mesh heat treated and hardened gears on similar shafts be mounted in ball bearings with recirculating oil and grease to all gears and shafts. Mixing action shall be planetary and shall have speeds of 58 (stir), 96, 179, 319, agitator RPM speeds as selected by an external dial. Speeds to be selectable on-the-fly and include a soft start and stir speed while lifting the bowl into place and controlled with a 15 minute timer with automatic time recall.
Accessories - Provide mixer with a 40 quart stainless steel bowl, flat beater, dough hook, wire loop whip with stainless steel wires.

Item 30
PREP TABLE WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - L-shaped per plan; 9'-3" x 30" plus a 48" x 30" return x 36" high to work surface plus 10" high splash at rear; two 18" x 20" x 10" deep integral sink basins.
Construction - 14 gauge stainless steel top, basins and splash, over angle reinforced framing, nine legs with gussets and adjustable feet, two partial undershelves, three crossrails, tall splash rear, and marine front and ends, secured 3" off face of wall.
Accessories - Drawer assembly, splash mounted faucet set and two 2" lever waste outlets. Mount on flanged feet.

Item 31a
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 84" x 12" mounted 1" off face of wall up 54" above finished floor

Item 31b
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 48" x 12" mounted 1" off face of wall up 54" above finished floor

Item 32
FOOD PROCESSOR
Make - Robot Coupe R301 Ultra Dice*C166 or equal by Berkel or Hobart
Power - 12 amps - 120/60/1 - cord and plug
Description - Combination food cutter shall be all standard construction with 1-1/2 HP direct drive fan cooled capacitor start motor with brake, magnetic interlocks, stainless steel cutter bowl with handle and see-thru lid, continuous feed top unit with attached large feed pusher, two standard discs and dicing kit.

Item 33
ADA WORK TABLE WITH SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 84" x 30" x 34" high plus 6” backsplash, 14" x 16" x 6-1/2" deep integral sink basin; offset drain to rear left.
Construction - 14 gauge stainless steel top over angle frame with rear formed in short splash, front edge rolled, sides turned down and mounted on six legs with gussets, five crossrails and adjustable feet, two with flanged feet. Provide basins with a lift out, 16 gauge stainless steel cover with all edges flanged down 1" and corners rounded, provided with two neatly punched thumb holes, and designed to rest on 1/4" rod stock supports welded across the basin corners at proper height to provide a flush surface.
Accessories - Crumb cup waste outlet, T&S Brass B-0323-04 faucet, or equal by Fisher or Encore, with 6" wrist blade handles. Provide adjustable legs for 34 in. to 36 in. high work surface. Provide 18” long flexible hot and cold water hoses.

Item 34
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 84" x 12" mounted 1" off face of wall up 54" above finished floor

Item 35
HAND SINKS WITH SIDE SPLASHES
Quantity - 3
Make - Advance 7-PS-70-CM*C166 or equal by Krowne
Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36" above floor
Accessories - Provide with a splash mounted faucet set with wrist handles (Item 27a), K-410 3" flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provided end splashes welded to each side.

Item 35a
FAUCETS
Quantity - 3
Make - T&S Brass B-2443-F10 modified or equal by Fisher
Description - Units shall be all standard construction with mixing body, 8" center inlets, wrist blade handles, and swivel gooseneck. Modified unit shall be provided with a B-0199-07-N05, 0.5 gallons per minute aerator tip in lieu of the standard.

Item 36a
EXHASUT VENTILATOR, TYPE 1 GREASE
Make - AquaMatic AM-ND-2 (quote 8400803) or equal by Caddy, Gaylord or Halton
Size - 7'-0" x 60" x 24" high plus 4" high collars, mounted up 6'-8" above finished floor; flat bottom.
Power - 0.3 KW - 120/60/1 for lights from item 38a ventilator fan management system.
Exhaust - 1,330 CFM exhaust through a 14" x 16" collar at -0.291" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edges with integral front baffle, double wall insulated fronts, and NSF Listed. Units shall have grease collection troughs, storage containers, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 85% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide unit with three UL Listed light fixtures with LED bulbs factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on two sides.

Item 36b
EXHASUT VENTILATOR, TYPE 2 VAPOR
Make - AquaMatic VHB-G (quote 8400803) or equal by Caddy, Gaylord or Halton
Size - 11'-0" x 60" x 24" high plus 4" high collars, mounted up 6'-8" above finished floor; flat bottom.
Power - 0.5 KW - 120/60/1 for lights from item 38a ventilator fan management system.
Exhaust - 1,870 CFM exhaust through a 20" x 14" collar at -0.129" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edges with integral front baffle, double wall insulated fronts, and NSF Listed. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on two sides.

Item 37
STAINLESS STEEL WALL FLASHING
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 19'-0" extending from bottom of ventilator to floor or top of coved material
Construction - Wall shall be clad with 20 gauge type 304 stainless steel cut in largest sheets to minimize joints and secured to wall with adhesive and no exposed fasteners. Provide Component Hardware J64-1450 “T” dividers at joints and J63-1451 cap strips at ends. Provide carefully punched holes at all service locations.

Item 38a
VENTILATOR DEMAND CONTROL SYSTEM PROCESSOR
Make - CaptiveAire DCV or equal by Gaylord or Halton
Power - 15 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturers shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Items 36a and 36b. Mount LCD screen control, recessed and flush to wall per plan 54" above floor. Mount system processor in the cabinet mounted on the right/ end of exhaust ventilator 36b. Mount the room air temperature sensor on the wall 54" above the finished floor.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturers service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 38b
VENITLATOR CONTROL INTERFACE PANEL
Specified as part of Item 38a.

Item 38c
ROOM TEMPERATURE SENSOR
Specified as part of Item 38a.

Item 39
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102 or Pyro-Chem
Power - 20 amps circuit - 120/60/1
Protection for exhaust hoods 36a and 36b
Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted in the hood manufacturer provided utility cabinet and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel and limited to vertical drops only. Horizontal piping shall be run over the ventilator's top. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a flush mounted pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required.

Workmanship - Exposed stainless steel fittings piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. **Chrome sleeves are not acceptable.**
Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.
Accessories - Provide swivel type nozzles with metal caps.

Item 40
RANGE WITH OVEN
Make - Vulcan EV24-S-4FP-480*C166 or equal by Southbend or Cleveland
Size - 24" x 34" x 36-1/2" high to work surface
Power - 16.3 amps - 13.0 KW - 480/60/3
Description - Range shall be all standard construction with stainless steel front, sides, back riser, top and top rail, porcelain enamelled oven liner, deck and door liner, four infinite heat switch controlled French hot plate elements, 20" x 26-1/2" x 14" high fiberglass insulated oven with thermostatic controls, spring balanced door with tubular handle, and one nickel plated oven rack.
Accessories - Provide unit with an 11" high flue riser with stainless steel front and ends and mount on 6" high casters with brakes.

Item 41
FORTY-GALLON TILT BRAISING PAN
Make - Vulcan VPP40E-480*C166 or equal by Eletrolux or approved equal
Size - 55” x 38” x 39” high (internal pan 39” x 25” x 10-1/2” deep)
Capacity - Forty-gallons
Power - 33.6 amps - 480/60/3
Description - Forty-gallon tilt braising pan with lid shall be fabricated from stainless steel and mounted on 6” high legs. Multifunction cooking for simmering, grilling, braising and steaming shall have three cooking modes, six timers and an auto-lift basket assembly. Twin LCD touch screens for manual or programmed recipe functions and continues display timer. Motorized tilt pan with embossed gallon markings, auto water filling and a powered pumped drain. Cooking temperatures from 80-482 degree Fahrenheit and HACCP logging.
Accessories - Provide K-12 extended warranty, VPP-Strainer kit, V-Probe. (3) VPP mesh baskets and VPP scraper tool. Mount on flanged feet.

Item 42
FLOOR PAN AND GRATE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 36" x 20" x 4" deep inside dimensions; 39" x 23" overall
Description - Pan shall be fabricated of 14 gauge stainless steel, all welded construction, pitched to a 4" outside diameter drain fitting with stainless steel removable, perforated basket. Two opposing sides shall be fitted with integral grate support ledges. Pan shall be set in floor so that grate ledges are parallel with cooking line aisle. Provide a model I4010 ADA compliant pultruded grate (Fibergrate Safe-T-Span) with 0.60" load bars, 0.4" clear slots and ends finished in accordance with manufacturer's instructions. Grate shall rest in pan so that slots are perpendicular to the cooking line aisle, and shall be cut in a manner that closed pockets will not be formed where they rest on the pan ledges.

Item 43a
STEAMER, TEN-PANS
Make - Cleveland 24-CEA-10*C166, Accutemp, Market Forge, or an approved equal
Size - 24 in. by 35 in. by 65-1/4 in. high
Power - 39.8 amps - 480/60/3
Description - Pressureless convection steamer shall be all standard construction with stainless steel interior and exterior, two independently operating compartments for up to ten 12″ x 20″ x 2½″ deep cafeteria pans (five each compartment), two fully insulated rear mounted independent electric steam generators each with two 8.0 KW heating elements, two five-gallon generator reservoirs, two generator cleaning ports located on the outside top of the unit, instant steam stand-by mode, two 60-minute timers, automatic water fill, automatic probe type water level control with rinse cycle, automatic generator drain, removable stainless steel rack slides, stainless steel doors with reversible door gaskets, doors hinged on left, door condensate drip trough, compartment door steam shut off switch, and mounted on stainless steel adjustable legs.
Accessories - Provide unit with six 12" x 20" x 2-1/2" deep perforated pans and four 12" x 20" x 2-1/2" deep solid pans. Mount on flanged feet.

Item 43b
WATER FILTER ASSEMBLY
Make - 3M ScaleGard HT SF165 Modified or equal by Everpure or Optipure
Description - Unit shall be all standard construction designed for wall mounting behind the steamer and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CLX chloramine reduction filter cartridge in lieu of standard HF65 cartridge.
Accessories - Provide four spare HF95-CLX filter cartridges and four spare HF8-S cartridges.

Item 44a
COBI-OVENS, DOUBLE STACKED
Quantity - 2
Make - Vulcan ABC7E-480*C166 or equal by Blodgett or Alto Shaam
Size - 42-1/4” x 43-1/2” x 34-1/4” high , double stacked 75” high
Power - (2) 29.8 amps (24 KW) - 480/60/3
Description - Combi Oven/Steamer, electric, boilerless, (7) 18" x 26" full size sheet or (14) 12" x 20" full size hotel pan capacity, (3) knobs with LED displays for temperature, timer & humidity, auto-adjustment of humidity with temperature selection, auto-reversing fan with electronic braking system, cool to touch glass door, flashing door light & audible alert, (4) Grab n Go wire racks, stainless steel interior & exterior, engineered & assembled in USA, UL EPH Classified, cULus.
Accessories - Provide a stacking kit; V-Spray hose kit; V3MRO-2 Reverse Osmosis water filtration system and one-year parts and labor warranty plus K-12 extended one year warranty. Mount on casters with brakes.

Item 44b
REVERSE OSMOSIS FILTRATION SYSTEM
Quantity - 2
Specified as part of item 44a.

Item 45
Spare number

Item 46
Spare number

Item 47
PREP TABLE WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 96" x 30" x 36" high to work surface plus 10" high splash at rear; two 18" x 20" x 10" deep integral sink basins.
Construction - 14 gauge stainless steel top, basins and splash, over angle reinforced framing, six legs with gussets and adjustable feet, partial undershelf, two crossrails, tall splash rear, and marine front and ends, secured 3" off face of wall.
Accessories - Drawer assembly, splash mounted faucet set and two 2" lever waste outlets. Provide a flat spot for mounting the manual can opener, fully weld the flat spot to the table spot leaving no gaps. Mount on flanged feet.

Item 48
MANUAL CAN OPENER
Make - Edlund S-11L*C166 or equal by Vollrath or Nemco
Description - Opener shall be all standard construction with cast stainless steel body, base and blade. Install on table per plan.

Item 49
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 48" x 12" mounted 1" off face of wall up 54" above finished floor

Item 50
REFRIGERATOR, PASS-THRU
Quantity - 2
Make - Continental 1RNSAPTHD*C166 or equal by Victory or Traulsen
Power - 5.5 amps - 1/4 HP - 120/60/1 - cord and plug
Size - 26” x 34” x 82-1/2” high
Door - Full height, hinged on the right
Capacity - 21 cubic feet
Certification - Unit shall be Energy Star compliant
Description - Refrigerator shall be all standard construction with stainless steel exterior front and ends of welded construction to include door corners, and aluminum interior. Unit shall include high density non-CFC polyurethane foam insulation, automatic interior lighting, automatic electric condensate evaporator, field-reversible self-closing cam lift door hinges with 120° stay open feature, locking door, plasticized fin coil and fan blades, magnetic snap-in door gasket, electronic controller with exterior display and hi-low alarm, epoxy coated steel wire shelves, and mounted on 5" casters. Refrigeration system shall be self-contained plug type air cooled hermetic compressor, expansion valve type, with automatic defrost and operating on Refrigerant R-290.
Accessories - Provide unit with optional five year compressor warranty. Provide universal pan slides in the top half and wire shelves in the bottom.

Item 51
MOBILE WORK TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 60" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.

Item 52
HEATED HOLDING CABINETS, PASS-THRU
Quantity - 2
Make - Food Warming Equipment MTU-12P or equal by Alto-Shaam, Cres Cor,
Size - 29-3/4" x 30-1/4" x 69" high
Power - 13.85 amps - 16.5 KW - 120/60/1 - cord and plug
Certification - Unit shall be Energy Star compliant
Doors - Dutch doors hinged on the left
Description - Pass-through cabinet shall be all standard construction with stainless steel interior and exterior, stainless steel base frame with tubular perimeter and 10 gauge stainless steel reinforcing plates at corners, high density fiberglass insulation on all sides, flush mounted doors with high temperature gasket mounted on the cabinet, edge mounted heavy duty hinges and latch, twelve pair of removable universal chrome plated and epoxy coated rod type pan slides capable of supporting 18" x 26" or 12" x 20" pans on 4-1/2" centers, mounted thermometer, recessed controls, thermostatically controlled system with separate heat and humidity controls, air distribution blower and removable stainless steel reservoir, and 10' cord set and cord storage loop. Mount on 5" diameter plate mounted polyurethane tired casters; two swivel, two rigid. Provide with two year warranty.
Accessories - Provide unit with see-thru Lexan Dutch doors, perimeter vinyl bumper and push/pull handles.

Item 53
MOBILE EQUIPMENT STAND
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 30" x 30" x 32" high
Construction - 14 gauge stainless steel top over channel frame, edges formed in turn down, mounted on four legs with gussets, undershelf, and 5" diameter casters, two with brakes.

Item 54
SLICER
Make - Hobart HS9 or equal by Bizerba
Power - 5 amps - 1/2 HP - 120/60/1 - cord and plug
Description - Slicer shall be all standard construction, automatic type with anodized cast aluminum housing and base, removable 13" diameter 304L stainless steel knife with removable ring guard cover, totally enclosed, permanently lubricated PSC knife motor, with poly-v belt drive, zero knife exposure, linear automatic carriage drive system with speeds of 28, 38, 48 and 58 strokes per minute, manual assist mode, and provided with thermoplastic coated steel feed grip, glass bead finished gauge plate and knife cover, tilting carriage, water protected push-button switches, top mounted and removable knife sharpener with two borazon stones, adjustable gauge plate from "0" to 1", lift lever system and rubber feet. Unit to be provided with mechanical and electrical interlocks to include home position start, close gauge plate to stop, carriage will not tilt away or remove if gauge plate is not closed, locked gauge plate when carriage is removed, no-volt release, and 30 second automatic shut-off without carriage motion. Slicer shall be NSF 8 compliant.
Accessories - Provide unit with knife removal tool.

Item 55
MOBILE WORK TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 60" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.

Item 56
REFRIGERATOR, REACH-IN
Make - Continental 1RNSAHD*C166 or equal by Victory or Traulsen
Power - 5.9 amps - 1/4 HP - 120/60/1 - cord and plug
Size - 26” x 34” x 82-1/2” high
Door - Full height, hinged on the right
Capacity - 20 cubic feet
Certification - Unit shall be Energy Star compliant
Description - Refrigerator shall be all standard construction with stainless steel exterior front and ends of welded construction to include door corners, and aluminum interior. Unit shall include high density non-CFC polyurethane foam insulation, automatic interior lighting, automatic electric condensate evaporator, field-reversible self-closing cam lift door hinges with 120° stay open feature, locking door, plasticized fin coil and fan blades, magnetic snap-in door gasket, electronic controller with exterior display and hi-low alarm, epoxy coated steel wire shelves, and mounted on 5" casters. Refrigeration system shall be self-contained plug type air cooled hermetic compressor, expansion valve type, with automatic defrost and operating on Refrigerant R-290.
Accessories - Provide unit with optional five year compressor warranty. Provide universal pan slides in the top half and wire shelves in the bottom.

Item 57
REFRIGERATED SANDWHICH TABLE
Make - Continental SW72N18-SA*C166 or equal by Victory or Traulsen
Size - 72" x 31" x 36" high
Power - 6 amps - 120/60/1 - cord and plug
Doors - Normal hinging
Description - Refrigerator shall be all standard construction with stainless steel top and front, 2" thick polyurethane insulation, hinged doors with heavy duty self-closing hinges, anodized aluminum ends case back and interior, air cooled refrigeration system with thermostatic controls and condensate evaporator, interior thermometer, epoxy coated steel wire shelves, and top fitted with a white nylon cutting board, and ten and eight pan openings complete with adapter bars and stainless steel pans. Mount on heavy duty swivel casters, front locking.
Accessories - Provide unit with five year compressor warranty. Provide removable covers in lieu of hinged lid assemblies.

Item 58
SERVING COUNTER, DELI
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 120” x 42” x 34” high.
Construction - See item 60.
Accessories - Provide with a 78” long (between end posts on centers) Versa-Gard VG9 two-tier self-service food protector (Item 58a) with brushed stainless steel uprights, end panels, concealed mount flanges, and mounted per plan. Mount counter on flanged feet. Provide a stainless steel toe kickplate.

Item 58a
SELF-SERVICE FOOD PROTECTOR
Specified as part of item 58.

Item 59
REFRIGERATED DISPLAY CASE
Quantity - 2
Make - Federal LPRSS4 or equal by Structural Concepts or Regal Pinnacle
Size - 48" x 34" x 46" high
Power - 16 amps - 120/60/1 - cord and plug
Description - Display case shall be all standard construction with stainless steel display deck and black enamelled interior ends and back panel, two tiers of solid black enamel shelves, top mounted fluorescent light with shield, plastic laminate clad exterior in color as selected by Architect from standard offerings, self-contained refrigeration system with adjustable thermostat and solid state controlled defrost, condensate evaporator, glass end panels, and night curtain.
Accessories - Provide unit with solid rear access doors.

Item 60
SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - Length and shape per plans (approximately 22'-6") x 42" x 34" high.
Power - (2) 20 amps circuit - 120/60/1 to two apron mounted GFI receptacles (convenience outlets);
(2) 20 amps circuit - 120/60/1 to body mounted GFI receptacle (item 59 display cases);
(2) 12.3 - 208/60/1 to body mounted GFI receptacle (item 61 food wells);
(1) 20 amps circuit - 120/60/1 to body mounted GFI receptacle (item 64 food display);
(1) 20 amps circuit - 120/60/1 to body mounted GFI receptacle (item 65 food display);

American Disabilities Act Requirements - Self-service food pans and food protectors shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Construction - Top shall be 3 cm Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame, and provide openings for the drop-in equipment with thermal protection at all edges per detail. Provide stainless steel cladding on exposed underside of substrate.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma) or equal (submit warranty letter for stone top and installation with counter submittal)
Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable flanged feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face. Provide a stainless steel toe kickplate.

Accessories - Provide with two 60” long (between end posts on centers) Versa-Gard VG6S full-service food protector (Item 60a) and one 54” VG21-SK convertible food protector Iitem 63a) with brushed stainless steel uprights, end panels, concealed mount flanges, and mounted per plan. Mount counter on flanged feet.

Item 60a
FULL-SERVICE FOOD PROTECTOR
Quantity - 2
Specified as part of item 60.

Item 61
DROP-IN HEATED/REFRIGERATED FOOD WELLS
Quantity - 2
Make - Atlas Metal WQHC-3*C166 or equal by Hatco
Size - 56" x 26-1/2 x 26-78" high (interior (3) 19-7/8” x 11-7/8” x 9” pan openings)
Power - 12.3 amps - 208/60/1 - cord and plug (NEMA L14-20P)
Description - Drop-in unit shall be all standard construction with 18 gauge 304 stainless steel top perimeter frame and die stamped food wells with welded and radiused corners. Each well shall be insulated with 1-1/2” of insulation on four sides and 2” on the bottom. Food pans recessed 3” from the top, individually controlled heated or refrigerated wells each with a 850 watt heat source, self-contained refrigeration with hermetically sealed compressor and CFC free refrigerant. Each pan has a 3/4” drain manifolded to a drain line with a quarter-turn shut-off valve.
Accessories - Provide a five-year compressor warranty.

Item 62
FILL FAUCET
Quantity - 3
Make - T&S Brass B-0208 or equal by Fisher or Encore
Description - Unit shall be all standard construction with a B-199-02F-12 aerator tip.

Item 63
SERVING COUNTER, PIZZA
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Specified as part of item 60.

Item 63a
CONVERTIBLE-SERVICE FOOD PROTECTOR
Specified as part of item 63.

Item 64
HEATED FOOD SLIDE MERCHANDISER
Make - Hatco GRSDS/H-36D*C166 or equal by AP Wyott
Size - 36" x 24" x 32-1/2" high
Power - (15.1 amps) 1.81 KW - 120/60/1 - NEMA 5-20P cord and plug
Description - Unit shall be all standard construction with two heated shelves, one slanted and one flat, with Hardkote finish, constructed of stainless steel and extruded aluminum with tempered glass end panels, incandescent lights, dividers, and thermostatic controls.

Item 65
DROP-IN HEATED FOOD MERCANDISER
Make - Hatco HBGBH-4818*C166 or equal by AP Wyott
Size - 48" x 18" plus perimeter flange
Power - 5.5 amps - 850 watts - 120/60/1 - cord and plug
Description - Black ceramic glass aluminum surface with thermostatic controlled heated base with 100° to 200°F. range, stainless steel flanged edge for drop-in installation, and remote control box.
Accessories - Provide HBGB-SMFLUSH-TSTAT flush mount control box with lighted power switch for mounting in counter apron.

Item 66
CONVEYOR TOASTER
Make - Hatco TQ-400*C166 or equal by Waring or AP Wyott
Size - 17-3/4" x 14-1/2" x 13-3/4" high
Power - 15 amps -120/60/1 - cord and plug NEMA 5-15P
Description - Toaster shall be all standard construction with stainless steel exterior, variable speed control, manual advance knob, automatic thermostat, one or two side selector switch, and heated stainless steel delivery tray.

Item 67
SERVING COUNTER, SALAD
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 99” x 40” x 34” high.
Construction - See item 60.
Accessories - Provide two pairs of hinged doors with pull handles and locks. Provide with a 60” long (between end posts on centers) Versa-Gard VG9 two-tier self-service food protector (Item 67a) with brushed stainless steel uprights, end panels, concealed mount flanges, and mounted per plan. Mount counter on flanged feet. Provide a stainless steel toe kickplate and louvered doors.

Item 67a
SELF-SERVICE FOOD PROTECTOR, TWO-TIER
Specified as part of item 67.

Item 68
DROP-IN HEATED/REFRIGERATED FOOD WELLS
Make - Atlas Metal WQHC-3*C166 or equal by Hatco
Size - 56" x 26-1/2 x 26-78" high (interior (3) 19-7/8” x 11-7/8” x 9” pan openings)
Power - 12.3 amps - 208/60/1 - cord and plug (NEMA L14-20P)
Description - Drop-in unit shall be all standard construction with 18 gauge 304 stainless steel top perimeter frame and die stamped food wells with welded and radiused corners. Each well shall be insulated with 1-1/2” of insulation on four sides and 2” on the bottom. Food pans recessed 3” from the top, individually controlled heated or refrigerated wells each with a 850 watt heat source, self-contained refrigeration with hermetically sealed compressor and CFC free refrigerant. Each pan has a 3/4” drain manifolded to a drain line with a quarter-turn shut-off valve.
Accessories - Provide a five-year compressor warranty.

Item 69
MOBILE CONDIMENT COUNTER
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 48" x 27" x 34" high
Construction - See item 60. Top shall be 3 cm Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame and provide white plastic laminate cladding on exposed underside of substrate. Provide stainless steel angle trim on any exposed edges of substrate. Mount on four 2" square legs with undershelf and plastic laminate clad panels on four sides all of similar construction to the serving counter. Rear face shall be provided with a pair of hinged doors in a 36" wide opening. Provide 5" diameter swivel casters; two with brakes.
Accessories - Provide door locks.

Item 70
MOBILE CASHIER STAND
Quantity - 3
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group or Julien Inc.
Size - 24" x 24" x 36" high main section with 30" x 10" trayslide set at 34" above the floor.
Construction - See item 60. Top shall be 3 cm Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame and provide white plastic laminate cladding on exposed underside of substrate. Provide stainless steel angle trim on any exposed edges of substrate. Provide neat hole in top for cord passage behind casher terminal. Mount on four 2" square legs with crossrails on three sides, footrest set in 8", undershelf and plastic laminate clad panels on three sides all of similar construction to the serving counter, with two stainless steel trayslides mounted on fold-down brackets. Provide 5" diameter swivel casters; two with brakes.
Accessories - Provide unit with a Component Hardware S95-1000 locking cashier drawer.

Item 71
CASHIER TERMINALS
Quantity - 3
No work in this Section. Units provided by Owner.

Item 72
TRAFFIC BARRIER, MOBILE
Make - Lawrence Tensabarrier 889 Advance/Universal Base
Size - (3) 38-1/4" high post; 13-1/2" diameter base; 7'-6" maximum belt length
Description - Units shall be all standard construction with satin stainless steel finish, and retractable belts. Belt color shall be as selected by Architect from standard options.

Item 73
OFFICE FURNITUTE
No work in this Section. Units provided by General Contractor.

PART 3 - EXECUTION

3.1 SANITATION REQUIREMENTS

A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation will be referred to the State Department of Health for a ruling.

B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.2 EXAMINATION AND ACCEPTANCE

A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.

B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work will be construed as acceptance of space conditions.

C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.

D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.3 CLEANING UP

A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.

B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Provide with a list of equipment to include make, model, and serial number where applicable. Book shall be turned over to Owner after review and approval.

D. Submit guarantees and warrantees to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.4 PROTECTION OF WORK

A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.

C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by the Architect.

3.5 DEMONSTRATION AND OPERATING INSTRUCTIONS

A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.

B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.

C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Book shall be turned over to Owner after review and approval.

D. Submit guarantees and warranties to the Architect in the above specified manual with all warranty cards completed and become effective at the time the equipment was satisfactorily demonstrated.

END OF SECTION 114000

SECTION 116143 - STAGE CURTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following:
   1. New stage curtains and rigging including valance, main traveler and rear traveler.

B. Related Sections:

   1. Division 05 Section "Metal Fabrications" for steel framing and supports for stage-curtain systems.
   2. Division 26 Sections for new stage lighting, electrical wiring and removal of existing stage lighting fixtures and wiring.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Rigging shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

   1. Design Loads: Weight of curtains and 20 lbs per linear foot.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for stage curtains. Include plans, elevations, sections, details, attachments to other work, and the following:

   1. Operating clearances.
   2. Requirements for supporting curtains, track, and equipment. Verify capacity of each track and rigging component to support loads.

C. Samples for Initial Selection: For each type of stage curtain indicated. Include color charts showing the full range of colors, textures, and patterns available, together with a 12-inch-square Sample (any color) of each type of fabric.

D. Product Certificates: For the following, from manufacturer:

   1. Rigging: Compliance of suspended battens and tracks with requirements.

E. Operation and Maintenance Data: For stage curtains and rigging to include in operation and maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of stage curtains.

B. Fire-Test-Response Characteristics: Provide stage curtains with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame-Resistance Ratings: Passes NFPA 701.

a. Permanently attach label to each fabric of curtain assembly indicating fabric is inherently and permanently flame resistant.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 STAGE CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment to comply with requirements indicated. Provide fabrics of each type and color from same dye lot.

B. Polyester Velour: Napped fabric of 100 percent polyester weighing not less than 25 oz./linear yd., with pile height approximately 75 mils; inherently and permanently flame resistant; 54-inch minimum width.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fred Krieger Fabrics; Charisma Velour IFR
   b. JB Martin Company; Dante
   c. KM Fabrics, Inc.; Prestige

2. Color, Texture, and Pattern: As selected by Architect from manufacturer's full range.

2.2 CURTAIN FABRICATION

A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on curtain not visible to audience. Provide vertical seams unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width.

1. Vertical Hems: Provide vertical hems not less than 2 inches wide, and not less than 4 inches wide at borders, valance, teasers, and tormentors, with not less than a 1-inch tuck, and machine sew with no selvage material visible from front of curtain. Sew open ends of hems closed.

2. Leading Edge Turnbacks: Provide turnbacks formed by folding back not less than 12 inches of face fabric, with not less than a 1-inch tuck, and secure by sewing turnbacks vertically.
3. Top Hems: Reinforce top hems by double-stitching 3-1/2-inch- wide, heavy jute webbing to top edge on back side of curtain with not less than 2 inches of face fabric turned under.

4. Pleats: Provide 50 percent fullness in curtains, exclusive of turnbacks and hems, by sewing additional material into 3-inch double-stitched box pleats sewn flat and spaced at 12 inches o.c. along top hem reinforcement.
5. Grommets: Brass, No. 3 or No. 4.

    a. Black Curtains: Provide brass or aluminum grommets with black finish.

    b. Pleated Curtains: Centered on each box pleat and 1 inch from corner of curtain; for snap hooks or S-hooks.

6. Bottom Hems: For curtains with fullness.

    a. For curtains that do not hang to the floor, provide hems not less than 3 inches deep with 3/4-inch weight tape. Sew open ends of hems closed.

    b. For floor-length curtains, provide hems not less than 6 inches deep with separate, interior, 100 percent cotton, heavy canvas chain pockets equipped with proof coil chain. Stitch chain pockets so chain rides 2 inches above finished bottom edge of curtain. Sew open ends of hems closed.

        1) Proof Coil Chain: Grade 30, No. 8, zinc plated, 3/16 inch, ASTM A 413/A 413M.

7. Velour Curtains: Fabricate with the fabric nap down.

B. Snap Hooks: Track manufacturer's standard heavy-duty hooks, attached to top hem with nylon strap secured by rivets.

2.3 STEEL-CURTAIN TRACK

A. Steel Track: Fabricate of roll-formed, galvanized, commercial-quality, zinc-coated steel sheet; complying with ASTM A 653/A 653M; G60 coating designation with continuous bottom slot and with each half of track in one continuous piece.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Automatic Devices Company; Silent Steel 280 series.

b. H & H Specialties Inc.; 400 series.

2. Thickness: 0.079 inch.

B. Suspended Track: NPS 1-1/2 steel pipe stiffener for supporting both sections of suspended curved tracks.

C. Clamp and Bracket Hangers: Manufacturer's steel clamps and brackets of sufficient strength required to support loads for attaching track to overhead support.

D. Track Lap Clamp: Metal to match track channel for attaching double-sectioned track at center overlap.

E. Heavy-Duty Track System: Equip track with heavy-duty components. Provide end stops for track.

1. Curtain Carriers: Standard carriers of plated steel with a pair of neoprene-tired ball-bearing wheels riveted parallel to body. Equip carriers with rubber or neoprene bumpers to reduce noise, and heavy-duty, plated-steel swivel eye and manufacturer's standard trim chain for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.

a. Master Curtain Carriers: One master carrier, for each leading curtain edge, of plated steel with two pairs of neoprene-tired ball-bearing wheels and with two line guides per carrier.

2. End Pulleys and Floor Block: One dead-end, single-wheel pulley; one live-end, double-wheel pulley; and one adjustable, floor block; each with not less than 5-inch molded-nylon- or glass-filled-nylon-tired ball-bearing sheaves enclosed in steel housings. Provide pulleys with steel housing finished to match track and with bracket for securing off-stage curtain end. Provide an adjustable floor block to maintain proper tension on operating line with steel housing painted black.

F. Manual Operation: Provide with cord operating line consisting of manufacturer's standard 3/8-inch- diameter, stretch-resistant operating cord consisting of braided synthetic-fiber jacket over solid, synthetic-fiber, linear filaments.

2.4 CURTAIN RIGGING

A. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with a drive-fit pipe sleeve not less than 18 inches long, and secure with four flush rivets, plug welds, or another equally secure method. Shop-paint completed pipe battens with black paint and with a 1-inch- wide yellow stripe at the center of each.

1. Steel Pipe: ASTM A 53/A 53M, Grade A, standard weight (Schedule 40), black, NPS 1-1/2 nominal diameter unless otherwise indicated.

B. Supports, Clamps, and Anchors: Sheet steel in manufacturer's standard thicknesses, galvanized after fabrication according to ASTM A 153/A 153M, Class B.

C. Trim and Support Cable: 1/4-inch- diameter, 7x19 galvanized-steel cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written recommendations for size, number, and method of installation, including a drop-forged galvanized turnbuckle to allow for leveling.

D. Trim and Support Chain: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A 391/A 391M.

E. Inserts, Bolts, Rivets, and Fasteners: Manufacturer's standard corrosion-resistant units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install stage-curtain system according to track manufacturer's and curtain fabricator's written instructions.

3.3 BATTEN INSTALLATION

A. Install battens by suspending at heights indicated with trim and support spaced to support load, but do not exceed 10 feet o.c.

1. Cable Trim and Support: Secure cables either directly to structures or to inserts, eye screws, or other devices that are secure and appropriate to substrate and that are not subject to deterioration or failure with age or elevated temperatures. Attach other cable end to pipe clamps with turnbuckles, housed or fixed with nuts after adjustment, to prevent loosening.
2. Chain Trim and Support: Secure chain with load-rated terminations.

3.4 TRACK INSTALLATION

A. Batten-Hung Tracks: Install track by suspending from pipe batten with manufacturer's track clamp hangers attached to batten pipe clamps at spacing, according to manufacturer's written instructions.

B. Spacing: Do not exceed the following dimensions between supports:

1. Heavy-Duty Track: 72 inches.

2. Medium-Duty Track: 48 inches.
3. Walk-Along Track: 48 inches. Provide additional supports at splices.

C. Install track for center-parting curtains with not less than 24-inch overlap of track sections at center, supported by special lap clamps. Provide 48-inch overlap for divider curtain track.

3.5 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with snap hooks.

B. Batten Hung: Secure curtains to pipe battens with ties.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain stage curtains and tracks.

3.7 CURTAIN SCHEDULE

Quantity	Description	Size HxW	% Fullness	Fabrics
1	Valance	4’ x 42’	50	Synthetic Velour
2	Main Traveler	18’ x 21’ ea.	50	Synthetic Velour
2	Legs	18’ x 4’ ea.	50	Synthetic Velour
1	Border	4’ x 42’	50	Synthetic Velour Color: Black
1	Rear Traveler	18’ x 21’ ea.	50	Synthetic Velour Color: Black

END OF SECTION 116143

SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, as indicated on the Sustainable Matrix. Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section Includes:

1. Basketball equipment.(6 @ Main Gym)
2. Volleyball equipment. (1 @ Main Gym)
3. Scoreboards. (2 @ Main Gym)
4. Safety pads. (@ walls in Main Gym)

B. Related Requirements:

1. Division 03 Section "Cast-in-Place Concrete" for installation of floor insert sleeves to be cast in concrete slabs and footings.
2. Division 09 Section "Wood Athletic Flooring" for game lines and markers.
3. Division 11 Section" Gymnasium Dividers."

1.3 DEFINITIONS

A. NFHS: National Federation of State High School Associations.

B. USAV: USA Volleyball.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.

2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Sustainable Design Submittals:

1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
3. Include transport and storage accessories for removable equipment.

D. Samples: For each exposed product and for each item and color specified.

E. Samples for Initial Selection: For each type of gymnasium equipment.

F. Samples for Verification: For the following products:
1. Pad Fabric: Wall padding not less than 3 inches square, with specified treatments applied. Mark face of material.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

B. Product Certificates: For each type of gymnasium equipment.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.9 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Basketball backboard failures including glass breakage.
b. Faulty operation of basketball backboards.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain each type of gymnasium equipment from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 BASKETBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc.
2. Gared Holdings, Inc.
3. Jaypro Sports Construction Group.
4. Porter Athletic, Inc.
5. Spalding Equipment.

B. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rules Book."

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Provide manufacturer's recommended connections complying with Division 05 Section "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Overhead-Supported Backstops:

1. Folding Type: Provide manufacturer's standard assembly for forward-folding, front-braced, with hardware and fittings to permit folding.

2. Basis of Design Product: Gared Holdings Inc. Model 3107

3. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.

a. Center-Mast Frame: Welded and bolted or clamped with side sway bracing.

b. Finish: Manufacturer's standard polyester powder-coat finish.

F. Backboard Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.

1. Retractor Device: Spring-activated, reel-type device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per folding backstop.

G. Backboard Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.

3. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.

a. Group Key Switch Control Stations: One switch per each backstop.
b. Keys: Provide two keys per station.

4. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.

H. Basketball Backboards:

1. Shape and Size:

a. Rectangular, 72 by 42 inches width by height.

2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:

   a. Glass: Not less than 1/2-inch- thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.

      1) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.

3. Target Area and Border Markings: Permanently etched in white color, marked in manufacturer's standard pattern and stripe width.

I. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.

1. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.

J. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication per manufacturer's standard design.

2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.

3. Breakaway Characteristics: Positive-lock movable breakaway design, with manufacturer's standard breakaway mechanism including preset pressure release, set to release at 180- and 230-lb load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.

4. Net Attachment: No-tie loops for attaching net to rim without tying.
5. Finish: Manufacturer's standard finish.

K. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:

1. Cord: Made from white cotton.

L. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports per manufacturer's standard design.

1. Attachment: Bolt on.
2. Color: As selected by Architect from manufacturer's full range.

2.4 VOLLEYBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc.
2. Gared Holdings, Inc.
3. Jaypro Sports Construction Group.
4. Porter Athletic, Inc.
5. Schelde North America.
6. Spalding Equipment.
7. Sports Imports.

B. General: Provide equipment complying with requirements in NFHS's "NFHS Volleyball Rules Book."

C. Floor Insert: Chrome-finished steel floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than length required to securely anchor pipe sleeve in structural floor; with anchors designed for securing floor insert to floor substrate indicated; one per post standard.

1. Floor Plate: Manufacturer's standard hinged access cover, recessed to accept finish flooring matching and designed to be level with adjacent flooring. Provide two tool(s) for unlocking access covers.
2. In addition to floor inserts for new volleyball equipment, provide four 3-1/2” sleeves to accommodate existing volleyball equipment to be relocated from existing facility.

D. Post Standards: Removable, paired volleyball post standards as indicated. Adjustable, telescoping height. Designed for easy removal from permanently placed floor insert supports. Fabricated from manufacturer's standard metal pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring. Finished with manufacturer's standard factory-applied, polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.

1. Nominal Pipe or Tubing Diameter: 3-1/2-inch OD at base.

2. Telescopic and Net Height Adjuster System: Provide manufacturer's standard telescoping system with locking device, telescopic post, and fittings for holding net at selected height; designed for height adjustment of post standard to position net at heights indicated.

   a. Net Heights: Between 84 and 95-5/8 inches or more.

3. Height Markers: Clearly marked at regulation play heights for girls/women and boys/men.

E. Net: 32 feet long; one per pair of paired post standards; and as follows:

1. Width and Mesh: Competition volleyball net, 39 inches with 4-inch- square mesh made of black nylon string.

a. Hem Band Edges: White, not less than 2-inch- wide top, bottom, and side bindings;; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post standard spacing indicated on Drawings.

1) Top Line: Not less than 1/4-inch- diameter rope.
2) Bottom Line: Not less than 1/4-inch- diameter rope.

2. Dowels: Not less than 1/2-inch- diameter fiberglass or 1-inch- diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
3. Net Antennas: 3/8-inch- diameter, high-tensile-strength, extruded-fiberglass or plastic rods, 72 inches long, extending above top hem band of net, with alternating white and red bands according to competition rules. Provide two antennas per net.

4. Boundary Tape Markers: 2-inch- wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook-and-loop attachment. Provide two tape markers per net for marking court boundaries.

F. Net-Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip] manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.

G. Bottom Net Lock Tightener: Provide manufacturer's standard quick-release-type tension strap; a spring-loaded, self-locking tensioner; a turnbuckle; a pulley; or other device and linkage fittings designed to quickly and easily tighten bottom line or net.

H. Safety Pads: Comply with NCAA and NFHS requirements. Provide pads consisting of not less than 2-inch thick, multiple-impact-resistant manufacturer's standard foam filler covered by puncture- and tear-resistant fabric cover, manufacturer's standard; with fire-test-response characteristics indicated. Provide pads with hook-and-loop closure or attachments for the following components:

1. Post Standards: Wraparound style, designed to totally enclose each standard to a height of not less than 72 inches; one per post.
2. Fabric Cover Flame-Resistance Ratings: Complies with NFPA 701.
3. Fabric Color: As selected by Architect from full range of industry standard colors and color densities.

I. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch- wide door openings. Fabricate welded-steel tubing units with heavy-duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

2.5 SCOREBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fair-Play; Basketball Scoreboards, Model BB-1620-4 with MP-72 Control or comparable product from the following:
   1. Nevco Scoreboard
   2. Electro-Mech Scoreboards

B. Wall mounted scoreboard with Home/Visitor scoring, time, period, possession arrows, bonus arrows, Home/Visitor fouls, player number and fouls.
   1. Digit Type: LED
      a. Color: Three color.
   2. Digit Sizes:
      a. Clock and Scores: 12 inch.
      b. Other Digit Size: 10 inch
   3. Provide heavy duty, vibrating horn (100 db min)
   4. Scoreboard Color: Selected from manufacturers standard colors.
   5. Protection Cover: Provide polycarbonate cover to protect scoreboard from impact.

C. Controls: Wireless control system and carrying case for battery operated scoreboard control console.
   1. Quantity: Provide four scoreboard control consoles.

2.6 SAFETY PADS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Draper, Inc.
   2. Gared Holdings, Inc.
   3. Jaypro Sports Construction Group.
   4. Porter Athletic, Inc.
   5. Spalding Equipment.

B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, not less than 14-oz./sq. yd and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

   1. Backer Board: Not less than 3/8-inch- thick plywood, mat formed, or composite panel.

2. Fire-Resistive Fill: Multiple-impact-resistant foam not less than 2-inch- thick, fire-resistive neoprene; 6.0-lb/cu. ft. density.
3. Size: Each panel section, as indicated.
4. Installation Method: Concealed mounting Z-clips.
5. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color(s).

E. Cut-out Trim: Provide manufacturer's standard flanged cut-out trim kits for fitting pads around switches, receptacles, and other obstructions.

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: All gym equipment attachment steel to be by the gym equipment manufacturer.

Comply with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
3. Steel Sheet: ASTM A 1011/A 1011M.

C. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.

D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and hangars.

E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.

G. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Softwood Plywood: DOC PS 1, exterior.

I. Particleboard: ANSI A208.1; made with binder containing no urea formaldehyde.

J. Equipment Wall-Mounted Board: Wood, neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

K. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

L. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure, subfloors, and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.

1. Floor Insert Location: Coordinate location with application of game lines and markers.
2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and floor-plate type.
3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall Safety Pads: Mount with bottom edge at 4 inches above finished floor.

F. Cut-out Trim: Limit cuts in face of padding from trim unit's corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.

G. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

H. Connections: Connect electric operators to building electrical system.

I. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Owner, and store units in location indicated on Drawings.

3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

SECTION 116653 - GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fold-up divider systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Motors: Show mounting arrangements and wiring diagram to power source and controls.

B. Shop Drawings: For gymnasium dividers.

   1. Include plans showing alignment of curtains in relation to court layout.
   2. Include elevations, sections, details, and attachments to other work.
   3. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
   4. Include loads, point reactions, and locations for attachment of gymnasium dividers to structure.

C. Samples for Initial Selection: For each type of gymnasium divider curtain fabric.

D. Samples for Verification: For divider curtain fabric, not less than 12 inches square of mesh and of solid fabric.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of gymnasium divider.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium dividers to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium dividers until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify size of space, available clearances, obstructions, and position for gymnasium dividers.

1.8 COORDINATION

A. Coordinate installation of overhead-supported gymnasium dividers and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Electrically Operated Dividers: Coordinate electrical requirements for type and location of power supply, conduit, wiring, and control boxes.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium dividers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gymnasium dividers.
b. Tearing or deterioration of fabric, seams, or other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain gymnasium dividers from single source from single manufacturer.

2.2 FOLD-UP DIVIDER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc.

2. Jaypro Sports Construction Group.
3. Porter Athletic, Inc.
4. Spalding Equipment.

B. Divider Curtain System: Electrically operated, upward folding, cable suspended, and as follows:

1. Top Hem: Double-thickness mesh or solid vinyl for continuous pipe batten.
2. Outer Edge Hems: Triple turned and welded.
3. Bottom Curtain Pocket: 6 inches with manufacturer's standard pipe batten.
4. Grommets: Manufacturer's standard material, size, and spacing; for lift cables to pass through curtain material.
5. Support Cables: 1/8-inch- diameter galvanized-stranded-steel wire rope. Provide fittings complying with cable manufacturer's written instructions for size, type, number, and installation method.
6. Support Chain and Fittings: Hardened alloy steel chain rated for lifting loads indicated, with commercial-quality, corrosion-resistant steel connectors and hangers.
7. Curtain Battens and Drive Pipe: Fabricate from steel pipe or tubing with a minimum number of joints, as necessary for required lengths. Provide galvanized battens and drive pipe, or shop prime and shop finish with black paint.

    a. Drive Pipe: 2-3/8-inch- nominal diameter steel pipe.
    b. Top and Bottom Battens: 1-1/2-inch- nominal diameter steel pipe.

2.3 MATERIALS

A. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and hangers.

B. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium divider manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

2.4 ELECTRIC OPERATORS

A. General: Factory-assembled electric operation system of size and capacity recommended and provided by gymnasium divider manufacturer for gymnasium dividers specified, with electric motors, thermal-overload protection, factory-prewired motor controls, control devices, and accessories required for proper operation. Include wiring from control stations to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Motor Electrical Characteristics:

1. Voltage: 110 V.
2. Phase: Single.
3. Hertz: 60.

4. Horsepower: 1 HP.

D. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop dividers at fully extended and fully retracted positions.

E. Control System:

1. Key Operation: NEMA ICS 6, Type 1 enclosure, momentary-contact, three-position switch-operated control.

a. Keys: Provide two key(s) per station.
2. Wireless control system.

2.5 DIVIDER CURTAINS

A. Upper Curtain, Mesh: Woven mesh of polyester yarn coated with vinyl, weighing not less than 9 oz./sq. yd..

1. Mesh Color: As selected by Architect from full range of industry colors and color densities.

B. Lower Curtain, Solid: Woven polyester fabric coated with vinyl, 18 oz./sq. yd., 8-foot height above floor.

1. Fabric Color(s): One color, as selected by Architect from full range of industry colors and color densities.

C. Hems: Folded and electronically welded.

D. Seams: Electronically welded.

E. Overall Curtain Height: Floor to ceiling, within installation clearances required.

F. Bottom of Curtain: Approximately 2 inches above finished floor.

G. Divider Curtain Flame-Resistance Ratings: Passes NFPA 701, Test 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions.

B. Unless otherwise indicated, install gymnasium dividers after other finishing operations, including painting, are completed.

C. Gymnasium Dividers and Components: Install level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.

1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure gymnasium dividers to structural support and to properly transfer load to in-place construction.

E. Connections: Connect automatic operators to building electrical system.

3.3 ADJUSTING

A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, uneven tension, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.4 CLEANING

A. After completing gymnasium divider installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium divider components and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium dividers.

END OF SECTION 116653

SECTION 122413 - ROLLER WINDOW SHADES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Sustainable Design Submittals:

1. For MRc2: EPDs: Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

2. For MRc4: Material Ingredients: Include submittal documentation requirements for MR Credit 4 Building Product Disclosure and Optimization - Material Ingredients for HPDs and/or Cradle-to-Cradle (C2C), Declare Label, or Product Lens certification.

C. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.

F. Product Schedule: For roller shades.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Basis-of-Design: SWF Contract; Pro Series Manual Shade System or a comparable product from one of the following:
   1. Hunter Douglas, Inc.

2. MechoShade

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.
   a. Limit Stops: Provide upper and lower ball stops.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

   a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
2. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

   a. Type: Enclosed in sealed pocket of shadeband material.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Basis-of-Design: SWF Contract; RTS Motorized Shade System or a comparable product from one of the following:
1. Hunter Douglas, Inc.
2. MechoShade

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wireless motor controls.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

    a. Electrical Characteristics: 120V AC, 60 Hz.

3. Remote Control: Provide the following for remote-control activation of shades:

    a. Control Station: Remote transmitter powered by lithium battery. Signal range up to 65 feet, 4 channel.
        1) Quantity: Provide two remote transmitters.
    b. Sun Sensor Control: Adjustable system consisting of digital displays detecting sun intensity and responding by automatically adjusting shades.
        1) Sensor Quantity: Two per room.
4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:
    a. Override switch.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
2. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Basis-of Design: SWF Contract; Summit.

1. Source: Roller shade manufacturer.
2. Weave: Basketweave.
3. Thickness: 0.036 inch.
4. Weight: 20 oz./sq. yd..
5. Roll Width: 118 inch.

6. Openness Factor: 3 percent.
7. Color: As selected from manufactures full line.

2.5 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
   2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections within Division 01 – General Requirements, which are hereby made part of this Section of the Specifications.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

C. Sustainable Design Intent: Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

1.2 SUMMARY

A. Section includes
   1. Roll-up rail mats.
   2. Recessed frames
   3. Surface mounted/Loose Lay

1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor grilles and frames.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles and frames.

B. Sustainable Design Submittals:

   1. For MRc3: Recycled Content: Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for recycled content indicating the post-consumer and pre-consumer percentages.
   2. For EQc2: Low Emitting Materials: Include submittal documentation requirements for IEQ Credit 2.

C. Shop Drawings:

   1. Items penetrating floor mats and frames, including door control devices.
   2. Divisions between mat sections.
   3. Perimeter floor frames.

D. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mats.
2. Tread Rail: Sample of each type and color.
3. Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Ultra Entry by Matter Surfaces.

B. Acceptable Manufacturers:

1. C/S Group.
2. Nystrom, Inc.
3. Pawling Corporation.

2.2 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

1. Uniform floor load of 300 lbf/sq. ft.
2. Wheel load of 350 lb per wheel.

B. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 FLOOR MAT AND FRAMES

A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.

B. Vinyl Foot Grid: Constructed from 30% post-industrial recycled polyvinyl chloride (PVC) if gray or other colors, and up to 100% post-industrial recycled PVC if black. Welded in a non-hinged, grille design with an embossed non-skid surface (*non-embossed surfaces not acceptable*) to sizes indicated with the following characteristics:

1. Extruded PVC Grid for recess/roll up, with polymide nylon 6.6 fiber insert in color.

a. Color: To be selected from manufacturer’s standard.

C. Framing for Vinyl Foot Grille
1. Recessed Application: Manufacturer's standard 2” extrusion frame.
a. Extruded Aluminum: ASTM B 221, Mill finish.

2.4 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.5 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.6 ALUMINUM FINISHES

A. Mill finish.

2.7 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
3. Delay setting mats until construction traffic has ended.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 126600 - TELESCOPING STANDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall-attached telescoping stands.
2. Recessed telescoping stands.

1.2 DEFINITIONS

A. Forward Folding: Wall- or floor-attached bleachers that open in the forward direction by moving the front row away from the stack to the fully extended position.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
2. Include load capacities, assembly characteristics, and furnished accessories.
3. Include electrical characteristics of electrical components, devices, and accessories.

B. Shop Drawings: For telescoping stands in both stacked and extended positions.

1. Include plans, elevations, sections, and attachment details.
2. Include load capacities.
3. Show seating layout, aisle widths, row-lettering and seat-numbering scheme, and wheelchair accessibility provisions.
4. Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of exposed product and for each color and texture required.

1. Include Samples of accessories involving color and finish selection.

D. Samples for Verification: For the following products prepared on Samples of size indicated below:

1. Seating Material: 6-inch- square Sample of each seating material, color, and finish indicated.
2. Upholstery Fabric: 12-inch- square Sample of fabric from dye lot to be used for the Work, with specified treatments applied.

E. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for certified wood.>
3. <Double click to insert sustainable design text for composite wood.>

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of telescoping stand assembly.

B. Material Certificates: For each type of flame-retardant treatment of upholstery fabric.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For telescoping stands.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Procedures for conducting periodic inspections.
b. Precautions for cleaning materials and methods that could be detrimental to telescoping-stand finishes and performance.
c. Methods for maintaining upholstery fabric.

1.6 QUALITY ASSURANCE

A. <Double click to insert sustainable design text for manufacturer qualifications.>

B. <Double click to insert sustainable design text for vendor qualifications.>

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

D. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of telescoping stand assembly that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including bench seating and attached components.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Periods: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Telescoping stands to withstand the effects of gravity loads, operational loads, and other loads and stresses in accordance with ICC 300.

B. Fire-Test-Response Characteristics of Upholstered Chairs: Comply with California Technical Bulletin 117.

C. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide telescoping stands from one of the following manufacturers:
1. Hussey
2. Interkal
3. Irwin Seating

2.3 WALL-ATTACHED TELESCOPING STANDS

A. Wall-Attached Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to wall construction.
1. Row Spacing: 26 inches.
2. Row Rise: 9-5/8 inch
3. Seat Type: Benches.
4. Operation: Electrically operated, with friction-type, integral power unit.
5. Electrical Characteristics for Each Seating Section:

a. Horsepower: 1/2.
b. Single-Phase Voltage: 115 V ac, 60 Hz.

6. Electrical Controls:

a. Control Devices: Wireless control system.
b. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.
c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 ft., mounted under telescoping seating for audio and visual warning during operation.

d. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

2.4 RECESSED TELESCOPING STANDS (Gym)

A. Recessed Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to building construction so that closed stands are recessed in opening.
1. Row Spacing: 24 inches.
2. Row Rise: 9-5/8 inches.
3. Seat Type: Benches.
4. Operation: Electrically operated, with friction-type, integral power unit.
5. Electrical Characteristics for Each Seating Section:

a. Horsepower: 1.
b. Three-Phase Voltage: 208 V ac, 60 Hz.

6. Electrical Controls:

a. Control Devices: Wireless control system.
b. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.
c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 ft., mounted under telescoping seating for audio and visual warning during integral power operation.
d. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

2.5 RECESSED TELESCOPING STANDS (Black Box)

A. Recessed Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to building construction so that closed stands are recessed in opening.
1. Row Spacing: 30 inches.
2. Row Rise: 9-5/8 inch.
3. Seat Type: Chairs.
4. Operation: [**Electrically operated, with friction-type, integral power unit**] [**Electrically operated, with non-friction-type, integral power unit**].
5. Electrical Characteristics for Each Seating Section:

a. Horsepower: [**1/2**] [**1-1/2**] [**2**] <**Insert horsepower**>.
b. Three-Phase Voltage: 208 V ac, 60 Hz.

6. Electrical Controls:

a. Control Devices: Wireless control system.

b. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.
c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 ft., mounted under telescoping seating for audio and visual warning during integral power operation.
d. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

2.6 COMPONENTS

A. Benches: Seats and skirts.

1. Material: Molded plastic with contour surfaces.

a. Color: As selected by Architect from manufacturer's standard.

2. Bench Height: Not less than 16 inches or more than 18 inches.
3. Bench Depth: 10 inches.

B. Chairs: Rotating from upright, locked position to folded-down position that allows supporting platform to telescope for storage.

1. Operation: Automatic.
2. Chair Width: 20 inches.
3. Seat Height: Not less than 17 inches or more than 18 inches.
4. Seats: Molded plastic with padded upholstery insert.

a. Color: As selected by Architect from manufacturer's full range.

5. Backs: Molded plastic.

a. Color: As selected by Architect from manufacturer's full range.

6. Armrests: Molded plastic.

a. Color: As selected by Architect from manufacturer's full range.

C. Wheelchair-Accessible Seating: Locate seating cutouts to provide wheelchair-accessible seating at locations indicated on Drawings.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by ICC 300.
2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches from finished floor.

D. Deck: Aluminum.

1. Finish: Clear anodized.

E. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.

F. Safety Rails: Steel, finished with manufacturer's standard powder coat system.

1. Self-storing mid-aisle handrails located at centerline of each aisle with seating on both sides.
2. End rails (guards) that are telescoping and self-storing.
3. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
4. Color: As selected by Architect from manufacturer's full range.

G. Understructure: Structural steel.

1. Finish: Manufacturer's standard rust-inhibiting finish.
2. Color: Manufacturer's standard.

H. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 5 inches in diameter and 1-1/2 inches wide.

I. Control Devices:
1. Wireless: Hand-held, wireless transmission unit that operates wireless receivers in each operating section, with a transmission range to keep handheld control unit within close proximity and with full view of stand and its movement area. Provide one unit for each operating section.

J. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.7 ACCESSORIES

A. Steps:

1. Slip-resistant, abrasive tread at aisles.
2. Intermediate aisle steps, fully enclosed, at each aisle.
3. Transitional top step, fully enclosed, at each aisle where last row of telescoping stands is adjacent to a cross aisle.
4. Removable front steps, fully enclosed, at each aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.

B. Closure Panels and Void Fillers:

1. Aisle closures at foot level that produce flush vertical face at aisles when system is stored.
2. End panels covering exposed ends of stands in the stored position.
3. Back panels covering rear of freestanding units. Panels extend full height and width of unit.
4. Panels at cutouts and truncations for accessible seating.

5. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
6. Gap fillers for closing openings between stand units or between stand units and adjoining construction.

C. Signage:
1. Accessibility signs at each accessible space and accessible aisle seat.

2.8 MATERIALS

A. Molded Plastic: High-density polyethylene; blow or injection molded, color-pigmented, textured, impact-resistant, with integral reinforcing ribs for attachment and anchoring points. Provide with UV inhibitors to retard fading.

2.9 FABRICATION

A. Fabricate telescoping stands to operate easily without special tools or separate fasteners unless otherwise indicated.

B. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

C. Form exposed work with flat, flush surfaces, level and true in line.

D. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.

1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install telescoping stands in accordance with ICC 300 and manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.

B. Adjust hardware and moving parts to function smoothly, and lubricate, test, and adjust each telescoping stand unit to operate in accordance with manufacturer's written instructions.

C. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up factory-applied finishes or replace components as required to restore damaged or soiled areas.

D. Replace upholstery fabric damaged during installation or work of other trades.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, operate, and maintain telescoping stands.

END OF SECTION 126600

SECTION 142100 ELECTRIC TRACTION ELEVATORS

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied but Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
    a. One fused three phase permanent power in building electrical distribution room
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME Al7.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
9. Access Doors: As required for access to governor and/or seismic switch. Access door shall be self—closing, self—locking if necessary and operable from the inside without a key.

DR Related sections:

1. Section 015000 — Temporary Facility and Controls
2. Section 033000 - Cast-in-Place Concrete:
3. Section 042000 - Unit Masonry
4. Section 055000 - Metal Fabrications
5. Section 071600 - Cementitious Waterproofing
6. Section 230000 - Heating, Ventilating, and Air Conditioning
7. Section 260000 - Electrical
8. Section 263000 - Electric Power Generating and Storing Equipment
9. Section 273000 - Voice Communications
10. Section 283100 - Fire Detection and Alarm
11. Section 310000 — Earthwork

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.2 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: (2) Monospace 500 gearless traction elevators – Machine Room-Less

B. Equipment Control: KCM831

C. Drive: Non Regenerative

D. Quantity of Elevators: 2 Elevators

E. Landings: 3

F. Openings: 3 Front

G. Travel: 28’ 0”

H. Rated Capacity: Elevators 1 & 2 — 3500 lb

I. Rated Speed: 150 FPM

J. Clear Hoistway Inside Dimensions: Elevator 1 = 9’-0” wide x 8’-1” deep. Elevator 2 = 9’-1” wide x 8’-0” deep.

K. Cab Height: 7'-6”

L. Clear height under suspended ceiling: 7'-4"

M. Entrance Width and Type: 42" and Right Hand Single Slide (both).

N. Entrance Height: 7'-0"

O. Main Power Supply: 480 V Volts + 5%, three-phase

P. Operation: Simplex

Q. Machine Location: Inside the hoistway mounted on car guide rail

R. Control Space Location: Integrated control

S. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic

T. Maintenance Service Period: 12 Months

1.3 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed + 5% of contract speed under any loading condition or direction of travel.

2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance

1. Vertical Vibration (maximum): ISO 18738/ISO 8041 system pk-pk 15 mg
2. Horizontal Vibration (maximum): ISO 18738/ISO 8041 system pk-pk 12 mg

3. Jerk Rate (maximum): 1 mls'

4. Acceleration (maximum): 0.4 m/s^2

5. In Car Noise: 55 dB(A) Maximum

6. Leveling Accuracy: +0.2 inches

7. Starts per hour (maximum): 180

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.

2. Layout, finishes, and accessories and available options.

3. Controls, signals and operating system.

4. Color selection charts for cab and entrances.

C. Shop Drawings:

1. Clearances and travel of car.

2. Clear inside hoistway and pit dimensions.

3. Location and layout of equipment and signals.

4. Car, guide rails, buffers and other components in hoistway.

5. Maximum rail bracket spacing.

6. Maximum loads imposed on building structure.

7. Hoist beam & OSHA tie off beam requirements.

8. Location and sizes of access doors.

9. Location and details of hoistway door and frames.

10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years' experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible for the cost of storage at an approved facility. Additional labor costs for double handling will be the responsibility of the General Contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.7 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon final acceptance of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.8 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 Months after date of final acceptance.

Predictive maintenance shall be included for the full maintenance period. This service must be capable of using Al-based analytics to identify potential equipment issues and notifying the elevator provider via an internet connection.

Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service to be performed during regular working hours of regular working days and shall include emergency call back service during regular working hours.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2: PRODUCTS

2.1 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:

1. Basis of Design: MonoSpace 500 traction elevators by KONE, Inc. (www.kone.com).

2. Other acceptable machine room-less products: manufacturer with minimum 15 years' experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.2 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer-based control system to perform all functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non- erasable EPROM and operating system firmware.

4. Variable field parameters and adjustments shall be contained in a non- volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller(s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

2.4 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: Extruded Aluminum.

2. Doors: Hollow metal construction with vertical internal channel reinforcements.

3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.

4. Entrance Finish: Brushed Stainless Steel.

5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.5 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Car Safeties: Device will be provided and mounted under the car platform, securely bolted to the Car Frame. The safety will be actuated by a centrifugal governor mounted at the top of the hoistway. The Safety is designed to operate in case the car attains excessive descending speed.

C. Platform: Platform shall be all steel construction.

D. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

E. Car Wall Finish:

1. Side Walls: Applied Plastic Laminate Walls

2. Rear Wall: Applied Plastic Laminate Walls

3. Car front, Door and Skirting: Brushed Stainless Steel

4. Ceiling: Brushed SST Finish, with 4 LED lights

5. Handrails: Brushed Stainless Steel

   a. Rails to be located on of car enclosure.

6. Sills: Aluminum extruded.

F. Cab Wall Protection Pads to be included

G. Flooring: By others. (Not to exceed 31b/sqft and 1/2" finished depth.)

H. Emergency Car Signals

l. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.

2. Emergency Car Lighting: Provide emergency power unit employing a 12- volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

I. Ventilation: Manufacturer's standard cab fan

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be Brushed Stainless Steel

1. Main Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a Brushed Stainless Steel finish.

2. Additional features of car operating panel shall include:

a. Car Position Indicator within operating panel Brushed Stainless Steel

b. Elevator Data Plate marked with elevator capacity and car number on car top.

c. Help buttons with raised markings.

d. In car stop switch per local code.

e. Call Cancel Button.

B. Hall Fixtures: hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. hall fixtures shall have a Brushed Stainless Steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish.

D. Camera Security System: Provide provisions inside cab for camera security system. Mount camera in corner of cab. Camera, control unit, mounting brackets, wiring materials, logic circuits, etc., by Security Subcontractor. Travelling cable by elevator contractor.

2.7 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

2. Zoned Car Parking.

3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Independent Service.
2. Hoistway Access Bottom Landing.
3. Hoistway Access Top Landing.
4. Car Wall Protection Pads

5. Emergency Battery Power Supply — Alternate Price
   a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if required) shall be provided by others.
   b.

D. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

E. Additional Operating Features to include:

1. Independent Service.
2. Hoistway Access Bottom Landing.
3. Hoistway Access Top Landing.
4. Car Wall Protection Pads

5. Emergency Battery Power Supply — Alternate Price
   a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if required) shall be provided by others.

F. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.

2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.

4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is intemipted.

5. Provide the means from the controller to reset the governor over speed switch and

also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

7. Provide the means for the control to reset elevator earthquake operation.

2.8 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of intemiption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3: EXECUTION

3.1 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of work, verify projections greater than two inches (four inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.

E. Prior to start of work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to final acceptance.

3.4 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.

2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

3. Ensure adequate support for entrance attachment points at all landings.

4. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

5. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.

6. Coordinate interface of elevators and fire alarm system.

7. Coordinate interface of dedicated telephone line.

3.5 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction

B. Obtain required permits and provide originals to Owner's Representative.

3.6 DEMONSTRATION

A. Prior to final acceptance, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION xxxxxx

Hillcrest Middle School
Trumbull, Connecticut

19 May 2026

Construction Documents
Specifications – Volume 2

State Project No. 144-0108 N

TSKP Project No. 250501

TSKP Studio
Architect

Langan
Civil/Landscape/Traffic/HazMat

Michael Horton Associates
Structural

CMTA
Mechanical/Elec/P/FP

Newcomb and Boyd
IT and Acoustics

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SECTION 210501 - COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

b. Refer to Specification Section 019113 General Commissioning Requirements.

1.2 CODES & STANDARDS (INCLUDING BUT NOT LIMITED TO THE FOLLOWING)

a. 2022 Connecticut State Building Code (CSBC) (IBC 2021 w/ amendments)

b. 2022 Connecticut State Fire Safety Code (CSFSC)

c. 2022 Connecticut State Fire Prevention Code (CSFPC)

d. NFPA 13 - Standard for the Installation of Sprinkler Systems

e. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

1.3 GENERAL SCOPE OF WORK

1. The scope of fire protection work for this project consists of a complete new automatic wet-type fire protection system within the building or modifications to existing systems.

2. The final sprinkler design and layout including updated flow test information and hydraulic calculations shall be provided by the Contractor and submitted for all required permitting and approval.

3. It shall be the responsibility of this Contractor to prepare drawings showing complete and fully coordinated sprinkler head and piping layouts in accordance with the requirements of NFPA and those authorities having jurisdiction over this project. It shall also be the responsibility of the Sprinkler Subcontractor to obtain all approvals from local authorities and the Owner's Insurance Underwriter prior to submission to the Architect.

4. All manufacturers, suppliers, fabricators, contractors, etc. Submitting proposals to any part of their work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents of Contract Documents. In case of conflict between these common work results and the general and/or special conditions, the affected Contractor shall contact the Engineer for clarification and final determination prior to the bid.

5. The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating fire protection systems indicated or specified in the Contract Documents.

6. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete any part of the fire protection systems in a substantial manner, in compliance with the requirements stated, implied or intended in the Plans and/or Specifications, shall be included in the bid as part of this Contract.

7. It is not the intent of this section of the Specifications to make any Contractor, other than the General Contractor, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

8. The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or Specification numbering system used which identifies disciplines is solely for the Architect and Engineer's convenience and is not intended to define a subcontractor's scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Plans and Specifications when preparing bids, prices and quotations.

9. This section of the Specifications or the arrangement of the Contract Documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade contractor or sub-contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the General Contractor holding the prime contract.

10. It is the intent of the Contract Documents to deliver to the Owner a new, complete and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

11. In general, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least forty-eight (48) hours prior to the interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage for the Contractors involved until a complete schedule of interruptions can be developed.

12. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Contractor's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

13. Each Contractor shall also be governed by any unit prices and addenda insofar as they may affect part of their work or services.

1.4 DEFINITIONS AND ABBREVIATIONS

1. Contractor - Any Contractor whether bidding, proposing or working independently or under contract with General Contractor, and who installs any type of Mechanical/Fire protection Work as specified in the Contract Documents or the General Contractor.

2. Engineer - The Consulting Mechanical-Electrical-Fire Protection Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
3. Architect - The Architect of Record for the project.
4. Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, General and Special Conditions, Addenda, Alternates, Unit Prices, Shop Drawings, Field Orders, Change Orders, Construction Contract with Owner, and other documents enumerated in the Owner/Contractor Agreement.
5. Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
6. The Project - All of the work required under this Contract.
7. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
8. Provide - Furnish and install complete, tested and ready for operation.
9. Install - Receive and place in satisfactory operation.
10. Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto or incorporated in the Contract Documents by reference.
11. Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
12. ADA - Americans with Disabilities Act.
13. ANSI - American National Standards Institute.
14. ASME - American Society of Mechanical Engineers.
15. IBC - International Building Code.
16. NEC - National Electrical Code.
17. NEMA - National Electrical Manufacturers Association.
18. NFPA - National Fire Protection Association.
19. OSHA – Occupational Safety and Health Administration.
20. UL - Underwriters Laboratories.

PART 2 – INTENT AND INTERPRETATION

2.1 GENERAL INFORMATION

1. It is the intention of the contract documents to call for a complete and operational system, including all components, accessories, finish work, etc. As necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the contract documents shall be provided and included in the contract sum.
2. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

3. The bidder/proposer shall completely review the contract documents. Any interpretation as to design intent or scope shall be provided by the engineer / architect. Should an interpretation be required, the bidder/proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the engineer shall be final.

4. The contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 – INDEMNIFICATION

3.1 GENERAL INFORMATION

1. Refer to Project General Conditions and Supplementary Conditions and Division 01.

2. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 4 – PLANS AND SPECIFICATIONS

4.1 GENERAL INFORMATION

1. The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their bid accordingly.

2. The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

3. The Plans and Specifications shall be considered to be complementary and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the contract and must be executed the same as though indicated by both.

4. Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

5. The Engineer shall reserve the right to make adjustments in location of piping, equipment, etc. Where such adjustments are in the interest of improving the project.

6. Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

7. Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

8. Each Bidder/Proposer shall review all Plans in the Contract Documents to ensure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur, it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular ensure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

9. Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

10. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

11. Where within the Contract Documents the word “typical” or “typ.” Is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

12. Each Contractor shall evaluate ceiling heights specified on architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

PART 5 – EXAMINATION OF SITE AND CONDITIONS

5.1 GENERAL INFORMATION

1. Each Bidder/Proposer shall inform their self of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.

2. Each Bidder/Proposer shall also fully acquaint their self with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

PART 6 – EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

6.1 GENERAL INFORMATION

1. When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. From that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.
2. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; unless specifically indicated; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states or countries are more stringent than these Specifications regarding such substitutions, then those laws shall prevail over these requirements.
3. Wherever any equipment and material are specified exclusively only such items shall be used unless substitution is accepted in writing by the Owner utilizing Procurement Substitution Requests or Substitution for Cause as indicated in Division 01 Specifications.
4. Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.
5. Ten (10) days prior to the submission of a proposal, each Bidder/Proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Bidder/Proposers signify that they have included the cost of all required items in the proposal and that the Bidder/Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 7 – CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.

7.1 GENERAL INFORMATION

1. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. In connection with their work. They shall also file all necessary Plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.
2. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to their part of the work prior to submission of a proposal.
3. The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
4. All materials furnished and all work installed shall comply with the national fire codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
5. All materials and equipment so indicated and all equipment and materials for the electrical portion of the fire protection systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.
6. All fire protection work shall be accomplished in accordance with local code requirements and the National Fire Protection Association.
7. The Contractor shall furnish three (3) copies of all final inspection certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
8. Where minimum code requirements are exceeded in the design, the design shall govern.
9. The Contractor shall insure that their work is accomplished in accord with the OSHA standards and that they conduct their work and the work of their personnel in accord with same.
10. Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the state department for environmental protection.

11. Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the Plans and Specifications require better materials, equipment, and construction than these minimum standards, in which case the Plans and Specifications shall be the minimum standards.

PART 8 – QUALIFICATIONS OF CONTRACTOR/WORKERS

8.1 GENERAL INFORMATION

1. All fire protection work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of a workers shall be made through the normal channels of Architect, Contractor, etc.
2. The installation of all fire protection systems by any Contractor shall be performed by a licensed Contractor with journeymen or master tradesmen as defined under state regulations and code.
3. All pipe fitting work shall be installed by workers normally engaged in this type work.
4. All electrical work shall be accomplished by licensed Contractors with journeymen or master electrician as defined under state regulations and code. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 9 – SUPERVISION OF WORK

9.1 GENERAL INFORMATION

1. The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 10 – CONDUCT OF WORKERS

10.1 GENERAL INFORMATION

1. The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that worker. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

PART 11 – COOPERATION AND COORDINATION WITH OTHER TRADES

11.1 GENERAL INFORMATION

1. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
2. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.
3. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 12 – GUARANTEES AND WARRANTIES

12.1 GENERAL INFORMATION

1. The Contractor shall guarantee all equipment, apparatus, materials, performance, and workmanship entering into their contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective for a minimum of one year in addition to the time frames outlined in the General Conditions of the contract. The effective date of completion of the work shall be the date of the Engineer's statement of substantial completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. To the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.
2. Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 13 – CHANGES IN MECHANICAL WORK

13.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 – CLAIMS FOR EXTRA COST

14.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 15 – MATERIALS AND WORKMANSHIP

15.1 GENERAL INFORMATION

1. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.
2. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.
3. Use extreme care in the selection of equipment and its installation to ensure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.
4. Each length of pipe, fitting, and devices used in the fire protection system shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

PART 16 – HAZARDOUS MATERIALS

16.1 GENERAL INFORMATION

1. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building or site.
2. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, ensure that their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
3. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
4. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.

5. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

6. No asbestos or mercury containing materials shall be installed in this project.

PART 17 – COORDINATION DRAWINGS

17.1 REFERENCE SPECIFICATION SECTION 01 31 00.

PART 18 – TEMPORARY SERVICES

18.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 19 –SURVEY, MEASUREMENTS AND GRADE

19.1 GENERAL INFORMATION

1. The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.

2. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

3. Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the Contract Documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 20 – PROTECTION OF EQUIPMENT

20.1 GENERAL INFORMATION

1. The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense.

PART 21 – REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT

21.1 GENERAL INFORMATION

1. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

PART 22 – EQUIPMENT SUPPORT

22.1 GENERAL INFORMATION

1. Do not support piping from existing plaster ceilings and/or supports. Each piece of equipment, apparatus, piping, or conduit mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

PART 23 – PIPE MOUNTING HEIGHTS

23.1 GENERAL INFORMATION

1. All exposed or concealed piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping shall, insofar as possible, run perpendicular or parallel to the building structure.

PART 24 –BROKEN LINES AND PROTECTION AGAINST FREEZING

24.1 GENERAL INFORMATION

1. No conduits, piping, troughs, etc. Carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping.

   All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Insulation on piping does not necessarily ensure that freezing will not occur.

PART 25 – WEATHERPROOFING:

25.1 GENERAL INFORMATION

1. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

PART 26 – FINAL CONNECTIONS TO EQUIPMENT:

26.1 GENERAL INFORMATION

1. The Contractor shall finally connect to fire protection services for equipment or accessories provided under this and other divisions of the work. Various equipment connections indicated are based upon “basis of design” equipment selections. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer’s recommendations. If in doubt, contact the Engineer prior to installation.

PART 27 – ACCESSIBILITY

27.1 GENERAL INFORMATION

1. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
2. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves.
3. Whether shown on the Plans or not, the Contractor shall provide in the bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

PART 28 – SCAFFOLDING, RIGGING AND HOISTING

28.1 GENERAL INFORMATION

1. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA standards and requirements. Remove same from premises when no longer required.

PART 29 – CONCRETE WORK

29.1 REFER TO DIVISION 03 SPECIFICATIONS.

PART 30 – RESTORATION OF NEW OR EXISTING LANDSCAPING, PAVING, SURFACES, ETC.:

30.1 GENERAL INFOMRATION

1. The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, landscaping, existing or new building surfaces and appurtenances, and any other items damaged or removed by their operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and/or Engineer.

PART 31 – MAINTENANCE OF EXISTING UTILITIES AND LINES

31.1 GENERAL INFORMATION

1. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily. Provide a seven (7) day written notice to Engineer, Architect and Owner prior to interrupting any utility service or line.
2. Known utilities and lines as available to the Engineer are shown on the Plans. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.
3. If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation in the respective area.
4. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
5. The Contractor shall repair to the satisfaction of the Owner and Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
6. Machine excavation shall not be permitted with ten feet of gas lines, fuel lines, electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only in accord with utility company, agency or other applicable laws, standards or regulations.
7. Protect all new or existing lines from damage by traffic, etc. During construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.
8. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping Plans, or in their absence, consult with the Architect.

PART 32 – CLEANING

32.1 GENERAL INFORMATION

1. The Contractor shall, at all times, keep the area of their work presentable to the public and clean of rubbish and debris caused by their operations; and at the completion of the work, shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.
2. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

PART 33 – NOISE, VIBRATION OR OSCILLATION

33.1 GENERAL INFORMATION

1. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, or exceeds the noise criteria limits as scheduled, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.
2. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. By means of flexible connectors, vibration absorbers, or other approved means.
3. The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 34 – INSPECTION, APPROVALS AND TESTS

34.1 GENERAL INFORMATION

1. Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.
2. The Contractor shall provide as a part of this contract any required agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.
3. The Contractor shall advise each inspecting agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing work. Failure of the inspecting agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
4. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such agency inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.
5. Approval by an agency inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
6. Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the agency inspectors to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 35 – ABOVE-CEILING AND FINAL PUNCH LISTS

35.1 GENERAL INFORMATION

1. The Contractor shall review each area and prepare and complete their own punch list for each of the subcontractors as required for the project schedule.
2. Seven (7) days notice shall be given to the Engineer for review of above ceiling work that will be concealed by tile or other materials. Seven (7) days notice shall be given to the Engineer for review of below ceiling work and final inspection.
3. When all work from the Contractor's punch list is complete at each of the major project stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven (7) days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review. The Contractor’s representative may be requested at the inspections.
4. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) for extra trips required to complete either of the above ceiling, below ceiling or final punch lists.

PART 36 – OPERATING INSTRUCTIONS AND TRAINING

36.1 GENERAL INFORMATION

1. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of one (1) day of eight (8) hours and as specified for other systems. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.
2. Each Contractor shall video each training session and furnish the video via thumb-drive (3 sets required). Also, furnish three digital sets on thumb-drive and three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
3. Each Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 37 – RECORD DRAWINGS

37.1 GENERAL INFORMATION

1. The Contractor shall insure that any deviations from the design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this Specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of fire protection systems. Also, pay particular attention to deviations in the control systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

PART 38 – COMMISSIONING - CONTRACTOR RESPONSIBILITIES

38.1 GENERAL INFORMATION

1. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
2. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
3. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
4. Attend commissioning team meetings.
5. Integrate and coordinate commissioning process activities with construction schedule.
6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

PART 39 – FIRE PROTECTION DEMOLITION & SALVAGE

39.1 GENERAL INFORMATION

1. It is the intent of the project to completely remove all components of the existing fire protection system within the building whether specifically noted or otherwise. The general scope of the fire protection system demolition is indicated on the drawings. Where fire protection systems are removed, also remove all associated branch piping, hangers, concrete pads, controls, etc. Contractor shall field verify existing conditions prior to bid. Refer to the demolition drawings for general indication of equipment and piping to be demolished. If other equipment or piping is found during construction which is not indicated on the drawings, it must also be removed.

2. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing by qualified tradesmen of all holes, etc. In the ceiling, wall, roof and floors where fire protection equipment and systems are removed.

END OF SECTION

SECTION 210502 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 - GENERAL

1.1 General Information

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Submit required shop drawings and product data in accordance with Division 01 requirements and the project schedule, and sufficiently in advance to avoid delay of the Work. Refer to Division 1's requirements for shop drawing submittal requirements.

C. Provide all shop drawings and submittals in electronic/PDF format through proper channels. The Engineer's comments will be returned in electronic format.

D. Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.

E. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

F. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

G. The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.

H. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

I. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.

J. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. In the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. To the equipment.

K. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

L. Colors for equipment in other than back of house spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

M. All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.

N. Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

PART 2 - SHOP DRAWINGS

2.1 General Information

A. Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:
1. Fire Protection Sprinkler Components & System
2. Product Data for heads, valves, alarms, switches, FDC, and BFP
3. Seismic bracing/hanger data
4. Test/drain and identification signage
5. Shop Drawings
6. Hydraulic Calculations with Updated Flow Test
7. Hazard Classification
8. System Test Reports
9. Record Drawings at closeout

2.2 Special Notes

A. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for all items marked above.

B. These documents shall include at least:
   1. Detailed operating instructions
   2. Detailed maintenance instructions including preventive maintenance schedules.
   3. Addresses and phone numbers indicating where parts may be purchased.
   4. Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.

END OF SECTION

SECTION 210553 - IDENTIFICATION FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Piping identification.
   2. Valve identification.
   3. Equipment identification.

1.3 QUALITY ASSURANCE

A. Piping System Identification: ANSI A13.1, "Scheme for the Identification of Fire Protection Piping Systems."

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. Conform to ANSI A13.1.
   1. Pressure-sensitive vinyl (self-sticking) material.
   2. Mechanically Fastened Type: Snap-on or strap-on.
      a. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.

B. Provide with direction of flow arrows.
   1. Size of Letters Legend

Outside Diameter of Pipe or Pipe Covering	Length of Color Field	Size of Letters and Arrows
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12inch	1-1/4 inch
8 to 10 inch	24inch	2-1/2 inch
Over 10 inch	32inch	3-1/2 inch

2.2 EQUIPMENT NAME PLATES

A. 1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters.
   1. Two 3/8-inch mounting holes.
   2. Lettering size: Minimum 1/2-inch high.
   3. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

2.3 ACCEPTABLE MANUFACTURERS

A. Pipe, Valve, and Equipment Markers
   1. Craftmark Identification Systems.
   2. W. H. Brady Co.
   3. EMED Company, Inc.
   4. Kolbi Industries, Inc.
   5. 3M Co.
   6. Seton Name Plate Corp.

PART 3 - EXECUTION

3.1 VALVE AND EQUIPMENT IDENTIFICATION

A. Provide engraved valve tags on all fire protection control valves, sectional valves, drain valves, and test valves. Tags shall correspond to valve schedules/charts included in the record documents and operation and maintenance manuals.

B. Provide identification signage for inspector’s test connections, main drains, fire department connections, and risers as applicable to the project.

C. Designate all equipment by distinguishing numbers and letters on charts and/or diagrams.

D. Install tags on all devices with numbers and letters corresponding to charts.

E. Fasten tags securely to devices with tag fasteners in manner for easy reading.

F. Attach equipment nameplates in conspicuous location on item of equipment or apparatus.
   1. Secure nameplates with self-tapping screws, or nuts and bolts.

G. For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

H. Furnish charts including device number, location (room number, department) and purpose.
   1. Include in "Operation and Maintenance Manuals."

3.2 PIPE IDENTIFICATION

A. Locate pipe markers as follows:
   1. Next to each valve and fitting, except on equipment.
   2. At each branch or riser take-off.
   3. At each passage through walls, floors, and ceilings.
   4. At each pipe passage to underground.
   5. On all horizontal pipe runs every 20 feet, at least once in each room and each story is traversed by piping system.
   6. Identify piping contents, flow direction.

B. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

3.3 SERVICE ABBREVIATIONS

A. General
   1. SPK Sprinklers
   2. FP Fire Protection
   3. FDC Fire Department Connection
   4. TEST
   5. DRAIN

END OF SECTION

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE PROTECTION, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Pipe hanger and supports.
   2. Pipe and equipment anchors.
   3. Pipe sleeves.
   4. Pipe Seismic bracing and restraint.
   5. Miscellaneous support steel
   6. Sleeves and Penetration seals

1.3 QUALITY ASSURANCE

A. Pipe Hanger Standards: NFPA 13 and Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers: Elcen Metal Products Co., B-Line Systems Inc., Carpenter and Paterson Inc., Anvil.

B. Concrete Anchors: Powers, DeWalt, Simpson, Hilti, ITW, or approved equal

C. Pipe and Equipment Anchors
   1. Shop-fabricated.
   2. Field-fabricated.

D. Sleeves
   1. Shamrock Industries, "Crete-sleeve" plastic hole forms.
   2. Proset Systems Inc., "Proset" fire-safe pipe penetrations.
   3. Shop for field fabricated.

E. Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc.

2.2 PIPE HANGERS

A. General
1. Materials, Design and Manufacture: MSS SP-58.
2. Fabrication and Installation: MSS SP-89.
3. Selection and Application: MSS SP-69.
4. Hangers Used Directly on Copper Pipe: Copper or cadmium-plated.
5. All Other Hangers and Channels, Angles, and Supporting Steel: Cadmium-plated or galvanized.
6. All Hanger Rods of Continuous Thread Type: Zinc Coated, Electrogalvanized, Galvanized or cadmium plate after threads are cut.
7. Galvanize all structural steel, angles, rods, channels, and hardware that are not provided with a rustproof finish.
8. Screw Threads on Hangers and Fittings: Conform to Class 2A and 2B of ANSI B1.1.

B. Pipe Hangers for Bare Pipe
1. Bare Pipe:

MSS	B-Line	ANVIL
1	B3100/02 C	260
3	B3144/46	295
4	B3142	216

C. Pipe Hangers in Other Situations: See MSS-SP-69.

D. Hanging Rollers, Cast Iron
1. MSS Type 41.
2. B-Line B3114.
3. Anvil 171.

E. Supporting Roller, Cast Iron
1. MSS Type 44, 45, or 46.
2. B-Line B3117SL, B3117, B3118SL or B3119.
3. Anvil 271, 277, or 274.

F. Concrete Inserts
1. Continuous Slot Inserts
   a) Anvil Power Struct PS349.
   b) B-Line Figure B32I.Individual Inserts
   c) Anvil Figure 282, or 281.
   d) Do not exceed manufacturer's recommended load on any insert.

G. Beam Clamps
1. B-Line Figure B3054 or B3055.

2. Anvil Figure 133, 218, 228, 292.

H. Attachment to “Z” Type Purlin
1. PHD Figure 290.
2. Michigan No. 315.

I. Attachment to Wood Structure
1. Provide angle clips and lag screws or side beam connectors: PHD figure 920 or 905.
2. Strap-type hangers not acceptable.

2.3 PIPE SLEEVES AND SEALANTS

A. Sleeves - General
1. Sleeve all piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping.
2. Box out openings larger than 14 inch diameter.

B. Sleeves, Steel Pipes: Use in following locations:
1. Fire-rated and smoke-rated construction.
2. Structural steel members (when approved by A/E).
3. Floors: Galvanized.
4. Concrete walls.
5. Mechanical rooms, tunnels, and stairwells.
6. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

C. Sleeves for Future Work: Same as for this work.

D. Sleeves in Other Locations: As detailed. If not detailed, use 18 ga galvanized sheet metal.

E. Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.
1. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.

F. Sleeve Sizes
1. Length: Ends flush with finished surfaces.
2. Diameter

e) Minimum 3 inch.
f) Minimum 1 inch larger than pipe and pipe insulation.
g) In concrete, 1-1/2 inch larger than pipe.
h) Diameter suitable for construction tolerances and to receive sealant, when indicated.

G. Sealants: Seal annular space around piping.
1. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity.

i) Provide proper material for each typical application as described by manufacturer.

2. Acceptable Manufacturers

j) Base

- Dow Corning "Fire Stop".
- Nelson "Flameseal".
- 3M "Fire Barrier".
- Pipe Shields Inc., Model WFB, DFB, or QDFB Series.

3. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.
4. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

PART 3 - EXECUTION

3.1 GENERAL

A. Structural Considerations
1. Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any fire protection piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading."
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to bottom of concrete filled floor deck, except by permission of A/E.
5. Attach hangers to beams whenever possible.

B. Install piping systems with approved hangers and supports to prevent sagging and to maintain proper alignment. Install supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports adjacent to valves, vertical risers, and changes in direction as required by NFPA 13 and manufacturer requirements.

C. Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.

D. Do not weld to structural steel without special permission of the A/E. Do not use wooden plugs for any form of fastening.

E. Space pipe hangers for horizontal piping as indicated, unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.

F. Run piping substantially as shown on the Drawings. Run pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate exact

locations of mains, risers and runouts in the field with the various Trade Contractors and the A/E.

G. Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the A/E. Anchors shall be approved by the A/E before they are used.

3.2 PIPE HANGERS AND SUPPORTS

A. Provide a hanger within one (1) foot or less of each horizontal elbow and valves that are above three (3) inches in size. If spacing between horizontal elbows (or plugged tees used as elbows) is less than six (6) feet, provide only one (1) hanger located between the elbows.

B. For fire protection piping, space according to NFPA 13.

C. Pipe Hanger Loading
1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inch	610 lb.
1/2 inch	1,130 lb.
5/8 inch	1,810 lb.
3/4 inch	2,710 lb.

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

D. Trapeze Hangers
1. Suspend trapeze hangers from concrete inserts of approved structural clips.
2. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support.

E. Vertical Pipe Supports
1. Support all vertical pipe runs in pipe chases at base of riser.
2. Support pipes for lateral movement with clamps or brackets.

F. Concrete Inserts
1. Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required.
2. Provide concrete inserts in time for installation in concrete.

3.3 ANCHORS

A. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.

B. Pipe Anchors
   1. Provide as indicated and required to permit complete installation of system.
   2. Do not anchor piping to plaster or gypsum wallboard partition walls.
   3. Provide anchoring devices at the locations indicated.
   4. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

3.4 SLEEVES

A. Coordinate location of any opening in structural systems with A/E and other trade contractors.

B. Maintain rating of fire- and smoke-rated construction.

C. Set sleeves plumb or level, in proper position, tightly fitted into the work.

D. Set all sleeves with ends flush with finished wall and ceiling surfaces.

E. Seal around all pipes and use firestopping for all fire protection penetrations through floor slabs, fire rated walls and partitions, and at each floor level in vertical utility service shafts.
   1. Install firestopping as described in manufacturer's installation instructions.

F. Seal around all sleeves.

G. Fill openings made by others for piping penetrations, with same construction as work opening is in, or construction of equivalent fire or smoke rating.

H. Firestopping shall be provided under the applicable firestopping specification section, coordinated by this Contractor.

3.5 MISCELLANEOUS STEEL

A. Piping Contractor (or Fire Protection Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.

B. Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.

C. All miscellaneous steel to be galvanized steel. Repair galvanized steel at field cuts and connections.

3.6 SEISMIC RESTRAINTS

A. Provide seismic restraints per NFPA 13.

B. Do not mix seismic bracing designs within a new system design.

C. Seismic force applications shall be engineered by the contractor and submitted for approval prior to installation.

D. Provide hanger rod stiffeners, braces, and seismic attachments as required by NFPA 13 and by the submitted engineered seismic bracing design.

END OF SECTION

SECTION 211313 - FIRE PROTECTION SYSTEMS – WET-PIPE

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON REQUIREMENTS FOR FIRE PROTECTION and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Each Contractor's attention is also directed to Specification Section HANGERS AND SUPPORTS FOR FIRE PROTECTION PIPING AND EQUIPMENT .

C. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

D. Refer to Specification Section 019113 General Commissioning Requirements.

1.2 DESCRIPTION OF WORK

A. Work under this Section shall include furnishing and installing a complete wet-pipe automatic sprinkler system, including sprinkler piping, fittings, valves, alarm devices furnished with the sprinkler system, supervisory devices, inspectors' test assemblies, drains, sprinkler heads, escutcheons, sleeves, hangers, seismic bracing, and all accessories required for a complete and code-compliant installation.

B. Coordinate all fire alarm interface devices and wiring requirements with Division 26 and Division 28.

C. Fire protection systems include:
1. Wet-Pipe Sprinkler Piping and Fittings
2. Heads and Accessories
3. Valves, Alarms, Flow Switches, Drains
4. Fire Department Connection
5. Backflow Preventer
6. Standpipes
7. Seismic Bracing and Hangers
8. Sleeves, Escutcheons, Identification

1.3 QUALITY ASSURANCE

A. Design Criteria

1. Provide a complete fire protection system as indicated and as required by local authorities.
2. Where there is conflict between local authority requirements or other agencies' standard requirements and these Drawings and specifications, requirements of local authorities or other agencies shall govern.
3. Design and install the entire system in accordance with indicated codes, standards and regulations.
4. Contractor shall hydraulically calculate the sprinkler system in accordance with NFPA 13 for the hazard classification indicated or required by the AHJ. Hydraulic calculations shall be based on a current certified flow test and shall include a safety margin of 5 psi or 10 percent of system demand, whichever is greater.
5. Do not downsize piping indicated to serve future areas.
6. Drawings are diagrammatic only to indicate rooms/areas of sprinkler protection and piping clearances when appropriate.
7. Submit coordinated shop drawings and hydraulic calculations to the AHJ and all required reviewing agencies for approval. Obtain all required approvals prior to fabrication and installation.
8. Coordinate head locations with ceiling layouts.
9. Provide a supervised floor control valve assembly at each floor unless otherwise indicated or prohibited by system configuration/authority having jurisdiction.
10. Each assembly shall include control valve, tamper switch, waterflow switch, test and drain assembly, pressure gauges, inspector's test connection, sight glass, and drain piping as required for a complete installation.
11. Limit the velocity of the water in the sprinkler system piping to 20 feet per second.
12. Coordinate sprinkler system layout with structure, ceilings, lighting, ductwork, and other trades to avoid conflicts and maintain code-required coverage and clearances.

B. Water Supply Requirements
1. Fire flow to meet local fire department and State of Connecticut requirements.
2. Fire protection contractor shall arrange and pay for a certified fire hydrant flow test performed near the point of service connection, unless a current test acceptable to the AHJ and Engineer is provided by others. Submit copies of the certified test report to the Engineer, Owner, and authorities having jurisdiction as required.
3. Hazard Class: Refer to Contract Drawings for sprinkler protection requirements and hazard classification.
4. Indicate classification of all sprinkled spaces on shop drawings.

C. Codes and Standards
1. NFPA 13, Sprinkler Systems.
2. NFPA 14, Standard for the Installation of Standpipe and Hose Systems.
3. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances.
4. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
5. NFPA 72, National Fire Alarm and Signaling Code
6. Connecticut State Fire Code and applicable adopted codes and amendments.

D. Authorities Having Jurisdiction
1. Connecticut State Inspection Agency (Building Code Dept.).
2. Trumbull Inspection Agency (Building Code Dept.).

3. State Fire Marshal's requirements.
4. Local Fire Marshal's requirements.
5. Connecticut State Insurance Services Office requirements.
6. Owner's insurance company or loss prevention division.

E. Installer's Qualifications
1. The systems are to be designed and installed by a Connecticut State-certified firm regularly engaged in the design and installation of automatic fire protection systems in accordance with the requirements of the National Fire Protection Association and the State of Connecticut, and by the authorized Insurance and Reviewing Agents of the Owner. Evidence to support the above requirements is to be provided, and any proposed installer who cannot show suitable experience will be rejected.
2. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this Project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the A/E and Owner.

1.4 JOB CONDITIONS

A. Arrange and pay for all permits, fees and inspections required.

B. Fire sprinkler contractor shall furnish all sprinkler-system-mounted supervisory and alarm devices, including waterflow switches, tamper switches, and related components required for a complete and code-compliant system. Coordinate electrical requirements, wiring responsibilities, and interface with the fire alarm system with the Electrical Contractor and fire alarm contractor. Electrical Contractor shall provide conduit, wire, and final electrical connections unless otherwise indicated.

C. Coordinate the exact location of this work with the work of other trades prior to fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and section of piping as required to meet job conditions. Coordinate with and review all related Drawings of all trades prior to start of work.

1.5 WARRANTY

A. Provide manufacturer’s standard warranty and contractor’s warranty in accordance with Division 01 requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packaging with labels intact. Store in a clean, dry, protected location.

B. Protect piping, fittings, sprinkler heads, valves, and accessories from dirt, moisture, corrosion, and physical damage. Reject and replace any damaged or deteriorated materials at not additional cost to the Owner.

C. Keep piping capped or plugged during storage and installation to prevent contamination.

D. Handle sprinkler heads carefully. Do not install heads that are dropped, damaged, painted, or contaminated. Keep protective covers in place until installation.

E. Protect valves and devices from debris and damage. Keep openings capped until installation.

F. Protect installed work from damage during construction. Replace damaged components at no additional cost to the Owner.

G. At completion, remove temporary protections, clean all components, and leave systems ready for testing and operation.

H. Do not install any materials that have been exposed to conditions that could impair performance, including corrosion, contamination, or physical damage.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND HANGERS

A. Fire Sprinkler Piping Above Ground
   1. Black steel, Schedule 40 (1 inch thru 2 inches) and Schedule 10 (2-1/2 inches thru 8 inches), with threaded or mechanical joints, ductile iron couplings, and ductile iron grooved fittings. Schedule 10 piping shall be permitted only where compliant with NFPA 13 and used with listed grooved mechanical systems.
   2. Threaded Fittings: Malleable iron.
   3. Mechanical Joint Fittings: Black steel pipe with rolled-grooved ends by Victaulic, Grinnell or approved equal.
   4. Grooved mechanical couplings shall consist of two ASTM A536 ductile iron housings, pressure-responsive, synthetic rubber gasket, and plated steel bolts and nuts.
   5. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.
      a. 1-1/4-inch through 8-inch: “Installation Ready” stab-on-design, for direct “stab” installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic FireLock EZ Style 009H (1-1/4 inch to 4 inch) or approved equal and Victaulic Style 107H QuickVic (2 inch to 8 inch) or approved equal.
      b. 10-inch and larger: Victaulic Style 07 Zero-Flex® standard rigid coupling.
   6. Flexible Type: Provide where required for seismic applications in accordance with NFPA 13 and applicable IBC/ASCE standards.
      a. 2 inch through 8 inch: “Installation Ready” stab-on design, for direct “stab” installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic Style 177 QuickVic or approved equal.
      b. 10 inch and larger: Victaulic Style 75 or 77 standard flexible couplings or approved equal.
   7. Provide corrosion-resistant coatings or materials where piping is exposed to moisture, exterior conditions, or corrosive environments.

B. Fire Sprinkler Piping Below Ground: Ductile cast iron, lined and coated, with mechanical joint fittings.

C. Pipe Hangers
1. All purpose type, UL-listed and FM-approved.
2. Comply with Division 21 Section “Hangers and Supports for Fire Suppression Piping and Equipment”.
3. Space in accordance with requirements of NFPA 13.
4. Hangers, hanger rods, inserts and clamps constructed as approved by NFPA 13.

2.2 VALVES AND HOSE CONNECTIONS

A. Valves and Hose Connections - General
1. UL approved and/or FM global listed.
2. Minimum 175 psi class.
3. Outlet/inlet threads to fit local fire department standards.
4. Finish (including accessories, caps and wall plates)
   a. Rough brass.
   b. Polished brass.
   c. Rough chrome.
   d. Polished chrome plate.

B. Gate Valves
1. 2 inch and Smaller: 175 lb. UL-FM bronze, non-shock, solid wedge, OS&Y gate valve. Replaceable bronze wedge facing rings. Valve to be capable of being repacked under pressure with valve wide open. Screwed ends.
2. 2-1/2 inch and Larger: 175 lb. UL-FM iron body non-shock, solid wedge, OS&Y gate valve. Replaceable wedge facing rings and yoke bonnet. Valve to be capable of being repacked under pressure with valve wide open. Flanged ends.
3. 2-1/2 inch and Larger: 250 psi CWP, UL-FM, ductile iron body, resilient wedge, bronze mounted, OS&Y gate valve with EPDM-coated cast iron disc, grooved ends. Victaulic Series 771.
4. Provide either flanged or grooved end valves compatible with piping system.

C. Butterfly Valves
1. 2 inch and Larger: 175 lb. UL-FM cast or ductile iron body butterfly, O-ring seat, alum-bronze or nickel-plated ductile iron disc, stainless steel stem, Buna-N seal, flanged.
2. 2 inch and Larger: 365 psi CWP, UL-FM ductile iron body, nickel-plated ductile iron disc, nitrile seat, stainless steel stem, weather-proof actuator housings with 2 prewired supervisory switches supervised in the open position. Victaulic Series 765 or 705.
3. Provide integral supervisory (tamper) switches for all control valves.

D. Check Valves
1. 2-1/2 inch and Larger: 250 lb**.** UL-FM iron body check, Buna-N seat, spring-actuated, wafer-style, or grooved-end body.
2. 2 inch and Larger: Up to 365 psi CWP, UL-FM ductile iron body, spring-actuated, stainless steel or EPDM-coated ductile iron disc, nickel-plated or welded-in nickel seat, grooved ends. Victaulic Series 717 or approved equal.

3. Provide check valves compatible with piping system (wafer, flanged, or grooved).

E. Post Indicator Valve
1. 2-1/2 inch and Larger: 175 lb. UL-FM iron-body gate, solid wedge disc, non-rise stem, indicator post flange.
2. 2-1/2 inch and Larger: 250 psi CWP, UL-FM ductile iron body, EPDM-coated cast iron disc, bronze mounted, resilient wedge, brass non-rising stem, grooved ends. Victaulic Series 772.

F. Indicator Post: 2-piece indicator post for non-rising stem gate valve, target plate OPEN and SHUT, vertical type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of burial of valve.

G. Outside Clapper Type Fire Department Connections
1. Finish: Polished brass.
2. Lettering: Auto Sprinkler (SPKR), Combination Auto Sprinkler and Standpipe, Fire Department Connection as appropriate.
3. Flush wall connections.
   a. Drop clappers, cast brass body, plugs and chain, lettering.
4. Exposed Wall Connections
   a. Drop clappers, body, escutcheon plate with lettering, caps and chain.
5. Free-standing Connections
   a. Brass sleeve, brass base plate with lettering, caps and chain.
6. Swing Check Valve
   a. Install on inlet of fire department connection.
   b. 4-inch forged body with spring loaded brass check, body taped 1/2-inch NPT at inlet for ball drip.
   c. Potter-Roemer 4500 Series.
7. Coordinate inlet size, thread type, Storz configuration, and signage with local fire department requirements.

H. Automatic Ball Drip Valve
1. Straight or angle cast brass ball drip, 1/2-inch.
2. Mount on siamese side of check valves and fire pump test header OS&Y valve.
3. Potter-Roemer 5981 or 5983.
4. Provide where required by NFPA 13 and local authority.

I. Alarm Check Valve
1. 300 lb. UL-FM ductile iron body, aluminum bronze clapper, EPDM O-ring seal, tapped bosses for and with water pressure gages, alarm test valve, main drain valve, alarm retarding chamber.
2. Include angle valves, globe valves, alarm line strainer, orifice restriction, pipe nipples and fittings.
3. Victaulic FireLock® Series 751.

J. Alarm Test Device
1. Single device or unit that provides visual verification of waterflow (as required by NFPA 13) in a fire sprinkler system and allows for draining of a floor section.
2. UL-listed and FM-approved.

3. Contains sight glass, inspector test valve, auxiliary drain valve and test orifice.
4. Optional replacement for conventional alarm test loop.
5. Victaulic "TestMaster".

K. Backflow Preventers
1. General
   a. UL and FM approved.
   b. size as indicated on the Drawings.
2. Double Check Detector Assembly
   a. Epoxy coated ductile iron valve bodies (2 gates), stainless steel valve body and internal parts (2 checks), replaceable bronze seats, stainless steel internal parts.
   b. 175 psi; UL/FM resilient seated OS&Y gates, spring check valves.
   c. Provide displacement type meter with cubic feet per minute register.
   d. 6 psi maximum pressure loss through middle one-third of flow range.
   e. Watts Series 774DCDAOSYCFM.
3. Coordinate type and installation requirements with local water authority and AHJ.

L. Provide identification tags for all valves in accordance with Division 21 identification requirements.

2.3 ALARM AND SIGNAL DEVICES

A. Devices specified in this section are furnished under Division 21 and shall be coordinated with Division 26 and Division 28 for power, wiring, and system integration.

B. Waterflow Detector
1. Vane type flow switch with retard mechanism or manual adjustment to prevent false alarm.
2. 175 psi rated.
3. 115 VAC rated for pilot duty only.
4. Suitable for a minimum working pressure of 175 psi.
5. Provide with contacts for remote signal wiring.
6. Potter VSR-F.
7. Provide separate contacts for alarm bell and fire alarm systems.

C. Alarm Bell
1. Audible horn alarm signal; electrically operated.
2. UL listed, 115 VAC.
3. For use with waterflow detector systems.
4. 10 inch bell.
5. Potter PBA-AC.

D. Valve Tamper Switch
1. 115 VAC/ 30 VDC.
2. Switches for Butterfly Valves: Approved type.
3. Two sets of SPDT contacts.
4. Potter OSYSU-A2, Simplex 2097-9031 or Notifier NGV (OS&Y valve), Potter PIVSU-A2 or Notifier NIP (post indicator valve) supervisory switch.

E. Pressure Gages
1. Weiss Model 3 PGA-1 3-1/2-inch dial glass face, black aluminum case, 1% accuracy, bronze tube, brass socket, range 0 to 250 psig. Provide a 1/4-inch gauge cock.
2. Optional Manufacturers: Ashcroft, Trerice, Marshalltown, or Jay.

2.4 SPRINKLER HEADS

A. Sprinkler Heads – General
1. Provide head types required for service indicated.
2. Standard 165 deg F rating except when application requires higher rating.
3. All sprinklers to be UL and/or FM listed as required for Project.
4. Metallic fusible link or glass-bulb-type.
5. Head Application
   a. Rooms without ceilings: Type 1 and type 4
   b. Finished Rooms: Type 2 ACT (lay-in ceilings)
   c. Finished Rooms: Type 3 (drywall/hard ceilings / specialty ceilings)
6. Provide sprinkler K-factor as required by hydraulic calculations and hazard classification.
7. Final head selection and layout shall comply with NFPA 13 and approved shop drawings.

B. Sprinkler Head Type 1
1. Upright or pendant design as required.
2. Standard bronze finish sprinkler.
3. Victaulic Model V27.

C. Sprinkler Head Type 2
1. Recessed design, deflector 1 to 1-1/2-inch below finished ceiling.
2. 2-piece recessed escutcheon with 1/2-inch adjustment.
3. Allow removal of escutcheon and ceiling tile without disturbing head and drop assembly.
4. Chrome finish, escutcheon and sprinkler.
5. Victaulic Model V27.

D. Sprinkler Head Type 3
1. Adjustable flush concealed, quick response.
2. White ceiling plate flush with finished ceiling.
3. 1/2-inch housing adjustment.
4. Chrome finish sprinkler.

E. Sprinkler Head Type 4
1. Horizontal sidewall design.
2. Satin chrome finish sprinkler and escutcheon.
3. Victaulic Model V36.

F. Tools: Furnish one emergency rubber ball shut-off on long handle to be used for temporary closing of sprinkler head after fire has been extinguished.

G. Sprinkler Cabinet: Provide spare heads of each type and sprinkler wrench for each type in quantity required by NFPA 13.
1. Provide cabinet in an accessible location approved by the Owner.

H. Sprinkler Head Guards
   1. Heavy-duty welded wire.
   2. Red baked enamel finish.
   3. Reliance Model B, sprinkler guards.
   4. Provide for all heads in electrical, telephone, communication**,** and mechanical rooms gymnasiums, CTE rooms & area at the bottom of stairwells.

I. Sprinkler escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler, by the sprinkler manufacturer.

J. Coordinate sprinkler head types, finishes, and escutcheons with architectural requirements.

2.5 FLEXIBLE SPRINKLER DROPS

A. In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic AquaFlex® stainless steel or approved equal, multiple-use sprinkler fitting system may be used to locate sprinklers as required by final finished ceiling tiles and walls only where approved by Engineer.

B. The drop system shall consist of a braided or unbraided (corrugated) type 304 stainless steel flexible tube, a zinc-plated steel 1-inch NPT male threaded nipple for connection to branch-line piping, and a zinc-plated steel reducer with a 1/2-inch or 3/4-inch NPT female thread for connection to the sprinkler head.

C. The flexible drop must be listed for a minimum of three 90-degree bends to assure proper installation. Union joints shall be provided for ease of installation.

D. The flexible drop shall attach to the ceiling grid using a one-piece open gate bracket (the bracket shall allow for sprinkler installation before or after the bracket is secured to the sprinkler grid).

E. All hoses shall be factory-pressure tested to 400 psi.

2.6 ACCEPTABLE MANUFACTURERS

A. Alarm Valves, Wet Systems, and Valves: Reliable, Grinnell/Gem, Globe Fire Equipment Co., Viking Corp., Victaulic, Or Approved Equal.

B. Fire Department Connections: Elkart, Potter-Roemer, Croker-Standard, Guardian Or Approved Equal.

C. Alarm and Signal Devices: Federal Signal Corp., Potter Electric Signal Co., Viking, Grinnell, Simplex, System Sensor, Or Approved Equal.

D. Sprinkler Heads: Globe Fire Equipment Co., Tyco, Viking Corp., Reliable, Victaulic, Or Approved Equal.

E. Flexible Sprinkler Drops: Victaulic Aquaflex®, Flexhead Industries, Viking, Or Approved Equal.

F. Backflow Preventers: Ames, Conbraco, Watts, Febco, Victaulic, Or Approved Equal.

G. Valves: Clow, Crane, DeZurik, Nibco, Mueller, Kennedy, Stockham, Victaulic, Or Approved Equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Cooperate with other trades to ensure adequate space for equipment and piping placement.

B. Review plans, specifications, and shop drawings of other trades to coordinate work.

C. Install in strict accordance with approved shop drawings.

D. Install all piping, valves, and connections required for a complete and operational fire protection system.

E. Do not begin installation until all required agency approvals have been obtained and submitted to the Engineer.

3.2 INSTALLATION OF PIPING, VALVES, AND ACCESSORIES

A. Install sprinkler piping in accordance with NFPA 13, applicable codes, and approved shop drawings.
   1. Offset, crossover and otherwise route piping to install system in available space.
   2. Pitch all branch lines, cross mains, feed mains and risers to drainage points.
   3. Provide angle drain valves at all low points.
   4. Plugs permitted at offsets when approved by local authority.
   5. Coordinate pipe routing with other trades prior to fabrication or installation.

B. Provide control valve and waterflow switch assemblies at each of the following locations:
   1. Each zone takes off within sprinkler piping system.
   2. Each sprinkler branch take-off from fire hose standpipe within combination sprinkler standpipe system.
   3. Base of all sprinkler risers.

C. Provide tamper (supervisory) switches on all control and isolation valves, including OS&Y valves, butterfly valves, and post indicator valves.

D. Provide auto ball drip valves at outside fire department connections between hose connection and check and shut-off valve.

E. Flush outside fire water mains prior to connecting to inside system.

F. Install indicator posts approximately 3 ft. above grade.

G. Install pressure gauges at the top of each sprinkler riser and elsewhere as required by local authority.

H. Install piping to sprinkler heads in elevator pits.

I. Provide sprinklers beneath ductwork exceeding 4 feet in width where required by NFPA 13.

J. Coordinate routing of main drains, inspector's test connections, and discharge piping to prevent freezing and icing hazards. Provide discharge to approved locations in accordance with local code and AHJ requirements.

K. Coordinate all inspections and approvals with the local Fire Marshal, Building Official, and all authorities having jurisdiction. Obtain final approval prior to system acceptance.

3.3 SPRINKLER INSTALLATION

A. Install in accordance with approved Shop Drawings.
   1. Modifications to system design or arrangement after approval of Drawings by local authority, may only be made after receiving written approval of authority and A/E.
   2. Minor field adjustments shall not compromise code compliance, hydraulic performance, or required coverage, and shall be subject to review by the A/E.
   3. Make all revisions in accordance with NFPA 13.

B. Install approved sediment traps (dirt legs) and drain valves at low points of all piping to permit complete drainage of system without disconnection of any piping.
   1. Drain valves at base of risers to have 1-1/2 inch hose adapters matching threads of hose systems in buildings.

C. Extend 2-inch main drain(s) to the exterior of building. Extend 1-inch inspector's tests connections on ends of sprinkler branches to nearest floor drain, janitor's sink, or exterior of building.
   1. Label all valves and outlets

D. Provide chrome plated escutcheon plates at pipe penetrations of ceilings, floors, and walls.

E. Firestop penetrations in accordance with Division 07 and 21 Section "Hangers and Supports for Fire Suppression Piping and Equipment".

F. Locate heads centered in ceiling tile and in center of metal strip in linear metal ceilings, if such location makes added heads necessary, provide all added heads as required to meet code.

G. Relocate heads if necessary to coordinate with ceiling layout.

H. Install sprinkler heads to provide and maintain minimum 18-inch clear between bottom of deflector and top of storage, files, shelving and cabinets.

I. Install sprinklers at the base of hydraulic elevators.

J. Do not install sprinklers or associated piping above electrical switchgear.

3.4 ELECTRICAL WIRING

A. Fire Protection Contractor shall provide wiring diagrams and all device-specific wiring not provided under Division 26 or Division 28 necessary for a complete and operational system.

B. Electrical Contractor to provide:
   1. Supervised wiring from main waterflow indicator to outside alarm bell and fire alarm panel.
   2. Supervised wiring from sprinkler flow switches to fire alarm panel.
   3. Supervised wiring from valve tamper switches to fire alarm panel.

C. Fire Protection Contractor to be responsible for:
   1. Wiring diagrams for all devices
   2. All other wiring not specified to provide an operating system

3.5 FIELD QUALITY CONTROL

A. Upon completion of sprinkler system installation, the Contractor is to test the entire system per NFPA 13 requirements. The contractor is to notify the authority having jurisdiction and the Owner's representative of time and date system testing will be performed so that tests can be witnessed by same. Contractor shall complete the "Contractor's Material and Test Certificate" and have signed by the authority having jurisdiction, Owner's representative, and Contractor who witnessed the testing. Copies are to be made of the Certificate and distributed to the approving authority and Owner's representative.

B. Test sprinkler piping, including outside supplies, under hydrostatic pressure to 200 psi for 2 hours.
   1. Prove system tight to satisfaction of A/E.
   2. Inside piping shows no leakage.
   3. Leakage in underground piping in accordance with NFPA 24.

C. Test complete alarm system including control and signal circuits wired by Electrical Contractor.
   1. Coordinate with electrical.
   2. Complete testing prior to acceptance by Owner.
   3. Notify Commissioning Agent of any field quality control testing.

D. Give advance notice and arrange for field tests and inspections by local authority.

E. Flushing and sterilization of fire system water lines to be as required by NFPA 13.

F. Provide final system flow test data including static pressure, residual pressure, and flow rate. Conduct testing during peak demand conditions where feasible.

3.6 PAINTING

A. Refer to Division 09 Section “Interior Painting”.

3.7 PROTECTION

A. Protect installed piping, valves, and sprinkler heads from damage during construction. Replace damaged components prior to acceptance.

3.8 CLOSEOUT

A. Provide record (as-built) drawings showing actual routing of piping, valve locations, and head locations.

B. Provide Contractor’s Material and Test Certificates.

C. Provide spare sprinkler heads and wrench as specified.

D. Provide operation and maintenance manuals.

E. Provide training to Owner on system operation and inspection requirements.

END OF SECTION

SECTION 220501 - COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

2. Refer Specification Section 019113 General Commissioning Requirements.

1.2 CODES & STANDARDS (INCLUDING BUT NOT LIMITED TO THE FOLLOWING)

1. 20222 Connecticut State Building Code (CSBC) (IBC 2021 w/ amendments)

2. 2022 Connecticut State Plumbing Code Regulation (CSPC) (IPC 2021 w/ amendments)

3. Connecticut Boiler and Pressure Vessel Code

4. 2022 Connecticut State Energy Conservation Code (CSECC) (IECC 2021 w/ amendments)

5. 2022 Connecticut State Building Performance Standard (High Performance Schools)

1.3 GENERAL SCOPE OF WORK

1. The plumbing work for this project consists of scope throughout the architectural floor plans.

1.4 SYSTEMS & ENERGY MANAGEMENT MANUAL OUTLINE:

A. Cx Report (including testing records, reports, meeting minutes, and all related documentation to the Cx process, noting storage location of specific documentation).

B. Ongoing Cx report (provide blank testing forms, schedule for re-commissioning, recommendations for recalibration, ongoing instructions for energy savings, description of systems)

C. Seasonal Operating guide

D. Construction Record Documents (As-builts, TAB final report, ATC as-built, warranties, design documents)

E. Project Operations and Maintenance Manuals (as specified)

F. Manual shall be compiled in electronic format, shall be unprotected, and shall be searchable. The documents within this manual shall be easy to navigate (provided with table of contents, filed individually tabbed & bookmarked.

G. All manufacturers, suppliers, fabricators, contractors, etc. Submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents of Contract Documents. In case of conflict between these common work results and the general and/or special conditions, the affected Contractor shall contact the Engineer for clarification and final determination prior to the bid.

H. The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating plumbing systems indicated or specified in the Contract Documents.

I. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete any part of the plumbing systems in a substantial manner, in compliance with the requirements stated, implied or intended in the Plans and/or Specifications, shall be included in the bid as part of this Contract.

J. It is not the intent of this section of the Specifications to make any Contractor, other than the General Contractor, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

K. The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or Specification numbering system used which identifies disciplines is solely for the Architect and Engineer's convenience and is not intended to define a subcontractor's scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Plans and Specifications when preparing bids, prices and quotations.

L. This section of the Specifications or the arrangement of the Contract Documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade contractor or sub-contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the General Contractor holding the prime contract.

M. It is the intent of the Contract Documents to deliver to the Owner a new, complete and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

N. In general, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least forty-eight (48) hours prior to the interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage for the Contractors involved until a complete schedule of interruptions can be developed.

O. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Contractor's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

P. Each Contractor shall also be governed by any unit prices and addenda insofar as they may affect part of their work or services.

1.5 DEFINITIONS AND ABBREVIATIONS:

A. Contractor - Any Contractor whether bidding, proposing or working independently or under contract with GeneralContractor, and who installs any type of Mechanical/Plumbing Work as specified in the Contract Documents or the GeneralContractor.

B. Engineer - The Consulting Mechanical-Electrical-Plumbing Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.

C. Architect - The Architect of Record for the project.

D. Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, General and Special Conditions, Addenda, Alternates, Unit Prices, Shop Drawings, Field Orders, Change Orders, Construction Contract with Owner, and other documents enumerated in the Owner/Contractor Agreement.

E. Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.

F. The Project - All of the work required under this Contract.

G. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

H. Provide - Furnish and install complete, tested and ready for operation.

I. Install - Receive and place in satisfactory operation.

J. Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto or incorporated in the Contract Documents by reference.

K. Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

L. ADA - Americans with Disabilities Act.

M. ANSI - American National Standards Institute.

N. ASME - American Society of Mechanical Engineers.

O. IBC - International Building Code.

P. NEC - National Electrical Code.

Q. NEMA - National Electrical Manufacturers Association.

R. NFPA - National Fire Protection Association.

S. OSHA - Office of Safety and Health Administration.

T. UL - Underwriters Laboratories.

PART 2 - INTENT AND INTERPRETATION

2.1 GENERAL INFORMATION

A. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc. as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included in the contract sum.

B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

C. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.

D. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 – INDEMNIFICATION

3.1 GENERAL INFORMATION

A. Refer to Project General Conditions and Supplementary Conditions and Division 01.

B. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 4- PLANS AND SPECIFICATIONS:

4.1 GENERAL INFORMATION

A. The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

C. The Plans and Specifications shall be considered to be complementary and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the contract and must be executed the same as though indicated by both.

D. Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of piping, equipment, etc. Where such adjustments are in the interest of improving the project.

F. Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

G. Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

H. Each Bidder/Proposer shall review all Plans in the Contract Documents to ensure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur, it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular ensure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

I. Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

K. Where within the Contract Documents the word “typical” or “typ.” Is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

L. Each Contractor shall evaluate ceiling heights specified on architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

PART 5- EXAMINATION OF SITE AND CONDITIONS:

5.1 GENERAL INFORMATION

A. Each Bidder/Proposer shall inform their self of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.

B. Each Bidder/Proposer shall also fully acquaint their self with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

PART 6- EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

6.1 GENERAL INFORMATION

A. When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. From that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.

B. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; unless specifically indicated; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states or countries are more stringent than these Specifications regarding such substitutions, then those laws shall prevail over these requirements.

C. Wherever any equipment and material are specified exclusively only such items shall be used unless substitution is accepted in writing by the Owner utilizing Procurement Substitution Requests or Substitution for Cause as indicated in Division 01 Specifications.

D. Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.

E. Ten (10) days prior to the submission of a proposal, each Bidder/Proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Bidder/Proposers signify that they have included the cost of all required items in the proposal and that the Bidder/Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 7- CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

7.1 GENERAL INFORMATION

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. In connection with their work. They shall also file all necessary Plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.

B. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to their part of the work prior to submission of a proposal.

C. The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

D. All materials furnished and all work installed shall comply with the national fire codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

E. All materials and equipment so indicated and all equipment and materials for the electrical portion of the plumbing systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.

F. All plumbing work shall be accomplished in accordance with the International Plumbing Code and amendments thereto, and the National Fire Protection Association.

G. The Contractor shall furnish three (3) copies of all final inspection certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.

H. Where minimum code requirements are exceeded in the design, the design shall govern.

I. The Contractor shall insure that their work is accomplished in accord with the OSHA standards and that they conduct their work and the work of their personnel in accord with same.

J. All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction.

K. Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the Connecticut state department for environmental protection.

L. Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the Plans and Specifications require better materials, equipment, and construction than these minimum standards, in which case the Plans and Specifications shall be the minimum standards.

PART 8- QUALIFICATIONS OF CONTRACTOR/WORKERS:

8.1 GENERAL INFORMATION

A. All plumbing work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of a workers shall be made through the normal channels of Architect, Contractor, etc.

B. The installation of all plumbing by any Contractor shall be performed by a licensed Contractor with journeymen or master tradesmen as defined under Connecticut state regulations and code.

C. All insulation and pipe fitting work shall be installed by workers normally engaged in this type work.

D. All automatic control systems shall be installed by workers normally engaged or employed in this type work.

E. All electrical work shall be accomplished by licensed Contractors with journeymen or master electrician as defined under Connecticut state regulations and code. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 9- SUPERVISION OF WORK:

9.1 GENERAL INFORMATION

A. The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 10- CONDUCT OF WORKERS:

10.1 GENERAL INFORMATION

A. The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that worker.

The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or dehabilitating drugs on the job site is strictly forbidden.

PART 11- COOPERATION AND COORDINATION WITH OTHER TRADES:

11.1 GENERAL INFORMATION

A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 12- GUARANTEES AND WARRANTIES:

12.1 GENERAL INFORMATION

A. The Contractor shall guarantee all equipment, apparatus, materials, performance, and workmanship entering into their contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective for a minimum of one year in addition to the time frames outlined in the General Conditions of the contract. The effective date of completion of the work shall be the date of the Engineer's statement of substantial completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. To the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.

B. Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 13- CHANGES IN MECHANICAL WORK:

A. REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 - CLAIMS FOR EXTRA COST:

A. REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 15 - MATERIALS AND WORKMANSHIP:

15.1 GENERAL INFORMATION

A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.

B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

C. Use extreme care in the selection of equipment and its installation to ensure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.

D. Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

E. All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity. Pumps shall have a data plate indicating horsepower, static pressure head and flow rate.

PART 16- HAZARDOUS MATERIALS:

16.1 GENERAL INFORMATION

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building or site.

B. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner.

The Contractor shall, as a part of their work, ensure that their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

C. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

D. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.

E. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

F. No asbestos or mercury containing materials shall be installed in this project.

PART 18 - COORDINATION DRAWINGS:

A. Reference Specification Section 01 31 00.

PART 19 - SURVEY, MEASUREMENTS AND GRADE:

19.1 GENERAL INFORMATION

A. The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the Contract Documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 20- PROTECTION OF EQUIPMENT:

20.1 GENERAL INFORMATION

A. The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense.

PART 21- REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT:

21.1 GENERAL INFORMATION

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

PART 22 - EQUIPMENT SUPPORT:

22.1 GENERAL INFORMATION

A. Do not support piping from existing plaster ceilings and/or supports. Each piece of equipment, apparatus, piping, or conduit mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

PART 23- PIPE MOUNTING HEIGHTS:

23.1 GENERAL INFORMATION

A. All exposed or concealed piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping shall, insofar as possible, run perpendicular or parallel to the building structure.

PART 24- BROKEN LINES AND PROTECTION AGAINST FREEZING:

24.1 GENERAL INFORMATION

A. No conduits, piping, troughs, etc. Carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Insulation on piping does not necessarily ensure that freezing will not occur.

PART 25- WEATHERPROOFING:

25.1 GENERAL INFORMATION

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 26- FINAL CONNECTIONS TO EQUIPMENT:

26.1 GENERAL INFORMATION

A. The Contractor shall finally connect to plumbing services for any terminal equipment, kitchen equipment, etc., provided under this and other divisions of the work. Various equipment connections indicated are based upon “basis of design” equipment selections. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer’s recommendations. If in doubt, contact the Engineer prior to installation.

PART 27- ACCESSIBILITY:

27.1 GENERAL INFORMATION

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.

C. Whether shown on the Plans or not, the Contractor shall provide in the bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

PART 28 - SCAFFOLDING, RIGGING AND HOISTING:

28.1 GENERAL INFORMATION

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA standards and requirements. Remove same from premises when no longer required.

PART 29 - CONCRETE WORK:

A. Refer to Division 03 Specifications.

PART 30- RESTORATION OF NEW OR EXISTING LANDSCAPING, PAVING, SURFACES, ETC.:

30.1 GENERAL INFORMATION

A. The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, landscaping, existing or new building surfaces and appurtenances, and any other items damaged or removed by their operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and/or Engineer.

PART 31 - MAINTENANCE OF EXISTING UTILITIES AND LINES:

31.1 GENERAL INFORMATION

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily. Provide a seven (7) day written notice to Engineer, Architect and Owner prior to interrupting any utility service or line.

B. Known utilities and lines as available to the Engineer are shown on the Plans. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.

C. If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation in the respective area.

D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

E. The Contractor shall repair to the satisfaction of the Owner and Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted with ten feet of gas lines, fuel lines, electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only in accord with utility company, agency or other applicable laws, standards or regulations.

G. Protect all new or existing lines from damage by traffic, etc. During construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping Plans, or in their absence, consult with the Architect.

PART 32 - CLEANING:

32.1 GENERAL INFORMATION

A. The Contractor shall, at all times, keep the area of their work presentable to the public and clean of rubbish and debris caused by their operations; and at the completion of the work, shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

PART 33- TEMPORARY USE OF EQUIPMENT:

33.1 GENERAL INFORMATION

A. The permanent plumbing equipment, when installed, may be used for temporary services, with the consent of the Owner and Engineer. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

B. Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 34- NOISE, VIBRATION OR OSCILLATION:

34.1 GENERAL INFORMATION

A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, or exceeds the noise criteria limits as scheduled, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. By means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 35- EQUIPMENT/CONTROLS STARTUP & VERIFICATION:

35.1 GENERAL INFORMATION

A. The Contractor shall include in the bid to provide equipment and controls startup and verification for all plumbing systems specified for this project.

B. Specific startup/verification Specifications are included throughout the Plumbing Specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians, not third-party Contractors, and shall complete and submit start-up reports/checklists.

The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up. All information shall be completed by the Contractor and submitted to the Owner/Engineer prior to acceptance of the equipment.

C. The manufacturer's recommended startup procedures and checklists will be acceptable for use in the project. Where "manufacturer" startup is not specified, then this Contractor shall perform startup services in strict accordance with manufacturer's instructions. All startup/verification process shall be thoroughly documented by the Contractor and shall include the time and date when performed.

PART 36 - INSPECTION, APPROVALS AND TESTS

36.1 GENERAL INFORMATION

A. Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.

B. The Contractor shall provide as a part of this contract any required agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.

C. The Contractor shall advise each inspecting agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing work. Failure of the inspecting agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

D. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such agency inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

E. Approval by an agency inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

F. Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the agency inspectors to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 37- ABOVE-CEILING AND FINAL PUNCH LISTS:

37.1 GENERAL INFORMATION

A. The Contractor shall review each area and prepare and complete their own punch list for each of the subcontractors as required for the project schedule.

B. Seven (7) days notice shall be given to the Engineer for review of above ceiling work that will be concealed by tile or other materials. Seven (7) days notice shall be given to the Engineer for review of below ceiling work and final inspection.

C. When all work from the Contractor's punch list is complete at each of the major project stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven (7) days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review. The Contractor's representative may be requested at the inspections.

D. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $250.00 per hour for extra trips required to complete either of the above ceiling, below ceiling or final punch lists.

PART 38- OPERATING INSTRUCTIONS AND TRAINING:

38.1 GENERAL INFORMATION

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of one (1) day of eight (8) hours and as specified for other systems. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished.

Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.

B. Each Contractor shall video each training session and furnish the video via thumb-drive (3 sets required). Also, furnish three digital sets on thumb-drive and three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

C. Each Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

D. Notify the CxA in advance of training sessions.

E. Refer to the Owner's Project Requirements (OPR) for training requirements. Training schedules, agendas and material should all be submitted for review prior to holding any training sessions.

PART 39- RECORD DRAWINGS:

39.1 GENERAL INFORMATION

A. The Contractor shall insure that any deviations from the design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this Specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of plumbing systems. Also, pay particular attention to deviations in the control systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

B. Refer to the Owner's OPR for additional requirements.

PART 40 - COMMISSIONING - CONTRACTOR RESPONSIBILITIES:

40.1 GENERAL INFOMRATION

A. Refer Specification Section 019113 General Commissioning Requirements.

B. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

C. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

D. Cooperate with the CxA for resolution of issues recorded in the Issues Log.

E. Attend commissioning team meetings.

F. Integrate and coordinate commissioning process activities with construction schedule.

G. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.

H. Review and accept commissioning process test procedures provided by the Commissioning Authority.

I. Complete commissioning process test procedures.

PART 41 - PLUMBING DEMOLITION & SALVAGE:

41.1 GENERAL INFORMATION

A. IT IS the intent of the project to completely remove all components of the existing plumbing system within the building unless specifically noted otherwise. This project is considered a “renovate-as-new” project and therefore none of the existing systems will be reused as part of this project except limited amounts of sanitary & storm piping noted. The general scope of the plumbing system demolition is indicated on the drawings. Where plumbing systems are removed, also remove all associated branch piping, hangers, insulation, concrete pads, controls, etc. Contractor shall field verify existing conditions prior to bid. Refer to the demolition drawings for general indication of equipment and piping to be demolished. If other equipment or piping is found during construction which is not indicated on the drawings, it must also be removed.

C. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing by qualified tradesmen of all holes, etc. In the ceiling, wall, roof and floors where plumbing equipment and systems are removed.

END OF SECTION

SECTION 220502 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 - GENERAL

1.1 GENERAL INFORMATION

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR PLUMBING and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
   1. Refer Specification Section 019113 General Commissioning Requirements.
   2. Refer to the Owner’s OPR for additional items related to as-builts and O&Ms.

C. The Contractor shall prepare and submit shop drawings, product data, certified equipment drawings, installation instructions, and operation and maintenance data for all plumbing systems and equipment in accordance with Division 01 requirements and the project submittal schedule.

D. Submittals shall be prioritized to support the construction schedule, including early submission of long-lead and critical-path equipment.

E. Provide all shop drawings and submittals in electronic/PDF format through proper channels. The Engineer’s comments will be returned in electronic format.

F. Submittal data shall include materials of construction, dimensions, capacities, performance data, pressure drops, electrical characteristics (if applicable), wiring diagrams, and accessories. No material requiring submittal review shall be fabricated, delivered, or installed until the submittal has been reviewed.

G. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

H. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the Design-Build Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

I. The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.

J. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the

proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

K. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.

L. Submittals for plumbing equipment shall include all relevant performance and construction data, including but not limited to flow rates, pressure ratings, materials, finishes, and accessories.

M. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

N. All submittals for mechanical equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

O. All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.

P. Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

Q. Indicate compliance with CT High Performance Building Standards as applicable.

R. Indicate compliance with LEED v4.1 Standards as applicable.

PART 2 - SHOP DRAWINGS

2.1 REQUIREMENTS

A. Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:
1. Floor Drains
2. Insulation
3. Plumbing Fixtures, Fittings and Trim
4. Plumbing Equipment
5. Elevator Sump Pump
6. Piping
7. Plumbing Specialties
8. Roof Drains
9. Valves

10. Water Heaters
11. Domestic Water Storage Tanks

2.2 SPECIAL NOTES

A. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for all items marked above. These documents shall include at least:
   1. Approved submittals and product data
   2. Installation and startup procedures
   3. Detailed operating instructions
   4. Preventative maintenance procedures and schedules
   5. Parts lists and exploded diagrams
   6. Manufacturer contact information
   7. Wiring diagrams and control sequences (if applicable)
   8.

B. Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system. Refer to Specification Section – AUTOMATIC TEMPERATURE CONTROLS FOR HAVC for additional requirements.

C. The Contractor shall submit project specific UL listed firestopping installation drawings to the Authority having jurisdiction.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Upon substantial completion of the project, the Contractor shall submit to the Engineer a PDF version of the Certified Hydronic Balance Report.

3.2 INSTALLATION

A. Installation shall comply with manufacturer’s written instructions and applicable codes and authority having jurisdiction (AHJ) requirements.

3.3 USE OF APPROVED SUBMITTALS

A. All work shall be installed in accordance with reviewed submittals. Where discrepancies exist between the Contract Documents and reviewed submittals, the more stringent requirement shall govern. Notify the Engineer of such discrepancies prior to installation.

3.4 FIELD VERIFICATION

A. Verify field conditions, dimensions, and utility requirements prior to installation and fabrication.

B. Do not proceed with installation where conflicts exist until such conflicts are resolved.

3.5 COORDINATION

A. Coordinate installation of plumbing systems and equipment with other trades, including structural, architectural, mechanical, and electrical work.

B. Ensure proper access, service clearances, and routing prior to installation.

3.6 CLOSE OUT DOCUMENTS

A. Submit final, complete operation and maintenance manuals incorporating all approved submittals and field changes.

B. Manuals shall reflect as-installed conditions and include final equipment selections, settings, and configurations.

END OF SECTION

SECTION 220507 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 - GENERAL

1.1 GENERAL INFORMATION

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. The Contractor shall include all excavating, filling, grading, backfilling and related items required to complete the work as shown on the drawings and specified herein or as required to complete, connect and place all plumbing systems in satisfactory operation on the interior and exterior of the building.

C. Refer to Division 31 – Earthwork for requirements associated with site excavation, trenching, dewatering, bedding, backfilling, compaction, grading, and surface restoration. Plumbing Contractor shall coordinate all work with Division 31 and comply with those requirements except where more stringent requirements are specified herein.

D. Unless otherwise shown or required, provide separate trenches for sewers, water lines and other underground raceways, with a minimum of 10 feet measured from outside diameter between pipes. In locations, such as close to buildings where separate trenches for sewers and water lines are impractical, lay the water pipe on a solid shelf at least 2'-0" above the top of the sewer and 2’-0" to the side.

E. Water lines crossing under sewer lines, or crossing less than 2 feet above sewer lines, must be concrete encased for a distance not less than 5 feet on either side of the point of crossover.

F. Without regard to the materials encountered, all excavation and materials excavated shall be unclassified. Materials to be excavated shall be unclassified, and shall include earth, rock, concrete or any other obstructions encountered in excavation and/or trenching to install underground utility pipes or other equipment.

G. Include all costs for rock removal, including mass rock and trench rock in the bids. No adjustment in the contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating. The Contractor shall be responsible for the removal of all materials encountered as required for the installation of the work.

H. It shall be distinctly understood that references to rock, earth, topsoil or any other excavated or non-excavated material or other material on the construction plans, cross section, contract documents, technical specification or provisions, whether in numbers, words, letters, lines or graphically shown, is solely for information for the Engineer and Owner. This information shall not be taken as an indication of the classification of the material to be excavated, bored or removed by any method, including drilling and blasting, or materials not removed. This information shall not be taken as to the quantity of either rock, earth, topsoil, or any other material involved, or the quality of the material such as hardness, wetness, workability or suitability of the material either during excavation and construction or as a material to be reused during construction.

I. Maintain carefully all benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed.

PART 2 - PRODUCTS

2.1 BEDDING AND BACKFILL MATERIALS

A. Bedding Material:
1. Manufactured sand or #8 crushed stone, clean, well-graded, and free of debris, organic material, frozen material, and stones larger than 1/2 inch.
2. Provide material suitable for uniform pipe support and in accordance with pipe manufacturer's recommendations.

B. Initial Backfill:
1. Same material as bedding unless otherwise required.
2. Place and compact carefully to avoid displacement or damage to piping.

C. General Backfill:
1. Native material free of debris, organic material, frozen material, and rocks larger than 2 inches.
2. Material shall be suitable for compaction and shall not contain materials that may damage piping or impair compaction.

D. Topsoil:
1. Clean, fertile topsoil free of subsoil, debris, weeds, and stones larger than 1 inch.
2. Suitable for seeding or sodding and matching adjacent site conditions.

E. Tracer Wire:
1. Provide tracer wire for non-metallic underground pressure piping.
2. Solid copper or copper-clad steel, minimum 12 AWG, insulated, suitable for direct burial.
3. Install continuously along piping with access at valve boxes, cleanouts, and building entry points.

F. Warning Tape:
1. Detectable underground warning tape, minimum 6 inches wide, color-coded per utility type.
2. Install continuously above piping at approximately 12 inches below finished grade.
3. Provide continuous labeling indicating type of utility buried below.

G. Imported Fill (if required):
1. Where native material is unsuitable, provide imported fill meeting requirements of general backfill.
2. Source and material shall be subject to Engineer approval.

H. Unsuitable Materials:
1. Materials classified as unsuitable by the Engineer or geotechnical report shall not be used for bedding or backfill.
2. Dispose of unsuitable material off-site in accordance with applicable regulations.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate trenches of sufficient width for proper installation of the work. Excavate to 6" below the bottom of new pipes for installation of specified bedding material.

B. Sheet, shore, and brace trenches as necessary to protect workers and adjacent structures and to comply with applicable OSHA, state, and local requirements. Do not remove sheeting until trench is backfilled sufficiently to protect piping and prevent caving. Where removal of sheeting and/or bracing is hazardous, leave in place. Cut off sheeting not removed at least 3 feet below finished grade.

C. Rules and regulations governing the respective utilities shall be observed in executing all work under this Division. Active utilities discovered in the course of excavation shall be protected or relocated in accordance with written instructions from the Engineer. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. If utility status or required disposition is uncertain, notify the Engineer before proceeding.

D. Machine excavation shall not be allowed within ten (10) feet of existing electric lines, natural gas lines or other lines carrying combustible materials. Use only hand tools.

E. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Engineer. Any damage to existing structures, exterior services, or rock intended for bearing, shall be corrected at the responsible Contractor's expense.

F. Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to insure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and jointmaking. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell or flange and/or is supported with blocks or wedges will not be accepted.

G. Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper joining of pipe. Any dewatering from this Contractor's trenches which is required during construction, shall be included in this Contract.

H. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility lines, large trees to remain, etc. The Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred in the course of excavation shall be at the responsible Contractor’s expense.

I. Use surveyor's level to establish elevations and grades.

J. Machine excavation shall be held a sufficient distance from foundations and footings to ensure no damage to same. Contractors shall accept full responsibility and pay for repairs and/or replacement of structural members, footings, etc.

K. The Contractor shall remove trash, rubbish, and unsuitable material from areas of excavation prior to starting work.

L. The Contractor shall provide and maintain barricades and temporary bridges around excavations as required for safety. Temporary bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these bridges in a safe and passable condition for all traffic until removal. Refer to OSHA Standards for such installations and comply with same in all details.

M. Pay particular attention to existing utilities and lines to avoid damage. The locations of existing lines which are indicated on the plans were taken unconfirmed from drawings prepared for previous construction and locations are approximate only. Also, certain water, gas, electric, storm and sanitary sewer lines and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be each Contractor's responsibility to ascertain the location of all lines and excavate with caution in their area.
   1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor’s expense.

3.2 BACKFILLING AND GRADING

A. Backfilling for Plumbing Work shall include all trenches, manhole pits, storage tank pits, and/or any other earth and/or rock openings which are excavated under this Contract. Backfilling shall be carefully performed and the surface restored to its original level to receive new finish. Wherever trenches and earth openings have not been properly filled and/or settlement occurs, they shall be re-excavated, re-filled and properly compacted, smoothed off and finally made to conform to the level of the original ground surface.

B. Provide 6 inches of bedding material below pipe and 12 inches above the top of pipe. Install piping on compacted bedding material. Install tracer wire where required for non-metallic underground piping. Complete required testing and verify pipe alignment and grade prior to final backfill. Backfill remainder of trench with approved material free of rock and debris, compacted in layers. Water settling shall not be used as the sole means of compaction.

C. Backfill and compact beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean top soil.

D. Backfill and compact beneath paved areas, walks, etc. shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill or unstable soil.

E. Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.

F. Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.

G. Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from off site shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.

H. If not specified or indicated elsewhere in the Contract Documents to be performed by Others, the Contractor shall lay new sod over their excavation work for existing disturbed grassy areas. Level, with adjacent surface, compact and water in accord with sound sodding practice.

I. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated as follows.

J. At a minimum, fill in grass areas shall be compacted to 90% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Specification Division EARTHWORK; whichever is most stringent.

K. At a minimum, fill in concrete or asphalt area shall be compacted to 98% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Specification Division EARTHWORK; whichever is most stringent.

L. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures and displacement of piping or conduit by placing and compacting material uniformly on both sides in each lift.

M. Do not place final backfill until required inspections and tests have been completed.

N. Grading Outside Building Lines: Restore grading and exterior surfaces in accordance with Division 31 – EARTHWORK and to match adjacent existing conditions unless otherwise indicated.

O. Maintenance Settling: Where settling is measurable or observable at excavated areas during Project Warranty Period, remove surface (pavement, concrete or any other surface or finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration.

P. Disposal of Excess Non-organic Soil and Rock: Any excess excavated waste material shall become the property of the Contractor and shall be disposed of by the Contractor off site at no additional cost to the Owner.

Q. Unless otherwise directed by the Owner during construction, excess topsoil and subsoil suitable for fill shall be disposed of by the Contractor off site at no additional cost to the Owner

3.3 MINIMUM DEPTHS OF BURY TO TOP OF PIPE

A. In the absence of other indication, the following shall be the minimum depth of bury to top of pipe of exterior utility lines. Check drawings for variations.
   1. Storm Lines 36 inches below final grade.
   2. Sanitary Lines 36 inches below final grade.
   3. Water Lines 48 inches below final grade.
   4. All Other Lines Not Listed36 inches below final grade.

END OF SECTION

SECTION 220513 - COMMON MOTOR ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL INFORMATION

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, fully functional, tested, inspected, and approved system. All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

C. Review the Specification Section – TEMPERATURE CONTROLS AND SEQUENCE OF OPERATIONS FOR HVAC to determine controls, including variable frequency drives, to be furnished. Coordinate with Division 23 and Division 26 to determine responsibility for furnishing and installation of variable frequency drives (VFDs), starters, and control devices.

D. Prior to ordering any materials or rough-in of any kind, the Plumbing Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for any discrepancies. A final coordination meeting shall be held with the General Contractor, Plumbing Contractor, Electrical Contractor and their sub-contractors.

1.2 ELECTRICAL COORDINATION SUBMITTAL

A. Submit coordinated electrical data for all equipment including:

B. Voltage, phase, MCA, MOCP

C. Disconnect requirement

D. Starter/VFD requirements

E. Control voltage

PART 2 - MOTORS

2.1 REQUIREMENTS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications and drawing schedules.

B. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

C. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

D. Motors shall be capable of frequency of starts as indicated by automatic control system and not less than five (5) evenly time spaced starts per hour for manually controlled motors.

E. Motors shall have a 1.15 service factor for poly-phase motors and 1.35 service factor for single phase motors.

F. Motors shall have a temperature rating for 40 deg C ambient environment with maximum 90 deg C temperature rise for continuous duty at full load with 1.15 service factor and Class B insulation.

G. Unless otherwise noted or required by application, motors shall conform to NEMA Standard MG 1 (Table 12-10) for general purpose, continuous duty, horizontal, T-frame, single speed, design “A” or “B”. Utilize design "C" motors where required for high starting torque.

H. Motor frames shall be NEMA Standard No. 48 or 56. Use driven equipment (fans, pumps, etc.) manufacturer's standards to suit specific application.

I. Provide inverter rated motors where variable frequency drives are utilized. Motor shall be premium efficiency type with Class F insulation and shall conform to NEMA MG 1 parts 30 and 31. Inverter duty rated motors shall have a temperature rating for 40 deg C ambient environment with maximum of 105 deg C temperature rise. Motors controlled by VFDs shall be suitable for inverter duty, including insulation systems, shaft grounding (where required), and bearing protection to prevent damage from induced shaft currents.

J. Motor bearings shall be ball or roller bearings with inner and outer shaft seals. Bearings shall be re-greaseable, except permanently sealed where motor is normally inaccessible for regular maintenance. Bearings shall be designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor. Bearings shall be rated for a minimum L10 life of 100,000 hours.

K. Motor enclosure type shall be open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation. Enclosures shall be guarded drip-proof type motors where exposed to contact by employees or building occupants. Enclosure shall be weather protected Type I for outdoor use or Type II where not housed.

L. Provide built-in thermal overload protection and, where required, internal sensing device suitable for signaling and stopping motor at starter.

M. Provide energy efficient motors with a minimum efficiency in accordance with NEMA MG 1, Table 12-10 for 1800 rpm, enclosed motors. If efficiency not specified, motors shall have a minimum efficiency as listed below:

1. 1 hp - 85.5%	5 hp – 89.5%	20 hp – 93.0%
2. 1.5 hp – 86.5%	7.5 hp – 91.7%	25 hp – 93.6%
3. 2 hp – 86.5%	10 hp – 91.7%	30 hp – 93.6%
4. 3 hp – 89.5%	15 hp – 92.4%	40 hp – 94.1%

N. On the motor nameplate, indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - MOTOR STARTERS

3.1 REQUIREMENTS

A. Where variable speed operation is indicated or scheduled, provide variable frequency drives (VFDs) in lieu of across-the-line starters. VFDs shall comply with Section 232923 – VARIABLE FREQUENCY DRIVES.

B. Provide motor starters where indicated on the plumbing equipment schedules or elsewhere in the Contract Documents.

C. Motor starters shall be NEMA style. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.

D. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall provide starters capable of limiting inrush currents. These shall be the reduced voltage open-transition type. Do not utilize closed transition starters unless specifically indicated.

E. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and plumbing schedules for further requirements.

F. Contacts shall be silver-alloy, double-break type except NEMA size 8 and 9 shall be single-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.

G. Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, except for size 8 and 9 which shall be hand wound. Provide coil clearing contact as required.

H. Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L. HOA switches shall be lockable in the OFF position.

I. Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated for automatic control. HOA switches shall be lockable in the OFF position.

J. Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push

button or similar means. Class 10 or Class 30 overloads may be used depending on type of motor duty encountered.

K. Provide at least one N.O. auxiliary contact (field-convertible to N.C. operation) with each starter. All starters shall have space for two additional single-pole contacts.

L. All starters shall be thru-wiring type.

M. Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 7½ H.P. or larger.

PART 4 - ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

4.1 REQUIREMENTS

A. All plumbing equipment shall be provided for single point electrical connection unless noted otherwise.

B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, Part C, and other applicable sections of the N.E.C.

C. The Contractor shall furnish all equipment with complete internal wiring and controls. The Electrical Contractor shall provide power wiring, disconnects, and overcurrent protection unless specifically noted otherwise. Final responsibility shall be coordinated per Division 26.

D. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning plumbing systems, installed per Code and Project requirements.

E. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of this Contractor.

F. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

G. Observe the following standards for manufacture of equipment and in selection of components: (1) Starters, control devices and assemblies - NEMA (I.E.C. style not acceptable), (2) Enclosures for electrical equipment – NEMA, (3) Enclosed switches – NEMA, (4) All electrical work, generally NFPA 70, (5) All electrical work in industrial occupancies - J.I.C. standards, (6) All electrical components and materials - U.L. listing required.

H. Where scheduled on the drawings, provide disconnect switches and contactors. Disconnect switches shall be fusible type or circuit breaker type. Disconnect switches shall be within sight of the equipment unless otherwise permitted by code.

PART 5 - REQUIREMENTS FOR PLUMBING EQUIPMENT 3/4 H.P. OR LESS

5.1 REQUIREMENTS

A. Small equipment with motor(s) of 3/4 H.P., single phase or less are generally not required to be furnished with starter(s), unless otherwise noted. Electronically commutated motors (ECMs) may be provided where applicable. For such equipment, provide integral contactor or horsepower-rated relay where controlled by DDC controls, thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment.

B. Provide transformer within unit as required to provide low voltage A.C. for thermostat control.

C. Provide internal fusing for unit motor and other loads in fuse block or in-line fuse holder. Internal fusing shall be coordinated with manufacturer requirements and UL listing.

D. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction.

END OF SECTION

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR PLUMBING and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated. All thermometers, pressure gauges and/or compound gauges shall be provided with a petcock to allow the gauge to be removed and replaced without shutting down system.

1.2 SUMMARY

A. This sections includes the following types of meters and gauges
   1. Temperature gauges and fittings
   2. Pressure gauges and fittings

B. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 specifications.

1.3 QUALITY ASSURANCE

A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.4 SUBMITTALS

A. Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:
   1. Product Data for each type of thermometer and gauge
   2. Calibration Certificates
   3. Operation and Maintenance Manuals

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. Thermometers and Wells: Trerice, WIKA, Ashcroft, Winters
   2. Pressure Gauges: Trerice, WIKA, Ashcroft, Winters
   3. Test Plugs: Trerice, Sisco, Watts, Peterson Equipment Co

B. All instruments shall be factory calibrated.

C. All components shall be rated for system design pressure and temperature.

D. Install instruments to be readable from normal operating position.

E. Provide instruments compatible with building automation system where indicated.

F. Provide products compliant with NSF 61 and NSF 372 for potable water systems.

2.2 THERMOMETERS

A. Type: Bimetal dial-type, adjustable angle, stainless steel case and stem.

B. Dial Size: Minimum 2-1/2-inch diameter (3-inch typical; 4-1/2-inch preferred in mechanical rooms).

C. Accuracy: ±1% of full scale.

D. Scale: Dual scale (°F/°C), permanently etched.

E. Range: Selected for system served (typically 25°F to 125°F for domestic water unless noted otherwise) and centered around normal operating conditions.

F. Stem Length: As required for proper immersion.

G. Provide thermometers installed in separable stainless steel wells for all piping applications. Direct immersion without wells is not permitted.

2.3 DIGITAL THERMOMETERS

A. Provide digital thermometers where indicated on drawings.

B. Range: -50°F to 300°F.

C. Accuracy: ±1% or ±1°F, whichever is greater.

D. Display: Minimum 3/8-inch LCD.

E. Power: Self-powered (solar) or battery as applicable.

2.4 THERMOMETER WELLS

A. Material: Brass or stainless steel.

B. Rating: Suitable for system design pressure and temperature.

C. Provide extension length to clear insulation.

D. Provide threaded cap with retaining chain.

2.5 PRESSURE GAUGES

A. Type: ASME B40.1, bourdon tube.

B. Case: Stainless steel with glass or polycarbonate lens.

C. Dial Size: Minimum 2-1/2-inch (4-1/2-inch preferred in mechanical rooms).

D. Connection: 1/4-inch NPT, bottom connection unless noted otherwise.

E. Accuracy: ±2% of full scale.

F. Range: Selected so normal operating pressure is approximately mid-scale (typical domestic water: 0–100 psi unless noted otherwise).

G. Provide gauges rated for system design pressure.

2.6 PRESSURE GAUGE ACCESSORIES

A. Provide gauge cock or ball valve at each pressure gauge for isolation and removal.

B. Provide snubbers where required to prevent pulsation or vibration damage.

C. Provide siphons for steam service only.

2.7 TEST PLUGS

A. Provide test plugs with 1/4-inch NPT fitting to accept 1/8-inch OD temperature or pressure probes.

B. Body: Solid brass, nickel-plated, with dual self-sealing valve cores.

C. Core Material:
   1. Neoprene for temperatures up to 200°F.
   2. EPDM (Nordel) for temperatures between 200°F and 275°F.

B. Length:
   1. Minimum 3-inch length for insulated piping.
   2. Minimum 1-1/2-inch length for uninsulated piping

C. Cap: Provide gasketed, color-coded cap with retaining strap.

D. Pressure Rating: Minimum 1000 psig at 140°F.

PART 3 - EXECUTION

3.1 THERMOMETER INSTALLATION

A. Install thermometers in locations and orientations to be readable from a standing position at floor level.

B. Install thermometers in piping using separable wells; direct immersion is not permitted.

C. Install thermometer wells in piping tees at locations indicated. Orient wells to ensure proper immersion and readability.

D. Provide extension lengths to clear insulation.

3.2 INSTALLATION OF PRESSURE GAUGES

A. Install pressure gauges in piping tees with gauge cock or ball valve for isolation.

B. Locate gauges for maximum readability from normal operating position.

C. Install gauges at a minimum at the following locations:
   1. Incoming domestic water service.
   2. Top of domestic hot and cold water risers.
   3. Additional locations indicated on drawings.

D. Provide snubbers where required to prevent pulsation or vibration damage.

E. Do not install gauges directly on vibrating piping; provide remote mounting with flexible tubing where required.

3.3 INSTALLATION OF TEST PLUGS

A. Install test plugs in piping tees at locations indicated and where required for testing and balancing.

B. Locate test plugs for accessibility and readability.

C. Install test plugs adjacent to each location where temperature or pressure measurement is required by the controls or balancing specifications.

D. Ensure test plugs extend beyond insulation and provide access for probe insertion.

E. Secure caps after installation.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces.

C. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.5 CONNECTIONS

A. Install meters and gauges to allow adequate clearance for servicing, removal, and maintenance.

B. Coordinate final locations with piping, equipment, and insulation to ensure accessibility and proper operation.

C. Comply with Division 22 piping requirements for installation of associated piping, fittings, and specialties.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR PLUMBING and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

1.2 QUALITY ASSURANCE

A. Each Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Plumbing Systems.

B. The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

C. Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.

D. All valves shall comply with applicable codes and standards, shall be new, and shall be rated for the intended service, pressure, and temperature.

E. Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

1.3 STANDARDS

A. General valve applications include: fixture and equipment isolation valves, branch shutoff valves, check valves, drain valves, thermostatic mixing, backflow preventers and relief valves are usually elsewhere, not here

B. Valve Bodies, Shells and Seats: Factory-tested.

C. Standard for 125 psi and 150 psi saturated steam rated valve pressure containing parts: ASTM B62.

D. Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.

E. Iron Body Valves
   1. Pressure-containing parts: ASTM A126, Grade B.
   2. Face-to-face and end-to-end dimensions: ASME B16.10.
   3. Design, workmanship, materials, and testing: MSS SP-70 and MSS SP-71.

F. Butterfly valves: face-to-face and end-to-end dimensions shall conform to MSS SP-67.

G. Valve Stems: ASTM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

H. Pressure Castings: Free of impregnating materials.

I. Manufacturer's name or trademark and working pressure stamped or cast into body.

J. Valves for potable domestic water service shall comply with the Reduction of Lead in Drinking Water Act and shall be certified lead-free in accordance with applicable federal and state requirements. Valves intended for potable domestic water service shall comply with 42 USC 300g-6, NSF/ANSI 61, and NSF/ANSI 372, and shall be certified lead-free.

1.4 JOB CONDITIONS

A. Coordinate the exact application and location of this work with the work of other trades prior to installation within various piping systems. Verify all positions and elevations. Provide additional offsets and section of piping as required to position valves for equipment clearance and accessibility as well as system and valve operational conditions.

B. Valve manufacturer shall verify indicated figure or model numbers so that selection meets required description and conditions specified. Specified data for valve shall take precedence over indicated figure or model number. Provide proper seat and seal material for applicable temperature, pressure and service indicated for each valve application.

PART 2 – PRODUCTS

1.5 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or approved equal: NIBCO, Crane, Jenkins, Milwaukee, DeZurik, Bell & Gossett, Apollo, Watts, Wilkins, and Bradley

1.6 VAVLES AND SPECIALITIES FOR DOMESTIC WATER PIPING

A. Gauge valves for 1/8-inch and 1/4-inch gauge connections shall be bronze globe valves with threaded or solder end connections as applicable, union bonnet, renewable seat and disc, and suitable for minimum 300 psi working pressure.

B. For shutoff valves within 1/4 inch through 2-1/2-inch size copper piping shall be two-piece full-port bronze ball valves with solder ends, stainless steel ball and stem, PTFE seats, and lever handle, rated for not less than 600 psi WOG.

C. For shutoff valves in copper piping and grades 3-inch size and greater; 200 psi WOG butterfly valve, lug-style body, suitable for dead-end and isolation service.

D. For shutoff valves within steel piping of 1/4 inch through 2-1/2”-inch size; two-piece ball valve with bronze FNPT threaded ends, lever handle, stainless steel ball and stem, full port, rated for not less than 600 psi WOG.

E. For shutoff valves within steel piping of 3 inch or above; 200 psig w.o.g butterfly valves, installed between standard ANSI Class 125/150 flanges, suitable for dead-end and isolation service without use of downstream flanges. 3 inch through 6-inch size valves to have manual stem position, lock to prevent tampering, notched plate and latching handle while valves of 8 inch size and above shall have manual enclosed weatherproof handwheel actuators with gear box and position indicator window, and all meeting the following criteria.

	Part	Specifications
1.	Stem	Stainless Steel, ASTM A-582 Type 410
2.	Collar Bushing	Brass, ASTM B-124
3.	Stem Seal	EPDM
4.	Body Seal	EPDM
5.	Nameplate	Aluminum
6.	Upper Bushing	Copper CDA 122
7.	Liner	EPDM
8.	Disc	Al. Bronze, ASTM B-148 Alloy 954/955
9.	Lower Bushing	Copper CDA 122
10.	Body (Lug)	Ductile iron, ASTM A-536

F. Check valves 2-inches and smaller shall be bronze swing check valve with teflon disc, threaded or soldered ends as applicable, renewable seat and dick, Class 150 Rated for 300 psi minimum as follows:

	Part	Material	Specifications
1.	Body	Bronze	ASTM B62
2.	Cap	Bronze	ASTM B62
3.	Lever	Bronze	Commercial
4.	Disc	Teflon	
5.	Disc Holder	Brass	ASTM B16 1/4 inch & 1/2 inch
		Bronze	ASTM B62 3/4 inch to 2 inch incl
6.	Pin	Stainless Steel	Commercial
7.	Plug	Bronze	ASTM B16
8.	Retaining Ring	Stainless Steel	Commercial
9.	Disc Nut	Bronze	Commercial

G. For vertical up-flow applications in steel or copper domestic water piping, provide bronze lift check valves with threaded ends and suitable for minimum 300 psi WOG.

H. For check valves within steel piping of 2-1/2-inch size and larger, for vertical up-flow applications, Class 250 w.o.g flanged iron body flat style silent check; and for horizontal applications, Class 125 w.o.g flanged iron body horizontal swing check.

I. For check valves within copper piping of 2-1/2 inch through 4-inch size, Class 300 w.o.g bronze for horizontal or vertical installation with solder ends.

J. Pressure Reducing Valves: Watts #U5B water pressure reading valve with bronze body, bolted bonnet, integral stainless steel strainer and outlet water pressure gauge. Internal disc, diaphragm and stainless steel seat shall all be removable. Valve shall be rated for inlet water pressures up to 300 psi. Provide water pressure-reducing valves where system pressure exceeds the allowable working pressure of downstream piping, fixtures, or equipment.

K. Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.

L. Reduced Pressure Backflow Preventers: Reduced pressure backflow preventers shall be provided with inlet strainer, two (2) gate valves for isolation, three (3) test ports and air gap fitting. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. Reduced pressure backflow preventers shall be UL listed and meet USC, ASSE, and AWWA C511 standards. Watts #909 or equal by Wilkins. All valves 3" and less in size shall bronze body construction, over 3" in size shall have epoxy coated cast iron bodies. Assemblies 2" and under in size shall have threaded ends, over 2" in size shall have flange ends. Perform backflow preventer test and provide results with closeout documentation.

M. All valves and specialties in contact with potable domestic water shall be lead-free and compliant with NSF/ANSI 61 and NSF/ANSI 372.

PART 3 – EXECUTION

3.1 GENERAL

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Valve installation shall meet the following:
1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
2. Locate valves for easy access and provide separate support where necessary.
3. Install valves in horizontal piping with stem at or above center of pipe.
4. Install valves in position to allow full stem movement.

5. Install chain wheels on operators for all butterfly valves 6" and larger and more 8 foot above floor. Extend chains to 5 foot above finished floor.
6. Install check valves for proper direction of flow and as follows:
7. Swing Check Valves: In horizontal position with hinge pin level.
8. Valves: In horizontal or vertical position, between flanges.
9. Lift Check Valves: With stem upright and plumb.
10. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Unless otherwise indicated, provide valves with the following applications:

1. Shutoff service, 2 inches and smaller: Ball valves.
2. Shutoff service, 2-1/2 inches and larger: Butterfly valves, where acceptable for the intended plumbing service.
3. Fixture connections: Provide shutoff valves at each plumbing fixture where required by code, indicated on the Drawings, or required for servicing.
4. Equipment connections: Provide isolation valves at each piece of plumbing equipment to permit servicing or removal without shutting down the entire system.
5. Branch connections and risers: Provide shutoff valves where required to isolate portions of the plumbing system for maintenance or phased shutdown.
6. Domestic water connections to equipment: Provide shutoff valve and check valve where indicated, required by code, or required by equipment manufacturer.
7. Low points of water piping systems and bases of risers: Provide drain valves where required to permit draining of piping and equipment.
8. Dead-end service: Provide lug-style butterfly valves only where rated for dead-end service.
9. Do not use shutoff valves for throttling unless specifically indicated otherwise.
10. Domestic hot water return branches: Provide balancing valves where indicated.

END OF SECTION

SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR PLUMBING and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. This Section includes, but is not limited to, furnishing and installing supports, anchors, and accessories for plumbing piping and plumbing equipment. Furnishing and installing shall be by each trade as required for completion of its work.

C. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

PART 2 - MATERIALS AND EQUIPMENT

2.1 Hangers, Clamps, Attachments Schedule:

A. ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason or approved equal.
1. All hangers, clamps and attachments shall be manufactured products.
2. Pipe Rings (2-inch pipe and smaller) – adjustable swivel split ring or split pipe ring.
3. Pipe Clevis (2.5-inch pipe and larger) – adjustable wrought clevis type.
4. Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
5. Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
6. Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
7. Brackets (All pipe sizes) – medium weight steel brackets.
8. Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
9. Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
10. Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
11. U-bolts (All pipe sizes) – standard u-bolt.
12. Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
13. Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
14. Protection Saddle (All pipe sizes) – 180-degree coverage, sheet metal pipe protection saddle.
15. Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
16. Concrete Channel Inserts (All pipe sizes) – continuous heavy-duty slot inserts Unistrut.
17. Adjustable Spot Inserts (All pipe sizes) – continuous heavy-duty spot insert Unistrut.
18. Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall confirm to ASTM A36.

2.2 HANGER RODS:

A. Hanger rods or single rod hangers shall conform to the following:

PIPE SIZE	HANGER ROD DIAMETER STEEL PIPE	HANGER ROD DIAMETER COPPER, PLASTIC, HDPE PIPE
2" and smaller	3/8"	3/8"
2-1/2" through 3-5/8"	1/2"	1/2"
4" and 5"	5/8"	½"
6"	3/4"	5/8"
8" through 12"	7/8"	3/4"
14"	1"	7/8"

B. Rods for double-rod hangers may be reduced in size, but in no case shall the minimum rod diameter be less than 3/8 inch.

C. Hanger rods and accessories installed in interior dry locations shall have ASTM B633 electroplated zinc finish.

PART 3 - INSTALLATION

3.1 REQUIREMENTS

A. Unless otherwise specified, all supporting, hanging, and anchoring of plumbing piping and plumbing equipment shall be performed by the installing trade as necessary for completion of the work and as directed in the following paragraphs.

B. Supporting and hanging shall be done so that excessive load will not be placed on any one hanger or structural member and as required to allow for proper pitch and expansion of piping.

C. Hangers and supports shall be placed near joints, turns, and branches, with additional supports provided where required to prevent sagging or excessive movement.

D. For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power-driven devices may be used when approved in writing by the Architect/Engineer.

E. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction.

F. When piping is routed in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping from bridging angles.

G. Trapeze hangers are not allowed, unless specifically approved by the Engineer.

H. Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.

I. Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.

J. Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

K. Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.

L. Support all ceiling hung equipment with approved vibration isolators.

M. Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

N. Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.

O. All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

P. Under no conditions will perforated band iron or steel wire driven hangers be permitted.

Q. Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.

R. All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3” and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1” and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Reference 220529 for additional piping support requirements.

S. Ensure that all bolts and nuts are tightened.

END OF SECTION

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:

1. Plumbing Piping identification.
2. Plumbing Equipment identification.

1.3 QUALITY ASSURANCE

A. Piping System Identification: ANSI A13.1-2015, "Scheme for the Identification of Piping Systems."

PART 2 – PRODUCTS

2.1 TAGS AND CHARTS

A. Provide and install on appropriate valves on the plumbing system a valve tag made of bronze or baked phenolic tag fitted to each valve so that it cannot be removed. Each tag shall be embossed with an identifier. Valve numbering scheme shall be coordinated with the Engineer and reflected in Record Documents. Identifiers include bypass valves, normally open/normally closed valves, zone isolation, etc.

1. Main Isolation Valves
2. Branch Isolation Valves
3. Equipment Isolation Valves
4. Emergency Shutoff Valves
5. Balancing Valves
6. Pressure Reducing Valves
7. Thermostatic Mixing Valves
8. Reduced Pressure Backflow Preventer

B. Provide in the operation manual valve tag information indicating valve identifier, the valves service, normal position and its location.

C. All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. water, domestic hot water, main valves, etc.).

D. Provide piping identification in accordance with ANSI A13.1-2015 standards.

E. Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

2.2 PIPE MARKERS

A. Conform to ANSI A13.1-2015 and shall be pre-printed, color coded, and include flow arrows.

1. Pressure-sensitive vinyl (self-sticking) material.
2. Mechanically Fastened Type: Snap-on or strap-on or piping in damp, dirty, oily, exterior, or other locations where adhesive markers may not remain secure.
3. Provide with direction of flow arrows.
4. Provide marker size, color field length, and letter size in accordance with ANSI A13.1 for the actual outside diameter of pipe or insulation.

Outside Diameter of Pipe or Pipe Covering	**Length of Color Field**	**Size of Letters and Arrows**
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

2.3 EQUIPMENT NAME PLATES

A. Provide engraved limacoid, bronze, baked phenolic or engraved aluminum nameplates, black background with white or natural aluminum letters, minimum 1/16 inch thick.

1. Two 3/8-inch mounting holes.
2. Lettering size: Minimum 1/2-inch high.
3. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

2.4 ACCEPTABLE MANUFACTURERS

A. Pipe and Equipment Markers

1. Craftmark Identification Systems.
2. W. H. Brady Co.
3. EMED Company, Inc.
4. Kolbi Industries, Inc.
5. 3M Co.
6. Seton Name Plate Corp.

PART 3 – EXECUTION

3.1 EQUIPMENT IDENTIFICATION

A. Provide equipment nameplates for plumbing equipment, tanks, control panels, and major accessories. Nameplate wording shall match the equipment designation used on the Drawings and equipment schedules.

1. Tag and locate all items indicated on drawing equipment schedules.

B. Equipment tags shall be engraved limacoid plates with equipment tag ID and electrical panel number and circuit number.

C. Install tags on all devices with numbers and letters corresponding to charts.

D. Fasten tags securely to devices with tag fasteners in a manner for easy reading.

E. Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, and control panels.

1. Secure nameplates with self-tapping screws, or nuts and bolts.

F. For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

3.2 PIPE IDENTIFICATION

A. Soil, waste, vent, and storm drainage piping shall be identified in mechanical rooms, janitor rooms, accessible pipe spaces, and other exposed locations.

B. Install pipe markers at each valve, at each branch connection, at each riser, at wall and floor penetrations, at each pipe passage to underground, and at intervals not exceeding 20 feet on straight pipe runs, with at least one marker in each room and each story traversed by piping.

C. Identify piping service and direction of flow. Identify return piping where applicable, including domestic hot water return.

D. Install markers in accordance with manufacturer’s instructions. Install on completed insulation where applicable.

3.3 SERVICE ABBREVIATIONS

A. General

1. DCW Domestic Cold Water
2. DHW Domestic Hot Water Supply
3. DHWR Domestic Hot Water Recirculating
4. PD Pump Discharge -Sump Pump/Sewage Ejector
5. SAN Sanitary Waste
6. V Vent
7. ST Storm
8. TW Tempered Water
9. TWR Tempered Water Return

10. GW Grease Waste

END OF SECTION

SECTION 220561 - PREPARATION OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

B. Comply with all applicable requirements of the governing plumbing code and local authorities having jurisdiction for cleaning, disinfection, and testing of plumbing systems.

1.2 SUBMITTALS

A. Submit reports and certifications demonstrating completion of cleaning, disinfection, testing, and verification of plumbing systems.

B. Submit disinfection report indicating date of disinfection, disinfectant used, concentration, duration of application, residual test results, and corrective actions taken, if any.

C. Submit bacteriological test results, when required by the Owner or authorities having jurisdiction, from a laboratory acceptable to the authority having jurisdiction.

D. Submit certifications for backflow preventer testing performed by personnel certified in accordance with applicable state and local requirements.

E. Submit operational verification report indicating systems tested, dates of testing, deficiencies identified, corrective actions taken, and final acceptance status.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEANING AND FLUSHING

A. After completion of the domestic water distribution system and prior to placing the system into service, verify that all valves are in the proper position and capable of full operation.

B. Flush domestic water piping systems with potable water in an orderly sequence from the source toward the most remote outlets.

C. Open outlets and permit water to flow until the water runs clear and all foreign matter is removed from the system.

D. Continue flushing through branch lines and risers until the entire system has been thoroughly cleaned.

E. The A/E may witness flushing procedures and require additional flushing if, in their opinion, the system has not been adequately cleaned.

3.2 DISINFECTION OF DOMESTIC WATER SYSTEMS

A. After flushing is complete, disinfect the domestic water distribution system in accordance with the requirements of the governing authorities having jurisdiction.

B. Disinfect the system by introducing chlorine or a solution of calcium hypochlorite or sodium hypochlorite and filling the piping system slowly to achieve a concentration of 50 parts per million chlorine, as verified by residual chlorine testing at remote points in the system.

C. Open and close valves and other appurtenances during disinfection to ensure complete distribution of the disinfecting solution throughout the system.

D. Maintain the disinfecting solution within the system for a minimum period of 24 hours.

E. At the end of the 24-hour period, test for residual chlorine at remote points in the system. If residual chlorine is less than 25 parts per million, repeat the disinfection procedure until the required residual is achieved.

F. After successful disinfection, flush the system with potable water until chemical residue has been removed and the system is suitable for service.

G. If required by the Owner or authorities having jurisdiction, provide additional bacteriological testing prior to final acceptance. If test results indicate the water is unsafe, re-disinfect and retest the system until acceptable results are obtained.

H. Provide written certification that flushing, disinfection, and required corrective measures have been completed and that the system is ready for service.

3.3 TESTING OF SANITARY WASTE, VENT, AND STORM DRAINAGE SYSTEMS

A. Test sanitary waste, vent, and storm drainage systems in accordance with the governing plumbing code and the requirements of local and state plumbing inspection authorities.

B. Repair leaks and defects disclosed by testing and retest systems until satisfactory results are obtained.

C. Provide written certification that required testing has been completed and that systems are free of leaks and ready for service.

3.4 OPERATIONAL VERIFICATION

A. Verify proper operation of plumbing fixtures, faucets, flush valves, stops, pumps, alarms, backflow preventers, water pressure reducing valves, thermostatic mixing valves, water heaters, and other plumbing specialties and appurtenances provided under the Contract.

B. Verify that domestic hot water systems are operating and delivering water at intended setpoints.

C. Verify that pumps operate without excessive noise or vibration and that controls function as intended.

D. Verify that floor drains, roof drains, indirect wastes, and similar drainage components flow freely and drain properly.

E. Verify that backflow preventers are tested and certified by qualified personnel where required by code or authority having jurisdiction.

F. Document deficiencies identified during operational verification and correct deficiencies prior to final acceptance.

G. Submit written verification report indicating date of test, systems tested, personnel performing the work, deficiencies found, corrective actions taken, and final status of each system.

H. Test systems as recommended by Local and State Plumbing Inspection Authorities.

END OF SECTION

SECTION 220593 - PLUMBING SYSTEMS TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

B. Refer to Specification Section 019113 General Commissioning Requirements.

1.2 DESCRIPTION OF WORK

A. Work Includes
   1. Furnishing all labor, materials, tools, equipment, and services to test, adjust, and balance plumbing systems as indicated, in accordance with provisions of the Contract Documents.
   2. Complete coordination with work of all other trades.
   3. Performing all testing, adjusting, and balancing required to place plumbing systems into proper and fully functional operation.

B. Test, balance, and adjust following plumbing systems:
   1. Domestic Hot Water Circulating system
   2. Domestic Cold Water systems where pressure and flow is indicated
   3. Tempered Water System
   4. Domestic Hot water heating system

1.3 QUALITY ASSURANCE

A. Agency Qualifications: Independent testing and balancing agency specializing in testing and balancing of hydronic and domestic water systems, and certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

B. Personnel Certification: Supervisors and technicians performing the Work shall be currently certified by AABC or NEBB for water balancing procedures applicable to the systems specified.

C. Balancing Standards: Perform testing and balancing procedures in accordance with the applicable requirements and recommendations of AABC or NEBB.

D. Instrument Calibration: Accurately calibrate all test instruments and maintain in good working order. Instruments shall have been calibrated within the last 12 months by an independent laboratory traceable to NIST standards. Maintain calibration records at the Project site and submit copies with final report.

1.4 SUBMITTALS

A. Submit the following in accordance with Division 01 requirements:
   1. Testing and balancing agency qualifications.
   2. Current certification documentation for firm and personnel performing the Work.
   3. List of test instruments to be used, including most recent calibration dates.
   4. Preliminary TAB procedures and report forms proposed for use on this Project.
   5. Preliminary deficiency report identifying conditions preventing proper testing and balancing.
   6. Final certified TAB report.

B. Submit final report signed by the certified TAB supervisor responsible for the Work.

1.5 RESPONSIBILITIES OF TESTING AND BALANCING AGENCY WORK

A. Schedule Work with trades involved.

B. Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.

C. Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.

D. Report in writing any conditions preventing proper balancing including, but not limited to, incomplete systems, air-bound piping, dirty strainers, improper pump rotation, non-functioning controls, missing balancing devices, inaccessible valves, missing test ports, or defective equipment.

E. Balance to within plus or minus 10 percent of set point of balancing valves or pumps unless otherwise indicated.

F. Prepare and submit test reports.

G. Recheck systems after corrections have been made and revise reports accordingly.

1.6 RESPONSIBILITIES OF PLUMBING CONTRACTOR'S WORK

A. Start systems and maintain correct operation during balancing operations.

B. Clean strainers prior to balancing system.

C. Vent all air from piping systems and place systems in full normal operation prior to balancing.

D. Verify that pumps, water heaters, water pressure booster systems, thermostatic mixing valves, aquastats, temperature controls, alarms, and associated accessories are installed, connected, and operating properly prior to balancing.

E. Make personnel accessible to provide necessary adjustments and corrections to systems as directed by balancing agency.

F. Maintain accessibility to test locations and devices requiring adjustment.

G. Provide to the Testing and Balancing Agency a complete set of approved Shop Drawings and submittals and a posted set of Plumbing Drawings indicating any and all changes to the Contract Documents.

H. Install all required balancing valves, pressure gauges, thermometer wells, test plugs, flow measuring devices, and other required accessories prior to start of TAB Work.

I. Complete piping flushing, cleaning, sterilization, and disinfection procedures where applicable before TAB Work begins.

1.7 JOB CONDITIONS

A. Balance at time directed by General Contractor and Owner's Representative.

B. Do not begin TAB Work until systems have been completed, tested, cleaned, and are in full operation.

C. Perform testing and balancing only when systems can be operated under normal load and occupancy conditions to the greatest extent possible.

1.8 GUARANTEE

A. Provide extended warranty of 90 days, after completion of test and balance work, during which time the CM/Owner may, at their discretion, request recheck or resetting of any equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

1.9 CLOSEOUT DOCUMENTATION

A. Submit final certified TAB report as part of closeout documents.

B. Include final settings of all balancing valves, pump data, temperatures, pressures, flows, control setpoints verified during TAB, and all deficiency and corrective action records.

C. Provide marked record documentation identifying final balancing positions and settings for each device adjusted.

D. Submit copies of all instrument calibration certificates with final TAB report.

E. Submit final report to Engineer, Owner, CM, and Commissioning Authority where applicable.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Accurately calibrate and maintain all test instruments in good working order.

B. Do not begin balancing until the system(s) have been completed and are in good order.

C. Record all inspections, tests, and adjustments.

D. Verify that systems are free of air, strainers are clean, valves are open or in proper operating position, and equipment is operating correctly prior to balancing.

E. Notify Contractor and Engineer in writing of any conditions preventing proper testing and balancing.

3.2 WATER BALANCE PROCEDURE

A. Open all valves to full open position unless otherwise required for proper system operation.

B. Check pump rotation.

C. Check expansion tanks to determine they are not air-bound.

D. Check for installation and proper operation of manual and automatic air vents.

E. Check hot and cold water supply temperatures and return water temperatures at mains. Reset to correct design temperatures where required and where controls are adjustable by this Contractor.

F. After completing balancing valve adjustments to set points noted on Drawings, test hot and cold water pressures and flows at pumps and re-adjust if required.

G. Check the following in domestic hot and cold water systems:
   1. Leaving water temperature at water heater.
   2. Leaving water temperature at thermostatic mixing valve.
   3. Pressure of domestic cold water at water service entrance.
   4. Pump operating suction and discharge pressures and final total dynamic head.
   5. Water metering device readings where provided.
   6. Domestic hot water return temperatures at each recirculation branch or as many locations as required to verify system balance.
   7. Water temperature and pressure at the most remote fixtures and highest fixtures indicated for verification.

H. Adjust domestic hot water recirculation balancing valves to achieve design flow and/or intended return temperature at each branch.

I. For booster pump systems, verify cut-in pressure, cut-out pressure, lead-lag sequence, and pump operation through full operating range.

J. List all mechanical specifications of pumps.

K. Record nameplate data and actual operating amperages of pump motors.

3.3 OPERATING TEST

A. After systems are balanced, conduct operating test of not less than 8 hours' duration each for domestic hot (and cold) water systems to demonstrate to satisfaction of the CM/Owner that systems comply with requirements of plans and specifications, and that all equipment and controls are functioning properly.

B. Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:
   1. Time, date, and duration of test.
   2. Water pressure at the most remote and the highest fixtures.
   3. Operation of each fixture and fixture trim.
   4. Operation of each valve, hydrant, and faucet.
   5. Pump suction and discharge pressures.
   6. Temperature of each domestic hot water supply.
   7. Operation of each floor and roof drain by flooding with water.
   8. Operation of each vacuum breaker and backflow preventer.
   9. Complete operation of each water pressure booster system (when applicable), including pump start pressure and stop pressure.
   10. Final balancing valve settings and temperature readings at representative return branches.
   11. List of deficiencies encountered and corrective measures taken.

3.4 FINAL REPORT

A. Final TAB report shall include, as a minimum, the following:
   1. Project name and location.
   2. Name of testing and balancing agency.
   3. Names and certification numbers of personnel performing the Work.
   4. Dates testing and balancing was performed.
   5. List of instruments used and calibration dates.
   6. Identification of each system tested.
   7. Pump schedule including manufacturer, model number, size, speed, motor horsepower, design flow, and actual operating data.
   8. Recorded suction pressure, discharge pressure, and calculated total dynamic head for each pump tested.
   9. Entering and leaving water temperatures for water heaters, mixing valves, recirculation loops, and other devices tested.
   10. Pressures and temperatures at water service entrance, remote fixtures, highest fixtures, and other points required by the Contract Documents.
   11. Final balancing valve settings for each valve adjusted.
   12. Statement of compliance or non-compliance with specified tolerances.

13. Deficiencies noted and corrective actions taken.
14. Signature of certified TAB supervisor attesting to accuracy and completeness of report.

END OF SECTION

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes but is not limited to.
   1. Pipe insulation.
   2. Equipment insulation.
   3. Insulation adhesives, mastics and caulking.

B. Definitions
   1. Concealed Insulated Surfaces: Piping and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed interstitial spaces, and above suspended ceilings.
   2. Exposed Insulated Surfaces: Piping and equipment located in mechanical rooms, tunnels, and rooms/spaces without suspended ceilings.

1.3 QUALITY ASSURANCE

A. Comply with fire and smoke hazard ratings indicated.
   1. Fire and smoke hazard ratings shall be as determined by ASTM E84, NFPA 255, or UL 723.
   2. Accessories including adhesives, mastics, cements, tapes, and glass fabric shall have flame-spread and smoke-developed ratings equal to or better than the insulation being installed.
   3. Following are the rating requirements:
      a. Flame spread (maximum): 25
      b. Smoke developed (maximum): 50
      c. Products or shipping cartons shall bear appropriate labels identifying flame-spread and smoke-developed ratings.
      d. Where prohibited by code or local authorities, do not use elastomeric insulation in return-air plenums or other environmental air plenums.

B. Provide plumbing insulation in accordance with applicable energy code requirements and minimum insulation thicknesses required by the governing code, except where more stringent requirements are indicated on the Drawings or specified herein.

C. Cold piping insulation systems shall be installed with continuous vapor barrier protection and sealed joints, seams, penetrations, and terminations to prevent condensation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass Fiber Pipe Covering, Calcium Silicate, and Thermal Insulating Wool: John Manville, Owens-Corning, Knauf or approved equal.

B. Fire-Retardant Adhesive: John Manville, Benjamin Foster, 3M, Insul-Coustic or approved equal.

C. Lagging Adhesive: John Manville, Benjamin Foster, 3M, Insul-Coustic or approved equal.

D. Elastomeric Pipe Insulation and Equipment Covering: Armacell, K-Flex, Aeroflex USA, or approved equal

E. Insulated Fitting Covers: John Manville, Certain-Teed, Knauf, or approved equal.

F. Insulation Caulking: Dow 790, Dow 732, or manufacturer's recommended compatible sealant.

2.2 GENERAL

A. Provide fire and smoke hazard ratings as indicated for entire composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation).

B. Do not use material that exceeds specified flame and smoke ratings.

C. Use permanent treatments to jackets or facings to impart specified fire ratings.

D. Use of water-soluble treatments is prohibited.

E. At hangers and supports, provide insulation protection saddles, shields, inserts, and vapor-barrier protection as required by Section 'Hangers and Supports for Plumbing Piping and Equipment' and manufacturer's recommendations.

2.3 PIPE INSULATION, NON-FLEXIBLE

A. Pipe Insulation, Non-flexible
   1. Glass fiber pipe insulation with factory-applied all-service jacket (ASJ), maximum thermal conductivity of 0.23 Btu-in./hr-sq. ft.-deg F at 75 deg F mean temperature.
   2. Apply to the following piping in thickness indicated:
      a. Domestic Cold Water, Tempered Water (potable & non-potable):
         1) Runouts to fixture (less than12 feet)..…….....1/2 inch
         2) 1-1/4 inch and smaller.....…….....1/2 inch
         3) 1-1/2 and larger.....…….....1 inch
      b. Domestic hot/recirculating water (thru 140 deg F): (potable and non-potable)
         1) 1-1/4 inch and smaller……..1 inch
         2) 1-1/2 inch and larger…….....1-1/2 inch

c. Horizontal rain leaders, including 24 inches above and below horizontal offsets and to underside of roof deck, shall receive 1-inch insulation

2.4 INSULATION FOR DOMESTIC WATER HEATER STORAGE AND SWING TANKS

A. Insulation for Domestic Water Heater Storage Tanks
   1. O-C Type 703 fiberglass board, 2 inch thickness, 3.0 pcf density, unfaced.
   2. Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75deg F.
   3. Apply to all domestic water heater storage tanks, and swing tanks except when specified as factory-insulated.

2.5 INSULATION FOR COLD EQUIPMENT

A. Insulation for Cold Equipment
   1. Armstrong Armaflex II sheet insulation; 3/4 inch material installed in 2 layers with joints staggered, 1-1/2 inch total.
   2. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
   3. Apply to following equipment in thickness indicated:
      a. Domestic water meter.....…….....3/4 inch
      b. Roof drain bodies.....……3/4 inch

2.6 INSULATION ACCESSORIES

A. Provide all accessory materials required for complete installation of insulation systems, including cements, adhesives, mastics, coatings, tapes, sealing compounds, fitting covers, jackets, bands, shields, saddles, and inserts. Accessories shall be compatible with insulation materials, jackets, and service conditions.

B. ASJ Tape: Provide pressure-sensitive tape matching the insulation jacket, suitable for sealing joints in ASJ jacketed insulation

C. PVC Fitting Covers and Jackets: Provide pre-molded polyvinyl chloride fitting covers and jacketing, with matching accessories, for valves, fittings, flanges, unions, and specialties where indicated or where required for a neat, durable finish.

D. Bands for Outdoor Jackets: Provide stainless steel or aluminum bands, seals, and clips for securing aluminum jackets on insulated piping exposed to weather.

E. Insulation Shields and Saddles: Provide galvanized steel or stainless steel protection shields and saddles at hangers and supports to prevent compression of insulation. Provide insulation inserts where required to maintain the integrity of the insulation and vapor barrier system.

F. Vapor Barrier Lap Adhesive: Provide fire-resistant vapor barrier lap adhesive compatible with insulation jacket and vapor retarder materials, for sealing laps, joints, seams, penetrations, and terminations in cold piping insulation systems.

G. Outdoor Aluminum Jacket: Provide aluminum jacket with moisture barrier for insulation installed outdoors, complete with matching fittings, bands, and accessories for a weatherproof installation.

H. Insulation Inserts: Provide load-bearing insulation inserts, same thickness as adjacent insulation, at hangers and supports on insulated piping where required to prevent compression of insulation and maintain vapor barrier continuity. Inserts shall be suitable for the pipe size, insulation thickness, and service conditions.

I. Protection Shields: Provide galvanized steel protection shields at hangers and supports for insulated piping. Shields shall be of length and gauge recommended by insulation manufacturer for the application.

PART 3 - EXECUTION

3.1 APPLICATION - GENERAL

A. Do not insulate piping until satisfactory completion of required pressure tests.

B. Apply insulation only to clean, dry surfaces and in strict accordance with manufacturer’s installation instructions.

C. Butt insulation tightly together. Seal longitudinal and end joints with compatible jackets, facings, tapes, and adhesives to maintain continuous thermal and vapor barrier integrity.

D. Apply adhesives, mastics and coatings per manufacturer's recommendations and as specified.

E. Provide continuous vapor barrier at hangers, supports, anchors, and other penetrations on cold piping and cold equipment.
   1. Adequately insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation.

F. Continue insulation through sleeves, wall penetrations, and ceiling penetrations unless otherwise prohibited by firestopping or code requirements. Coordinate insulation terminations at fire-rated assemblies with firestopping requirements.

G. Insulate all fittings, valve bodies, flanges and other pipeline accessories.

H. At hangers and bracing, install in accord with Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment”.

I. Provide insulation inserts and protection shields at pipe hangers, supports, and clamps to prevent compression of insulation. Maintain continuous insulation and vapor barrier at cold piping supports.

J. Provide removable and reusable insulation blankets, pads, or covers on valves, strainers, pressure reducing valves, heat exchangers, pumps, specialties, and other components requiring access for maintenance, operation, or inspection. Blanket insulation shall provide thermal performance equivalent to adjacent insulation and be securely fastened for neat reinstallation after removal.

K. Do not insulate unions, cleanouts, relief valve discharge piping terminals, access panels, balancing devices requiring adjustment, equipment nameplates, tags, labels, or operating and safety devices where insulation would interfere with operation, maintenance, inspection, or identification. Carefully terminate insulation at such locations.

L. Replace insulation that is wet, damaged, compressed, stained, or improperly installed. Patched insulation will not be permitted where, in the opinion of the A/E, the vapor barrier or thermal performance has been compromised.

3.2 APPLICATION OF NON-FLEXIBLE PIPE INSULATION

A. On piping, install with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge on hot piping.
   1. On cold piping, use self-sealing lap system or adhesive applied to both surfaces per manufacturer's recommendation.
   2. Do not staple cold piping.
   3. Butt adjoining sections of insulation tightly together and continue jacket by installing self-sealing lap closures and butt strips in accordance with manufacturer’s recommendations.

B. Installation of Insulation of Fittings
   1. For pipe sizes 2 inches and smaller, finish with mineral fiber cement to thickness of adjoining pipe insulation.
   2. Over 2 inches, insulate with mitered pipe insulation segments or preformed fiberglass fittings secured with vinyl faced insulation strapping tape or 18 ga galvanized annealed wire and finished with one coat of mineral fiber cement.
   3. Finish fitting insulation with glass cloth and mastic or with premolded fitting covers in accordance with manufacturer’s recommendations.
   4. Prefabricated fitting covers approved for use at pipe fittings may be used instead of finishing method outlined above.
   5. Install in accordance with manufacturer's recommendations.

C. Cover all insulated piping exposed to weather with additional jacket of 0.016-inch smooth aluminum with moisture barrier.
   1. Apply aluminum jacket with 0.020-inch x 3/8-inch aluminum bands on 9-inch centers, minimum 2-inch lap joint.
   2. Provide weatherproof aluminum jacketing over insulated piping exposed outdoors.
   3. Use Ceel-Co 300 Series plastic jacketing applied per manufacturer's recommendations.

D. Reinforce jackets on insulated piping in mechanical rooms and central plant less than 8 ft. above floor.
   1. Cover with 0.030 inch PVC jacket conforming to 25-50 fire requirements.

3.3 APPLICATION OF INSULATION ON HOT EQUIPMENT

A. Install insulation on hot plumbing equipment in accordance with manufacturer’s recommendations.
   1. Install insulation with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge.
   2. Butt adjoining sections of insulating tightly together and continue jacket by installing self-adhering butt strips over entire joint.

3. Insulate flanges and fittings with mineral fiber cement.
4. Finish body with 0.016-inch aluminum jacket. Reinforce end and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

3.4 APPLICATION OF INSULATION ON DOMESTIC WATER HEATER STORAGE TANKS WHEN TANKS NOT FACTORY-INSULATED

A. Install insulation with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge.

B. Butt adjoining sections of insulating tightly together and continue jacket by installing self-adhering butt strips over entire joint.

C. Insulate flanges and fittings with mineral fiber cement.

D. Finish body with 0.016-inch aluminum jacket. Reinforce end and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

3.5 APPLICATION OF INSULATION ON COLD EQUIPMENT

A. Apply with Armstrong 520 adhesive covering entire surface as well as back of insulation.

B. Coat all butt edges and press firmly together with 1/8-inch overlay pressure.

C. Apply two (2) coats of Armstrong Armaflex finish over sheet surfaces.

D. On cold piping systems, maintain continuous insulation and vapor barrier over the full insulated surface. Seal all joints, seams, laps, penetrations, and terminations vapor-tight. Insulation installation shall prevent condensation under all operating conditions.

END OF SECTION

SECTION 221116 - PLUMBING PIPING

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. This Section applies to non-potable and potable cold water, hot water, hot water recirculation, and tempered water piping.

1.3 EQUIPMENT BY OTHERS

A. Include all necessary roughing-in and final equipment connections by plumbing trade as required.

B. Wherever equipment is furnished and set in place under Work of another Section or by Owner, they shall furnish detailed Drawings and exact rough-in dimensions and locations at the Site.
   1. Information shall be furnished sufficiently in advance to allow proper installation of all required services.
   2. If information is not furnished sufficiently in advance to permit proper rough-in and coordination, promptly notify the Architect/Engineer. Coordinate final locations prior to installation.
   3. This Division shall include all required service rough-ins and final connections to the equipment.

1.4 QUALITY ASSURANCE

A. General
   1. Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the plumbing systems.
   2. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the indicated purposes. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected; all Work shall be true to detail.

B. Codes and Standards (Division 22 Section “Common Work Results for Plumbing” Listings and the following).
   1. Plumbing installation shall be in accordance with the state of Connecticut and local Trumbull plumbing code, and all other codes having jurisdiction.
   2. American Standard Code for Pressure Piping ANSI B31.1
   3. National Association of Corrosion Engineers

4. American National Standards Institute (ANSI)
5. American Society of Mechanical Engineers (ASME)
6. American Society for Testing and Materials (ASTM)
7. American Water Works Association
8. Manufacturer's Standardization Society of the Valve and Fitting Industry
9. Plumbing and Drainage Institute
10. State of Connecticut or local Plumbing Code, as applicable.
11. State of Connecticut or local Building Code, as applicable.
12. 42 USC 300G: The Reduction of Lead In Drinking Water Act.

C. Material Standards
1. ASTM B32-20: Specification for Solder, Metal Sizes.
2. ASTM B42-25: Specification for Seamless Copper Pipe, Standard Size.
3. ASTM B75/B75M-26-: Specification for Seamless Copper Tube.
4. ASTM B88-22: Specification for Seamless Copper Water Tube.
5. ASTM B251/B251M-25: Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
6. ASTM B302-17: Specification for Threadless Copper Pipe.
7. ASTM A53/A53M-24: Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
8. AWWA C651-23: Standard for Disinfecting Water Mains.

1.5 HANDLING, DELIVERY, AND STORAGE

A. General
1. Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations.
2. No extra cost shall be charged the Owner for handling, delivery, or storage.
3. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.

1.6 JOB CONDITIONS

A. Coordinate the exact location of this work with the work of other trades prior to fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and a section of piping as required to meet job conditions. Coordinate with and review all related Drawings of all trades prior to start of work.

B. All uninsulated piping and fittings exposed to public view in kitchen and servery shall be chrome-plated or stainless steel. All piping and fittings in kitchen not exposed to public view shall be chrome-plated or painted with high-temperature aluminum paint.

PART 2 - PRODUCTS

2.1 PIPING

A. General
1. The outside of all piping and fittings shall bear the Manufacturer's standard marking for type, pressure, etc.
2. The A/E does not guarantee the accuracy of the figure numbers as listed.

B. Pipe - General
1. All pipe and fittings shall be equal to or better than the grade specified.
2. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
3. Pipe shall be labeled.
4. Fittings and valves shall have the Manufacturer's name or trademark legibly raised or cut into each piece.
5. All pipes shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs, or oil.
6. No salvaged or used pipe shall be used without the written approval of the A/E or Owner. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.

C. Pipe 4-inch Size and Smaller
1. Pipe: Copper tube, seamless, type L hard temper, ASTM B-88, above ground, and type K soft temper, 2-inch and smaller, below ground.
   a. Fittings: Cast brass or wrought copper, solder type, ASTM 75, ANSI B16.22, or B16.18.
   b. Joints: Soldered, 95-5 tin-antimony solder above ground, and silver solder below ground.
   c. Unions: Sweat-end, 150 lb. cast brass, ground joint.
   d. Mechanically formed tee connections and couplings, such as T-drill, are acceptable. All joints shall be brazed with brazing material conforming to AWS A5.8 Classification BCUP-3 or BCUP-4.
   e. Copper press fittings may be used as an option, per ASTM B16.18 or ASTM B16.22. O-rings shall be EPDM. Copper press fittings to be equal to ProPress as manufactured by Viega or Nibco Press System.
   f. For 2-1/2-inch through 4-inch Type L copper piping above ground, the use of a grooved piping system including couplings, reducers, elbows, tees, and flange adaptors that are certified and approved by BOCA, IAMPMO, SBCCI, and UL for up to 300 psig working pressure and up to 230 deg F operating temperature is acceptable. All copper piping shall be roll grooved.

D. Pipe 5-inch Size and Larger
1. Pipe: Galvanized steel, Schedule 40, ASTM A-120 or A-53.
   a. Coating: Hot-dipped galvanized inside and outside.
2. Fittings
   a. Threaded, galvanized, 125 lb. SWP, ANSI B16.4.

b. Galvanized flanged, 125 lb. C I, ANSI B16.1.

3. Joints: Threaded, galvanized 125 lb. C I, ANSI B16.1, Victaulic, Aeroquip or Stockham.
4. Unions: Same as joints.
5. Gaskets: 1/16-inch-thick rubber. Type of gaskets selected shall protect ends of galvanized pipe and be as recommended by piping and joint manufacturers for the specific applications, temperatures and water conditions.
6. Also acceptable for 4 inch and larger galvanized steel, Schedule 40 piping above ground, is the use of a Victaulic grooved piping system including couplings, reducers, elbows, tees, and flange adaptors that are certified and approved by BOCA, IAPMO, SBCCI and UL for up to 300 psig working pressure and up to 230 degrees F operating temperature.
7. Also acceptable for 5-inch and larger is the use of copper piping, similar to the data listed for copper pipe 4-inch size and smaller.

E. Pipe and Fittings 3-inch and Larger (Underground)
1. Ductile Iron Pipe
a. Pipe: Conform to AWWA C151.
b. Cement-mortar lining: Conform to AWWA C104.
c. Protective coating outside: Bitumastic or coal tar enamel.
d. Thickness class: 53.
e. Pressure class: 350 psi
f. Joints: Mechanical or push-on, conform to AWWA C111.
g. Fittings
1) Gray iron or ductile iron
2) Full body: Conform to AWWA C110, or
3) Compact: Conform to AWWA C153.
4) Class
5) 250 or 350 up to 24-inch diameter.
6) Bituminous coating: Inside and outside.
7) Cement lining: Conform to AWWA C104.
8) Polyethylene encasement.
9) Conform to AWWA C105.
10) Thickness: 8 mil.

2.2 PIPING AUXILIARIES/SPECIALTIES

A. General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled. All auxiliaries and specialties shall be suitable for the piping to which they are attached.

B. Interior Hose Bibbs
1. Manufacturers:
a. Woodford, Prier, Crane, Nibco, or Red-White.

C. Wall Hydrants
1. Manufacturers: Josam, J.R. Smith, Mifab, Wade, Woodford, or Zurn.

D. Hose Valves
1. Manufacturers:

a. NIBCO, Harvel, or Spears.

E. Water Meter
1. Meter is purchased from the utility company and installed by the Plumbing Contractor.
2. Provide meter installation meeting utility company requirements.

F. Strainers
1. Manufacturers: Sarco, Anderson, Armstrong, Crane, or Watts.
2. Sarco type BT or BF-150, bronze body with stainless steel screen. Provide drain valve on strainer.

G. Washer Connection Boxes
1. Manufacturers: Guy Gray, Oatey, Water-Tite, or Acorn.
2. Guy Gray Co. Model No. FB-200 (bottom supply) or #FBB-200TS (top supply) with 1/2-inch combination MPT brass sweat connection, 1/2-inch hose end valves, 2-inch drainpipe and overflow guard.
3. Where boxes are installed in concrete block walls, Contractor shall provide a stainless steel or chrome-plated trim on box so that it is flush with wall. No concrete block shall be exposed within enclosure. All exposed screws to be vandalproof.

H. Water Hammer Arresters
1. Manufacturers: Josam, Mifab, Wade, J.R. Smith, Watts, or Zurn.
2. Josam type “Absorbatron”.
3. Meet the requirements of PDI Standard WH-201 for size and location.
4. Size of unit shall be clearly indicated on unit.

I. Vacuum Breakers and Dual Checks
1. Manufacturers: Watts, Chicago Faucet, Febco, Wilkins, Conbraco, or Woodford.
2. Hose Connections: ASSE 1011, Watts #8A, 3/4-inch hose thread. (#8AC in finished areas).
3. Ice Machines: ASSE 1024, Watts Series 7 with two chrome nickel plated brass replaceable dual checks for 3/8 inch through 1 inch size.
4. Coffee Maker: ASSE 1022, Watts SD-3 with stainless steel body, dual checks, wye strainer and drain port for 1/4 inch through 3/8-inch size. Pipe drain port to drain and terminate with air gap.

J. Backflow Preventers
1. Manufacturers: Watts, Conbraco, Febco, Wilkins, Zurn, Ames, or Mifab, .
2. Pipes 1-1/2 inch and Smaller: ASSE 1013, Watts LF009 Series, all bronze, lead free, reduced-pressure-type with two ball valves. Provide strainer upstream.
3. Pipes 2 inch and Larger: ASSE 1013, Watts 957 Series, lead free, reduced-pressure-type with two check valves, pressure relief valve, and two ball (2-inch size) or gate valves. Provide strainer upstream.
4. Backflow preventers shall be serviceable without removal from pipeline.
5. Provide indirect drain with air gap fitting.

K. Trap Primer
1. Manufacturers: Josam, J.R. Smith, Wade, Zurn, Watts, or Mifab.
2. Mifab M-500 trap primer with M1-DU distribution unit as required.

3. Provide 1/2 inch soft type K copper pipe from the trap primer distribution devices to the trap primer inlet of the floor drains.
4. Trap primer shall require no greater than 3 psi to activate.

L. Trap Primer Manifold System
1. Precision Plumbing Products “Prime-Time” electronic trap priming manifold with atmospheric vacuum breaker, solenoid valve, water hammer arrestor, 3/4-inch copier manifold with 1/2 inch compression fitting taps, and 24-hour timer all installed in a 16 ga. steel enclosure with prime-coated access door and screwdriver door latch.
2. Provide 1/2-inch soft type “K” copper pipe from the trap primer distribution system to the trap primer inlet of the floor drains.
3. Electrical Contractor to provide 120 volt, one-phase, power to unit.
4. See noted data on Plans relating to locations of distribution systems and number of outlets required at each system.
5. Manufacturer: Precision Plumbing Products, Mifab, or Zurn.

M. Trap Seal Protection Devices
1. Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer or approved equal.
2. Standard: ASSE 1072-2007
3. Body: ABS Plastic
4. Diaphragm & Sealing Gasket: Neoprene Rubber
5. Size: 2 inch (50 mm), 3 inch (75 mm), 4 inch (100 mm).
6. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

N. Domestic Water Valve Cabinet
1. 16-inch x 16 inch x 4 inch deep recessed cabinet with 1 inch flange all around flush with wall.
2. Cabinet shall be constructed of 18-gauge, 304 stainless steel with #3 polished finish.
3. Cabinet shall have continuously hinged door (gasketed) with keyed cam lock. Door shall be same construction as cabinet.
4. Cabinet to be manufactured by Karp Associates, Inc., Milcor, Mifab, Wilconsin Co., or equal.

O. Drain Valves: Powell 502-HS with cap and chain, or equal by Hammond, Keystone, or Watts.

P. Water Pressure Regulator: Cash Acme type E-55, or equal by Cla-Val, Conbraco, Mifab, Watts.

Q. Gauge Cocks: Powell Fig. 757, or equal by Anvil, Waltec, Victaulic, White Rogers.

R. Hot Water Balancing Valves.
1. Manufacturers:
   a. ½” up to 2”: Circuit Solver CSUA (no exceptions).
   b. 2 ½” and larger: Sarco W-SS-6, Flow Design Model (FDI) Model UA, Griswold or Tour Anderson (TA) Combination Balancing/Shut-Off.

1. Manual throttling venturi with union, chrome-plated ball, teflon seats, blowout-proof stem, adjustable memory stop, dual pressure and temperature ports, threaded or soldered connections, brass body, 600 psig at 205 deg F, ±3 percent accuracy.

S. Relief Valves

1. ASME tested and certified.
2. Shall have capacity to handle 100% of service.
3. Shall be set at 10% above the working pressure of equipment or service to which it is connected, or as noted.
4. Shall be iron body with stainless steel trim, renewable discs and seat rings, slow-opening-type.
5. Discharge shall be piped to nearest floor drain and arranged for safe discharge.
6. Manufacturers: Consolidated, Farris, Leslie, Lonergan, Manning-Maxwell-Moore.

T. Temperature Regulators
1. ASME-coded.
2. Shall be pilot operated, of packless construction, for dead-end service.
3. Main valve shall be cast iron body, single-seated, with SECO metal seat, normally closed and guaranteed to shut tight.
4. Shall have an adjustable bi-metal thermostat, with a bronze or stainless-steel bulb suitable for the application. Shall be complete with gages.
5. Shall be sized to meet the capacity and service indicated.
6. Shall be installed with strainer, shut-off valves.
7. Manufacturers: Spence Engineering Co., Fisher, A W Cash, McLear.

U. Temperature and Pressure Relief Valves
1. ASME-coded
2. All-bronze construction with seat-to-disc alignment that will not stick or freeze.
3. Shall start to open at 230 deg F and shall be fully open at 240 deg F.
4. Shall have snap action thermostat and sensing bulb sized to water heater Manufacturer's recommendations
5. Manufacturers: Watts, McDonnel, Wilkins, Conbraco.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with Division 22 Section “Common Work Results for Plumbing”, as well as the requirements of Division 22 Sections “Hangers and Supports for Plumbing Piping, and “Plumbing Insulation”.

B. Piping shall be installed in a manner which permits easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.

C. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.

D. Piping shall not be supported from other pipes, conduits, ducts or similar installations.

E. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.

F. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the runouts of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.

G. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.

H. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.

I. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.

J. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed in a manner which does not cause pocketing or inhibit the flow of the material.

K. Install shut-off service valves with unions on all connections to equipment and on each side of control valves as required for ease of proper servicing and maintenance; see Division 22 Section "General Duty Valves for Plumbing Piping".

L. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the nearest floor drain, hub drain, or mop sink, installed with an approved air gap as required, and arranged for safe discharge.

M. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.

N. Flanges and Gaskets
   1. Where forged steel flanges are to be bolted to cast iron flanges, a smooth or flat-face forged steel flange with a full-face gasket shall be used.
   2. All gaskets, other than teflon envelope or full-face, shall be of the flat ring type, with the outside diameter of the gasket extending to the edge of the bolts.
   3. Gaskets for all joints shall have an inside diameter equal to the outside diameter of the pipes on which they are to be used, to ensure that no portion of the gasket will project into the ports of valves, pipe, or fittings.
   4. The dimensions of all gaskets shall conform to ANSI Standard B-16.21 for non-metallic gaskets.

O. Dielectric Separation
   1. Provide dielectric separation at all copper piping and valves connected to ferrous piping.
   2. Brass or bronze valves installed in ferrous piping shall not require dielectric separation.
   3. Connections between copper piping and ferrous flanged piping and equipment connections shall be with a bronze companion flange with dielectric separation for flanges and bolts.
   4. Connections between copper piping and screwed ferrous piping shall be Clearflow Dielectric Waterway fittings.

P. Movement
   1. Mains: Provide adequate offsets, bends, loops, flexible joints and guides as required to prevent over-stressing of piping and/or the structure.

2. Branches: Provide for expansion and contraction by means of offsets, swings, joints or loops to eliminate stress on connected piping, valves or equipment. Provide for proper drainage as required.
3. Maintain a free floating, properly braced and supported piping system.

Q. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.

R. Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

S. Painting of Piping: Refer to Division 09 Section “Interior Painting”.

3.2 SLEEVES

A. General
1. All sleeves shall be accurately located as required under this Division and shall be properly sealed. Sleeves shall be set true to line, grade and position, shall be plumb or level, and shall be maintained during the work under other Divisions.
2. Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.
3. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done by the proper trade at the cost of this Division, with no change in the Contract Sum or the Date of Substantial Completion.
4. Sleeves shall not penetrate any structural member, except as shown on Drawings, without written approval from the A/E. Wherever any additional reinforcing of members is required, the cost shall be under this Division.
5. Provide sleeves when underground piping passes under or through footings/grade beams. Sleeves under footings/grade beams shall have lean concrete from sleeve to underside of footing/grade beam.

3.3 BUILDING PIPING SYSTEM: INSTALLATION

A. Potable and Non-Potable Domestic Water: Cold, Hot, Tempered, Recirculating, sump pump discharge and relief lines.
1. General and Sub pump Discharge and Relief Lines
   a. All piping shall be copper installed and pitched to provide proper drainage.
   b. Install drain valves at all low points and as required to provide drainage facilities for the piping. Wherever system is sectionalized, install drain valves between each sectional shut-off valve.
   c. All hot water piping shall be pitched to provide natural gravity recirculation regardless of a recirculation pump.
   d. Install pressure gauge in domestic cold-water main at water entrances to building.
2. Shock Elimination
   a. All piping shall be protected against water shock.

b. Provide water hammer arrestors at quick-closing valves and at fixture groups where required to control hydraulic shock. Size and locate water hammer arrestors in accordance with PDI WH 201 and manufacturer recommendations. Install arrestors in accessible locations or provide access panels where concealed.
c. Install a water hammer arrestor of the proper size at the end of the main, at the end of all branch lines, and at the end of lines serving groups of fixtures.
d. Water hammer arrestors shall be sized and installed as recommended by the Plumbing and Drainage Institute and shall eliminate water hammer.
e. All water hammer arrestors shall be installed in locations where they are readily accessible for service. Where required, provide suitable access doors.

3. Contamination Protection
   a. All new distribution systems shall be protected against contamination due to backflow from non-potable sources.
   b. Provide an approved backflow preventer of the reduced pressure zone type at each connection to a fixture where indicated or required by code.
   c. Pipe to nearest floor drain.
4. Backflow Prevention
   a. Install a code approved backflow preventer unit in the service main, where indicated on the Drawings, or as required by code.
   b. Include strainer, dual-service shut-off valves, double-check valves, and check cocks.
   c. Properly support, independent of the piping, with union connections.
5. Trap Primer
   a. All trap primers are to be in an accessible area, preferably in mechanical rooms, janitor's closets, or accessible chases.
   b. Install trap primer so that, for every 20 feet of piping to floor drain inlet, the device is mounted one foot above the finished floor.
6. Water Meter
   a. Arrange for and pay all costs involved in the installation of a water meter in the building service line, where indicated.
   b. Support independent of the piping with union connections.
   c. Installation and meter shall be in accord with and approved by the water utility company.
   d. The entire domestic hot, cold and recirculating hot water system shall be sterilized in strict accordance with requirements of the Department of Health Codes, Rules and Regulation for the State of Connecticut.

END OF SECTION

SECTION 221316 - BUILDING SANITARY, STORM DRAINAGE, AND ACID WASTE

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

B. Refer to Specification Section 019113 General Commissioning Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Provide a complete building storm water drainage system to 5 feet outside building exterior wall. Work includes, but is not limited to, the following:
      a. Roof drains.
      b. Area drains.
      c. Trench drains.
      d. Pipe materials.
      e. Expansion joints.
      f. Clean-outs.
   2. Provide a complete soil, waste and vent piping system to 5 feet outside building exterior wall. Work includes, but is not limited to the following:
      a. Equipment coordination when equipment or fixtures are supplied by others.
      b. Pipe materials.
      c. Piping auxiliaries/specialties.
      d. Drains.
      e. Clean-outs.

1.3 EQUIPMENT BY OTHERS

A. Include all necessary roughing-in and final equipment connections by the plumbing trade as specified.

B. Wherever equipment is furnished and set in place under Work of another Section or by Owner, they shall furnish detailed Drawings and exact rough-in dimensions and locations at the Site.
   1. Information shall be furnished sufficiently in advance to allow proper installation of all required services.
   2. This Division shall include all required service rough-ins and final connections to the equipment.

1.4 QUALITY ASSURANCE

A. General
1. Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the building sanitary and storm plumbing systems.
2. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the purposes indicated. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and shall be true to detail.

B. Codes and Standards (Division 22 Section "Common Work Results for Plumbing" Listings and the following.)
1. Plumbing installation shall be in accordance with the state of Connecticut and local plumbing code and all other codes having jurisdiction.
2. American Standard Code for Pressure Piping ANSI B31.1.
3. National Association of Corrosion Engineers.
4. American National Standards Institute (ANSI).
5. American Society of Mechanical Engineers (ASME).
6. American Society for Testing and Materials (ASTM).
7. American Water Works Association.
8. Manufacturer's Standardization Society of the Valve and Fitting Industry.
9. Plumbing and Drainage Institute.
10. State of Connecticut or local Plumbing Code, as applicable.
11. State of Connecticut or local Building Code, as applicable.

C. Material Standards
1. ASTM A74-04: Specifications for Cast Iron Soil Pipe and Fittings.
2. ASTM A53-04: Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
3. ASTM B306-02: Specifications for DWV Copper Pipe.
4. ASTM C564-03: Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
5. Cast Iron Soil Pipe Institute CISPI No. 301-90 and ASTM A888-04: Specification Data for Hubless Cast Iron Pipe Systems with No-Hub Pipe and Fittings.
6. Cast Iron Soil Pipe Institute CISPI No. 310-90: Specification for coupling for use in connection with no-hub cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.
7. ASTM C1053-00: Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (OWV) Application.
8. ANSI A112.21.1-91: Floor Drains.
9. ANSI A112.36.2M-1991 (R2002): Metallic Clean-Outs.
10. ANSI A112.1.2-04: Air Gaps in Plumbing Systems.
11. ANSI A112.21.2M-1983: Roof Drains.

1.5 HANDLING, DELIVERY AND STORAGE

A. General
1. Handling, delivery and storage shall be in accordance with the manufacturer's recommendations.
2. No extra cost shall be charged to the Owner for handling, delivery or storage.
3. In no case shall the pipe or appurtenances be dumped, dropped or thrown.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. General
1. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
2. No salvaged or used pipe shall be used without the written approval of the A/E or Owner. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.
3. All cast iron pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

B. Buried Soil, Waste, and Vent Piping
1. ASTM A74 service weight cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed joints.
2. Options
   a. ASTM A888 and CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless-steel couplings.
   b. ASTM D2665 solid schedule 40 plastic pipe with drainage fittings and solvent welded joints.
      1) PVC plastic pipe is not permitted within one hundred (100) feet downstream of any kitchen equipment.

C. Above-Ground Soil, Waste and Vent
1. ASTM A888 and CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless-steel couplings.
2. Options
   a. ASTM A74 service weight cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed joints.
   b. ASTM A53 Schedule 40 galvanized steel pipe with cast iron screwed drainage fittings.
   c. ASME A112.3.1 type 316L stainless steel drainage pipe and fittings, spigot, and socket joints with EDPM gaskets.
   d. ASTM D2665 solid schedule 40 plastic pipe with drainage fittings and solvent welded joints.

1) PVC plastic pipe is not permitted within a return air plenum.

D. Indirect Waste and Drains Above Ground
1. ASTM B306 DWV copper tubing with DWV copper fittings.
2. Options
a. ASTM D2665 solid schedule 40 plastic pipe with drainage fittings and solvent welded joints.
b. Same materials as soil, waste, and vent.

E. Grease, Waste and Vent Piping (Below Slab):
1. Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International. Heavy Duty Couplings shall conform to CISPI Standard 310 and be certified by NSF® International. Heavy Duty couplings shall conform to ASTM C 1540 and shall be used. Gaskets shall conform to ASTM C 564. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer's recommendations and applicable code requirements. Couplings shall be installed in accordance with the manufacturer's band tightening sequence and torque recommendations. Tighten bands with a properly calibrated torque limiting device. The system shall be hydrostatically tested after installation to 10 ft. of head (4.3 psi maximum).
2. Piping below slab shall be a minimum of 2" in size.

F. Sump Pump Discharges
1. ASTM A53 Schedule 40 galvanized steel with cast iron screwed drainage fittings shall be used to point of connection to a gravity storm line or terminating with air gap at plumbing fixture/equipment.
2. Options: ASTM B306 DWV copper tubing with DWV copper fittings.

G. Interior Buried Storm Piping
1. ASTM A74 cast iron service weight soil pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed.
2. Options
a. CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless-steel couplings.
b. ASTM D1785 solid schedule 40 plastic pipe with ASTM D2665 drainage fittings and solvent welded joints.

H. Above Ground Storm Piping
1. CISPI 301 hubless cast iron pipe, as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with heavy duty 304 corrugated stainless-steel couplings.
2. Options
a. ASTM A74 service weight cast iron pipe, bitumastic-coated, bell and spigot joints, drainage fittings with ASTM C564 gasketed.
b. ASTM A53 Schedule 40 galvanized steel pipe with cast iron screwed drainage fittings.

c. ASTM A112.3.1 type 316L stainless steel drainage pipe and fittings, spigot and socket joints with EDPM gaskets.
d. ASTM D1785 solid schedule 40 plastic pipe with ASTM D2665 drainage fittings and solvent welded joints.

2.2 PIPING AUXILIARIES/SPECIALTIES

A. General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled, and shall be suitable for the piping to which they are attached.

B. Air Gap Fitting
1. J.R. Smith Fig 3951, rough bronze or plain end with set screw, threaded inlet and threaded outlet, sizes as indicated.
2. Manufacturers: Mifab, Watts, Wade, or Zurn.

C. Vent Flashings
1. Furnish 6 lb. lead flashing for General Contractor installation.
2. Flashing shall extend 12 inches in all directions, sealed between roofing plies, extended up to end of vent and clamped with vandalproof vent cap.
3. Vents Thru Roof (VTR): Refer to Architectural Drawings for vent thru roof detail in EPDM roof.

D. Vandalproof Vent Cap
1. J.R. Smith Fig. 1748 cast iron with set screws.
2. Manufacturers: Josam, Mifab, Stoneman, Wade, or Zurn.

E. Storm and Sanitary Piping Hubless Cast Iron Couplings
1. Shield constructed of type 304 stainless steel meeting ASTM 240. Neoprene gaskets shall conform to ASTM C564.
2. Couplings shall have a minimum of 4 bands and be capable of tightening to 80 lbs. torque.
3. The use of sealant or adhesives on couplings is not permitted unless approved by the manufacturer.
4. Couplings shall be heavy duty in accordance with ASTM C1540.

F. Cast Iron No-hub Restraints
1. Cast iron no-hub horizontal pipe and fittings, larger than 4”, shall be suitably braced to prevent horizontal movement. Install at every branch opening or change in direction by the use of braces, blocks and rods to prevent movement or joint separation. This bracing may be field fabricated or a manufactured system.
2. Holdrite 117 series or equal.

2.3 DRAINS

A. General
1. All drains installed in waterproof slabs shall be provided with a flashing ring.
2. Install a 30-inch x 30-inch x 6 lb. lead flashing properly fastened to the flashing ring.

3. Cast Iron roof, area, and floor drain manufacturers: J.R. Smith, Josam, Kusel, Mifab, Wade, Watts and Zurn.
4. Corrosion resistant floor drain manufacturers: Zurn, Watts, Kusel, Orion, R&G Sloan, and Duriron.

B. Roof Drains
1. Refer to plumbing schedules for basis of design manufacturer and model.

C. Area Drains
1. Refer to plumbing schedules for basis of design manufacturer and model.

D. Floor Drains
1. Finish areas: Refer to plumbing schedule for make & model. Provide adjustable cast iron body, round nickel bronze strainer. Vandalproof screws. Caulk outlet. 1/2-inch trap primer inlet.
2. General areas: Refer to plumbing schedule for make & model. Provide cast iron body, 12-inch-diameter cast iron tractor grate, solid free-standing sediment bucket, 1/2-inch trap primer inlet. Size as indicated on Drawings.

E. Trench Drains: 6-inch-wide modular interlocking system with 0.6% built-in sloped channels as manufactured by ACO Drain, Inc., S100K Series, or equal. First sloped channel shall be 5-1/2-inch deep. Channels shall all be the same width and length and be constructed of precast polyester concrete with water absorption rate of less than 1%. Provide a slotted ductile iron grating over the entire drain, including catch basin section, with a Class F load rating. Grating shall be secured with a locking device including all nuts and bolts. Provide SK900 Series catch basin of the same width as channels with knock-out panel for piping and a plastic lift-out trash bucket. Provide trench drain complete with all channel end caps and neutral (non-sloped) channels so that total length is as noted on Drawings, inclusive of catch basin.

2.4 CLEANOUTS

A. General
1. Capable of adjustment to match finish surface.
   a. Be round.
2. All cover plates/plugs shall be permanently labeled to match the drain service.
3. For cast iron fittings
4. Cast Iron clean-out manufacturers: Josam, J.R. Smith, Mifab, Wade, Zurn, Watts
5. Corrosion-Resistant Clean-Out Manufacturer: Duriron.

B. Clean-Out Types
1. Floor Clean-Outs
   a. Finished Floor and Tile Floor: J. R. Smith Fig. 4020, Duco cast iron body and frame with round adjustable scoriated nickel bronze top. Vandalproof top. Top Labeled Co. Provide nickel bronze carpet clamping frame with vandalproof screw in carpeted areas.
   b. Unfinished Floor and Equipment Area Floor: J. R. Smith Fig. 4240, Duco cast iron body and frame with round adjustable scoriated cast iron top. Vandalproof top. Top Labeled Co.

2. Wall Cleanouts
   a. J. R. Smith Fig. 4422, Duco cast iron caulk ferrule with vast bronze taper thread plug and prime-coated steel shallow cover. Vandalproof screws.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General
1. Comply with Division 22 Section “Common Work Results for Plumbing”.
2. Piping shall be installed in a manner to permit easy removal of valves and disconnect of equipment. Unions or flanged joints shall be installed for this purpose.
3. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
4. Piping shall not be supported by other pipes, conduits, ducts or similar installations.
5. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
6. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the runouts of main piping and shall be installed using multiple elbows or other similar methods to minimize strain on the equipment connections.
7. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
8. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.
9. All open ends of pipes, including equipment connections, shall be properly always sealed during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
10. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed not to cause pocketing or inhibit the flow of the material.
11. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.
12. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.

B. Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

3.2 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendices.
   3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendices.

3.3 SLEEVES: INSTALLATION

A. General
   1. All sleeves shall be accurately located as required under this Division. Sleeves shall be set true to line, grade and position, shall be plumb or level, and shall be maintained during the work under other Divisions.
   2. Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.
   3. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done by the proper trade at the cost of this Division, with no change in the Contract Sum or the Date of Substantial Completion.
   4. Sleeves shall not penetrate any structural member, except as shown on Drawings, without written approval of the A/E. Wherever any additional reinforcing of members is required, the cost shall be under this Division.
   5. Provide sleeves when underground piping passes under or through footings/grade beams. Sleeves under footings/grade beams shall have lean concrete from sleeve to underside of footing/grade beams.

3.4 FLASHINGS: INSTALLATION

A. General
   1. All penetrations of roofs and similar areas required for installation of vents, roof drains, and piping under this Division shall be properly flashed and made watertight.
   2. Coordinate with all necessary General Trades Work sufficiently in advance and install in conjunction with roofing installation.

B. Flashing of Vent and Soil Pipe Extensions: All vent and soil pipe extensions through roof shall be minimum 3-inch size and flashed with 6 lb. sheet lead or 16 oz copper, 24-inch square, with sleeve soldered on, extending to top of pipe and turned down 2-inch inside.

C. Flashing of Roof Drains: All roof drains shall be flashed with 6 lb. sheet lead extending 12 inches from outer edge of drain opening.

D. Flashing of Curbs
   1. Curbs shall be flashed under the General Trades Divisions of this Specification.
   2. Provide counterflashing as required for weathertight construction.

3.5 BUILDING DRAINAGE SYSTEM: INSTALLATION

A. General
   1. All storm and sanitary lines shall be of the sizes noted and routed as indicated.
   2. Unless otherwise indicated or required by codes, all building drains shall be installed with a minimum uniform grade of one percent (1%).
   3. No underground drains shall be installed in water. Trenches shall be dry and acceptable before laying of pipe.
   4. All overhead lines shall be installed as close to the building structure as possible.
   5. All overhead cast iron drains shall be supported at each joint, each change of directions, each cast iron trap, and all necessary intermediate points to maintain a uniform pitch without sagging or pocketing of the line.

B. Floor Drains
   1. Install floor drains with lead flashing in waterproof floors per manufacturer's recommendations.
   2. Install floor drains 1/2-inch lower than finished floor elevations to ensure positive drainage. Coordinate installation closely with General Contractor.

C. Cleanouts
   1. Install at each of the following points, but not limited to:
      a. Base of each soil and waste stack
      b. Base of interior storm downspouts
      c. Change of direction of 45 deg or greater in the building drains
      d. Inside where the drains leave the building
      e. Where a battery of wall hung water closets are installed, provide cleanout at end of sanitary line in wall.
      f. Where indicated
      g. Install on continuous runs of the drains at 100' intervals on the storm and sanitary.
      h. As directed by local code

2. Shall be connected to the main with long sweep or sanitary wye fittings, unless otherwise noted.
3. Shall be installed to match the finished surface line.
4. Removable plugs shall be lubricated with a mixture of grease and graphite.

D. Traps
1. Install on all floor drains, all waste and soil discharge connections, and where indicated. Locate for ease of service. Any other traps required by official bodies having jurisdiction shall be installed at no additional cost to the Owner.
2. Where traps on plumbing fixtures are installed below grade or otherwise concealed, a clean-out shall be installed in the adjacent finished surface as indicated.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

END OF SECTION

SECTION 221331 - ELEVATOR SUMP PUMP

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Elevator sump pump.

1.3 QUALITY ASSURANCE

A. General
   1. Provide all equipment as necessary for a complete installation of the Plumbing Systems.
   2. Receptacle and associated wiring shall be provided by the Electrical Contractor.
   3. The complete installation shall be in accordance with all applicable state and local codes.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all products in this section.

B. Product Data
   1. Manufacturer's cut sheets and literature.
   2. Performance data.
   3. Pump curves.
   4. Wiring diagrams for control panels.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Close-Out
   1. Operating and maintenance information.
   2. Owner instruction report.
   3. Guarantees and warranties.

PART 2 - PRODUCTS

2.1 ELEVATOR SUMP PUMP (ESP-1)

A. One simplex Zoeller Pump Co. Series 153 Submersible Pump shall be furnished. Pump shall be capable of pumping storm water. Pump shall be equipped with hermetically sealed, Class F insulated motor, installed in a heavy ribbed cast iron shell. Pump shall be rated for 50 GPM @ 20 feet TDH each pump when driven by a 1/2 HP, 1750 RPM, 115 volt / 60 HZ, 1 phase hermetically sealed motor.

B. Pump construction to include single mechanical seal. The motor shell and pump volute shall be made of close grained cast iron. Pump shaft shall be stainless steel and all fastening hardware shall be stainless steel. The pump impeller shall be bronze closed type, accurately machined to the proper diameter, and dynamically balanced prior to installation in the pump. The impeller shall be non-overloading throughout the entire range of the pump curve. Pump and motor unit to receive a coat of red chromate primer and finish coat of water resistant metallic blue enamel.

C. Integral mechanical float type liquid level control shall be furnished for proper pump operation.

D. Manufacturers: Zoeller, Weil, Liberty, or equivalent.

2.2 PUMP CONTROLLER

A. Supply one UL listed - NEMA 1 or 4X steel simplex control panel suitable for wall mounting. Panel shall be completely factory wired and bench tested for satisfactory operation prior to shipment. The pump controller shall include oil detection circuitry which will shut down the pump, sound an alarm and energize a dry contact if a hydrocarbon is present in water in the sump pit. The following features will be included in the controller:
   1. Properly sized NEMA rated starter pump.
   2. High water alarm with light and silencing switch.
   3. Main fused disconnect switch.
   4. Circuit breaker.
   5. Oil detection circuitry with alarm and silence switch.
   6. Dry contacts for remote alarm monitoring for the following:
      a. High water alarm.
      b. Oil detection alarm.

2.3 OPERATING CONTROLS

A. Mercury float type liquid level controls shall be furnished for proper pump and alarm operation. Supply an oil sensor to detect hydrocarbons in the sump and disable the pump.

B. Three mercury switches, each sealed in a corrosion resistant polypropylene float shall be provided. Each switch to have a PVC coated UL listed cable and to be attached to a corrosive-resistant bracket to a stainless steel suspension rod. The switch bracket to be provided with a reinforcing sleeve to prevent sharp bending and damage to the cable.

C. One oil sensor, containing an infrared LED and a light receiver. Continuous light from the LED is directed into a prism, which forms the tip of the sensor. Two probes extend from the prism which measure conductivity to detect oil in the water and shut the pump down.

2.4 FIBERGLASS BASIN

A. Supply a fiberglass basin 24 inch ID x 3-foot depth, constructed of resin reinforced with not less than 20 percent glass strands.

B. Cover plate shall be minimum 1/4-inch-thick perforated and painted steel with necessary openings for pump discharge, power and control cables.

C. Manufacturers: Jackel, Topp Industries, Weil.

2.5 VALVES

A. Bronze check valve shall be installed on the pump discharge.

B. A Bronze shutoff valve shall be installed on the pump discharge.

2.6 WARRANTY

A. Warranty time shall be one-year from start up. Warranty shall extend to material and workmanship of the complete system.

PART 3 - EXECUTION

3.1 EXECUTION

A. See additional details and diagrams on the project drawing documents.

B. The complete installation of all items of equipment shall be in accordance with the Manufacturer's instructions. The entire system shall be tested and adjusted under actual operating conditions.

C. These pumps are not to be used during construction.

D. Flush all incoming lines to the pump basin and thoroughly clean the basin prior to placing pumps into operation.

E. A representative of the manufacturer shall be present during the pump start-up and shall completely check the pump system prior to the placing of pumps into operation.

3.2 START-UP

A. The pump manufacturer shall provide a technician for one (1) day start-up of the complete system, to insure ample time to make corrections and/or repairs. Start-up will consist of but not limited to the following:
   1. Start-up and run of pump
   2. Check all electrical devices
   3. Provide a start-up report to the contractor, within 48 hours from start-up date for review and corrections if needed.

END OF SECTION

SECTION 223300 - DOMESTIC WATER HEATER AND ACCESSORIES

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

B. Refer to Specification Section 019113 General Commissioning Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Electric water heater.
   2. Heat pump water heater.
   3. Recirculation pumps.
   4. Thermostatic mixing valves.
   5. Expansion tanks.
   6. Accessories.

1.3 QUALITY ASSURANCE

A. UL Standards: Provide water heater complying with the following:
   1. UL 1453, Electric Booster and Commercial Storage Tank Water Heaters.

B. Electrical Component Standard: Provide components complying with NFPA 70, National Electric Code.

C. Listing and Labeling: Provide water heaters that are listed and labeled.
   1. The terms "listed" and "labeled" shall be as defined in the National Electric Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

D. ASHRAE Standards: Provide water heaters with performance efficiencies not less than prescribed in ASHRAE 90A, Energy Conservation in New Building Design.

1.4 WARRANTY

A. Special Project Warranty
   1. Submit a written warranty, executed by manufacturer, agreeing to repair or replace water heater units that fail in materials or workmanship within the specified warranty period. Failures include, but shall not be limited to, tanks. This warranty shall be in addition to, and a limitation of, rights the Owner may have against the Contractor under the Contract Documents.

2. Warranty period is 3 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-TO-WATER GEOTHERMAL WATER HEATER (DWH-1)

A. Summary
1. Provide factory-assembled, water-cooled modular scroll chiller(s) with integral heat-recovery capability, including compressors, heat exchangers, refrigerant circuits, controls, insulation, electrical components, and accessories required for a complete operational system.
2. Units basis of design shall be Multistack Model (2) MSH020Y water-cooled modular scroll chiller modules with dedicated heat-recovery condenser. Acceptable manufacturers include WaterFurnace, Trane or approved equal.

B. References
1. AHRI Standard 550/590 – Performance Rating of Water-Chilling Packages Using the Vapor Compression Cycle.
2. UL 207 (CSA C22.2 No. 140.3-15) – Refrigerant Equipment.
3. NEC (NFPA 70).

C. Performance
1. Provide selection that meets or exceeds Heating Capacity shown on drawings. Unit shall meet or exceed a cooling COP of 2.4 and heating COP of 3.4.
2. Refrigerant shall be an A2L R-454B or R-32.
3. Waterside pressure rating of 150psi and Refrigerant side pressure rating of 650 psi.

D. Construction
1. Brazed-plate evaporate and condenser heat exchangers.
2. Double-wall vented heat-recovery exchanger with stainless steel fittings.
3. Stainless steel evaporator and condenser supply headers.
4. Factory-installed strainers/filters in evaporator and condenser supply headers.
5. 3/4 inch closed-cell foam insulation on evaporator and condenser assemblies.
6. Indoor-rated acoustical panels and premium sound package compressor wraps
7. Furnish refrigerant monitoring sensor and alarm contact at each module plus master control common alarm output.

E. Compressors
1. Hermetic scroll compressors, variable speed
2. Independent refrigeration circuits per module.
3. Lead/Lag sequencing for 24-hr rotation.
4. Automatic rescheduling in fault conditions.
5. Electrical - Provide with single-point power via hinger panel distribution box, in 460 Volts, 60 Hertz, 3 phase and SCCR rating of 65kaic. MCA shall be 91 amps with an MOP of 125.

F. Controls
1. Factory DDC chiller control system with master controlling supporting electronic hot-water temperature control, fault logging, and trend monitoring.
2. Expansion inputs/outputs for field connection to differential pressure transmitters. Each module shall included thermal dispersion flow switch (24V factory powered) and refrigerant monitor alarm with contact.
3. System must integrate with BAS via BACnet MSTP communications.
4. Refer to plumbing schedule for manufacturer make, model, and design characteristics.

2.2 RECIRCULATING PUMPS (CP-1 THRU CP-4)

A. In-line all lead-free bronze pump with gauge ports at nozzles and with vent and drain ports. Ceramic or carbon steel shaft supported by permanently lubricated carbon or steel bearings. Pump suitable for continuous operation at 230 deg F at 150 psi working pressure. Built-in overload protection. Motor shall be non-overloading at any point on the pump curve. Capacity and electrical characteristics as noted on the Drawings.

B. Manufacturers: Bell & Gossett, Grundfos, TACO, Armstrong.

2.3 THERMOSTATIC MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Armstrong International, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. Powers; a division of Watts Water Technologies, Inc.
   e. Symmons Industries, Inc.
   f. Bradley Corp.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components. Lead-free design.
6. Connections: Threaded union inlets and outlets.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, wall mounting bracket, and adjustable temperature-control. Thermometer on outlet.
8. Tempered-Water Setting: As noted on Drawings.
9. Valve Finish: Rough bronze.
10. Refer to Drawings for design characteristics such as flow rate and pressure drop.

2.4 EXPANSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
1. Available Manufacturers
   a. AMTROL Inc.

b. Armstrong Pumps, Inc.
c. Elbi of America, Inc.
d. Taco, Inc.
e. Watts Regulator Co.
f. Bell & Gossett.

2. Construction
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread. Include tap for pressure gauge.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.
   d. ASME rated.
3. Capacity and Characteristics
   a. Working-Pressure Rating: 150 psig (1035 kPa).
   b. Capacity Acceptable: Refer to Schedule on Drawings.
   c. Air Precharge Pressure: Set air pressure equal to incoming water pressure downstream of water service backflow preventer.

2.5 WATER HEATER ACCESSORIES

A. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 (DN 20) WITH ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

C. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

F. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stands for floor mounting, capable of supporting domestic-water heater and water. Provide dimensions that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

G. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heaters and water.

PART 3 - – EXECUTION

3.1 CONCRETE BASES

A. Construct concrete equipment base.

B. Install reinforcing bars, tied to frame and place anchor bolts and sleeves using manufacturer's installation template.

C. Place concrete and allow to cure before installation of equipment.

3.2 WATER HEATER INSTALLATION

A. General: Install water heaters on 4-inch concrete bases. Set and connect units in accordance with manufacturer's written installations instructions. Install units' plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances. Orient so controls and devices needing servicing are accessible.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections of Division 22. The drawings indicate general arrangement of piping, fittings and specialties. The following are specific connection requirements:
   1. Install piping adjacent to equipment arranged to allow servicing and maintenance.
   2. Connect hot and cold water to units with shut-off valves and unions. Extend relief valve discharge full-size to closest floor drain.
      a. Where water heater piping connections are dissimilar metals, make connections with dielectric fittings or dielectric unions specified in Division 22 Section "Common Work Results for Plumbing".
      b. Install expansion tanks at cold water inlet piping as shown on drawings.
   3. Install drain as indirect waste spill into open drain or over floor drain.
      a. Install drain valves at low point in water piping, for water heaters not having tank drain.
      b.

B. Water-To-Water Domestic Water Heater Piping Connections
   1. Install a unit differential pressure transmitter directly downstream of chiller with no pressure-adding devices between. (DP1)
   2. Installed a system differential pressure transmitter on the system side (DP2).
   3. Provide a system bypass valve sized for minimum gallons per minute and characterized ball or globe valve type with <60s stroke time.
   4. Bypass loop volume and loop time shall meet manufacturer recommendations.
   5. Pump bypass valves must be controlled such that's pumps or bypass maintain unit DP setpoint and opposite device maintains system DP setpoint.

C. Electric Connections
   1. Power wiring and disconnect switches area specified in Division 26.

2. Grounding: Connect unit components to ground in accordance with the National Electric Code.

3.4 FIELD QUALITY CONTROL

A. General
   1. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service, and demonstrate and train Owner's maintenance personnel as specified below.
   2. Notify Commissioning Agent of any field quality control testing.
   3. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.

B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing and preventative maintenance.
   1. Review data in Operating and Maintenance Manuals. Refer to Division 01 Section “Contract Close-Out”.
   2. Schedule training with at least 7 days’ advance notice.

3.5 COMMISSIONING

A. Perform the following before start-up final checks:
   1. Fill water heater with water.
   2. Piping system test complete.
   3. Check for pipe connection leaks.
   4. Test operation of safety controls and devices.

B. Perform the following start-up procedures:
   1. Energize circuits.
   2. Adjust operating controls.
   3. Adjust hot water outlet temperature setting.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Inclusion of all plumbing fixtures, complete and ready for use.
      a. All fixtures, except as otherwise specified, shall be constructed of vitreous china with all visible exposed surfaces glazed.
   2. Providing all stops, traps, escutcheons, connections, etc., as are necessary to complete the installation of each fixture, whether such items are listed or not.
   3. Plumbing Trim
      a. All finished exposed faucets, traps, connecting piping, stops, flush valves and other fixture trim shall be chromium-plated brass unless otherwise specified and shall be supported rigidly to fixtures and to walls with matching brackets at not more than 2'-0" center. All fastenings shall be chromium-plated brass or may be 302 stainless steel if of matching color and finish.
      b. Faucets shall be furnished as required. All faucets shall be lead-free.
      c. Vacuum breakers shall be provided as a part of the fixture trim wherever there is a possibility of back-siphoning.
   4. Fixture Stops
      a. Shut-offs for urinal and water closet flush valves shall be an integral part of the fixture or fitting; shut-offs for all other fixtures shall be loose-key, lock-shield-type.
      b. All fixture stops shall be angle- or straight-type adapted for each particular location and shall be located immediately adjacent to the fixture. Use threaded adaptors when used in conjunction with copper tube work. All stop valves shall be lead-free
   5. All exposed screws or fasteners for plumbing fixtures and faucets shall be vandalproof. Contractor shall take care to coordinate this item with his suppliers prior to Shop Drawings submittal.
   6. Aerators, where required for sinks and lavatories shall be vandalproof.

1.3 QUALITY ASSURANCE

A. Meet the requirements of the following:
   1. State of Connecticut Plumbing Code.
   2. State of Connecticut Department of Housing, Buildings and Construction.
   3. 42 USC 300G: The Reduction of Lead In Drinking Water Act.
   4. Material Standards

5. ANSI/ASME A112.19.2-2003: Vitreous China Plumbing Fixtures.
6. ANSI/ASME A112.19.3-2000 (R2004): Stainless Steel Plumbing Fixtures (Designed for Residential Use).
7. ANSI/ASME A112.19.4M-94: Porcelain Enameled Formed Steel Plumbing Fixtures.
8. ANSI/ASME A112.19.5-1999: Trim for Water Closet Bowls, Tanks, and Urinals.
9. ANSI/ASSE 1016-90: Performance Requirements for Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities.
10. ANSI/ASSE 1025-78: Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon-Type, Residential Applications.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Acceptable Manufacturers
   1. Plumbing Faucets (Commercial Grade): Chicago Faucet, Delta, Moen, Powers, Symmons, Speakman, T&S Brass Co., Hydrotek
   2. Flush Valves: Sloan, American Standard, Zurn, Kohler, and Hydrotek
   3. Vitreous China Plumbing Fixtures: American Standard, Kohler, Eljer, Zurn.
   4. Mop Sinks
      a. Terrazzo: Crane, Creative Industries, Fiat, Florestone, Stern and Williams.
      b. Molded Stone: Crane, Fiat, Florestone, Mustee, Swan Corp., Zurn.
   5. Closet Seats: Church, Sperzel, Olsonite, Beneke, Centoco.
   6. Shower Mixing Valves: Powers, Leonard, Lawler, Speakman, Bradley.
   7. Stainless Steel Sinks: Elkay, Just, CECO, Metcraft.
   8. Emergency Showers or Eyewash: Guardian, Speakman, Haws, Watersaver, Encon, Bradley.
   9. Electric Water Coolers: Elkay, Haws, Oasis, Murdock.
   10. Precast Shower Receptacles: Fiat, Stern and Williams, Swan Corp.
   11. Acrylic/Fiberglass Prefabricated Showers and Tubs: Aquatic, Aqua Glass, Aquarius, American Bath, Kohler.
   12. Carriers: Josam, Mifab, Smith, Wade, Watts, Zurn.
   13. Supply Stop Valves: McGuire, Brasscraft, Nibco, Watts.
   14. Plumbing Fixtures – General: Constructed or equipped with anti-siphon devices to prevent siphoning waste material into potable water supply system.
   15. Escutcheons and Plates: Conceal all holes where pipes pass through walls, floors or ceilings; use plates or escutcheons.
   16. Piping Exposed in Finished Areas (including fittings and trim): Chromium-plated or nickel-plated brass with polished bright surface.
   17. Trim for Lavatories and Sinks: Provide with renewable cartridges.
   18. Vitreous Caps: Provide for water closet bolts.
   19. Sealant: Silicone-type. See Division 7 Section “Joint Sealants”.

2.2 DECONTAMINATION EYEWASH

A. Provide multiple nozzle emergency eyewash, galvanized steel piping, 12 chrome-plated brass full-cone, direction preset, non-adjustable, self-cleaning nozzles, 2 weep sprays, universal

emergency sign, instant action valve with stay-open chrome-plated ball valve with stainless steel push flag, 1-inch supply.

1. Refer to plumbing schedule for make & model #: Tempered water system consists of a thermostatic mixing valve with integral check stops, dial thermometer range 0 to 140 degrees, secondary thermostatic mixing valve set to open cold water upon temperature rise over 95 degrees, 1-1/4-inch inlets and 1-1/4-inch outlet, stainless steel lockable wall mounted cabinet. System to be set to 90 degrees and 72 gpm.
   a. Leonard Model TM-850-STSTL-EXP.

2.3 CHAIR CARRIERS

A. Carriers for Water Closets
1. Use cast iron couplings where required by Code.
2. Josam 12000 Series.
3. Carrier for Urinals: Josam 17800 or 17810.
4. Carriers for Lavatories: Josam 17100, 17100-76.
5. Carriers for Electric Water Coolers: Josam 17900 or 17905.
6. Carriers for Service Sinks: Josam 17720.

2.4 INSULATION AT HANDICAPPED (ADA-COMPLIANT) LAVATORIES

A. Insulation
1. Handicapped lavatories: exposed waste, hot and cold-water supply lines shall be insulated with a molded, flexible vinyl insulation system with all fasteners. Provide insulation for 1-1/4-inch waste offset drain, tailpiece, P-trap and waste arm and 3/8-inch supply tubing and 3/8-inch keyed stop valve. Color shall be white.

1. Manufacturers/Products

a) IPS Corp Truebro Lav-Guard 2.
b) Plumberex Pro-Extreme.
c) McGuire ProWrap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sink manufacturer shall provide proper template to architectural woodwork supplier for cutting of countertop.

B. Plumber shall place sink in countertop and complete faucet and piping.

C. Install all fixtures in accordance with Manufacturer's recommendations.

D. All fixture support carriers shall be of the type necessary to permit adjustment to fit variations in construction. All grounds or special supports necessary for setting fixtures shall be provided before plastering or other finished construction work is begun. All fixtures shall be hung at standard height unless otherwise indicated by the A/E.

E. Minimum fixture connection sizes are shown on the Drawings.

F. Provide chrome-plated brass escutcheons on all waste and supply piping penetrating the walls and floors for fixtures, including piping within cabinets.

G. Provide fixture carriers and required drainage fittings on all wall hung fixtures. Anchor carriers securely to floor.

H. Where plumbing fixtures abut to walls, floors, and countertops, seal all joints with sealant.

I. Seal floor sinks to wall and floor with building sealant. Color shall match fixture.

J. Provide anchors behind the wall for flush valve supply piping.

K. Adjust self-sustaining closet seats for proper operation and to sustain in any position.

L. Adjust electric water coolers flow for correct operation and temperature.

M. Insulate the hot and cold water and waste piping under handicapped lavatories.

N. Adjust shower mixing valves for correct leaving water temperature.

O. After all fixtures have been set and are ready for use, and before the Contractor leaves the job, they shall thoroughly clean all fixtures furnished and set by them, removing all stickers, rust stains and any other matter or discoloration of fixtures, leaving every part in new condition. They shall, further, adjust all flush valves and other fixture water tempering or balancing at supplies to give proper water flow of fixtures.

END OF SECTION

SECTION 230100 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer Specification Section 019113 General Commissioning Requirements.

1.2 CODES & STANDARDS (INCLUDING BUT NOT LIMITED TO THE FOLLOWING)

A. 2022 Connecticut State Building Code (CSBC) (IBC 2021 w/ amendments)

B. 2022 Connecticut State Mechanical Code (CSMC) (IMC 2021 w/ amendments)

C. 2022 Connecticut State Energy Conservation Code (CSECC) (IECC 2021 w/ amendments)

D. 2022 Connecticut State Building Performance Standard (High Performance Schools)

1.3 GENERAL SCOPE OF WORK

A. The mechanical work for this project consists of scope throughout the architectural floor plans.

1.4 REQUIREMENTS

A. The General, Special and Supplementary Conditions, and all other Contract Documents shall apply to the Contractor's work as well as to each of their Sub-Contractor's work.

B. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents of Contract Documents. In case of conflict between these Common Work Results and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination prior to the Bid.

C. The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, and appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical Systems indicated or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete any part of the Mechanical Systems in a substantial manner, in

compliance with the requirements stated, implied or intended in the Plans and/or Specifications, shall be included in the Bid as part of this Contract.

E. It is not the intent of this Section of the Specifications to make any Contractor, other than the Construction Manager, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the Construction Manager to the Architect, then to the Engineer. Also, this Section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

F. The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or specification numbering system used which identifies disciplines is solely for the Architect and Engineer's convenience and is not intended to define a subcontractor's scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Plans and Specifications when preparing Bids, prices and quotations.

G. This Section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

H. It is the intent of the Contract Documents to deliver to the Owner a new, complete and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

I. In general, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least forty-eight (48) hours prior to the interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage for the Contractors involved until a complete schedule of interruptions can be developed.

J. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Contractor's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

K. Each Contractor shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.

L. Definitions and Abbreviations:
1. Contractor - Any Contractor whether bidding, proposing or working independently or under contract with Construction Manager, and who installs any type of Mechanical Work as specified in the Contract Documents or the Construction Manager.
2. Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
3. Architect - The Architect of Record for the project.
4. Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, General and Special Conditions, Addenda, Alternates, Unit Prices, Shop Drawings, Field Orders, Change Orders, Construction Contract with Owner, and other documents enumerated in the Owner/Contractor Agreement.
5. Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
6. The Project - All of the work required under this Contract.
7. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
8. Provide - Furnish and install complete, tested and ready for operation.
9. Install - Receive and place in satisfactory operation.
10. Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto or incorporated in the contract documents by reference.
11. Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
12. ADA - Americans with Disabilities Act.
13. ANSI - American National Standards Institute.
14. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
15. ASME - American Society of Mechanical Engineers.
16. IBC - International Building Code.
17. NEC - National Electrical Code.
18. NEMA - National Electrical Manufacturers Association.
19. NFPA - National Fire Protection Association.
20. OSHA - Office of Safety and Health Administration.
21. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
22. UL - Underwriters Laboratories.

PART 2 - INTENT AND INTERPRETATION

2.1 REQUIREMENTS

A. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included in the contract sum.

B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

C. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.

D. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 - INDEMNIFICATION:

3.1 REFER TO PROJECT GENERAL CONDITIONS AND SUPPLEMENTARY CONDITIONS.

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 4 - PLANS AND SPECIFICATIONS

4.1 REQUIREMENTS

A. The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their Bid accordingly.

B. The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

C. The Plans and Specifications shall be considered to be complementary and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

F. Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

G. Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

H. Each Bidder/Proposer shall review all Plans in the Contract Documents to ensure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur, it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular ensure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

I. Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

K. Where within the Contract Documents the word “typical” or “typ.” is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

L. Each Contractor shall evaluate ceiling heights specified on Architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

PART 5 - EXAMINATION OF SITE AND CONDITIONS

5.1 REQUIREMENTS

A. Each Bidder/Proposer shall inform their self of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.

B. Each Bidder/Proposer shall also fully acquaint their self with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after Bids are accepted.

PART 6 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

6.1 REQUIREMENTS

A. When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.

B. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; unless specifically indicated; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

C. Wherever any equipment and material are specified exclusively only such items shall be used unless substitution is accepted in writing by the Owner utilizing Procurement Substitution Requests or Substitution for Cause as indicated in Division 01 specifications.

D. Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.

E. Ten (10) days prior to the submission of a proposal, each Bidder/Proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Bidder/Proposers signify that they have included the cost of all required items in the proposal and that the Bidder/Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 7 - CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

7.1 REQUIREMENTS

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with their work. They shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.

B. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to their part of the work prior to submission of a proposal.

C. The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

D. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

E. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.

F. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the International Mechanical Code (IMC) and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.

G. The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.

H. Where minimum code requirements are exceeded in the Design, the Design shall govern.

I. The Contractor shall insure that their work is accomplished in accord with the OSHA Standards and that they conduct their work and the work of their personnel in accord with same.

J. All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction.

K. Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the State Department for Environmental Protection.

L. Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the Plans and Specifications require better materials, equipment, and construction than these minimum standards, in which case the Plans and Specifications shall be the minimum standards.

PART 8 - QUALIFICATIONS OF CONTRACTOR/WORKERS:

8.1 REQUIREMENTS

A. All Mechanical Contractors and their subcontractors bidding this project must have been a licensed company for a minimum of three (3) years to qualify to Bid this project. Individual employee experience does not supersede this requirement.

B. All mechanical subcontractors bidding the mechanical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.

C. All mechanical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of a workers shall be made through the normal channels of Architect, Contractor, etc.

D. The installation of all Heating, Ventilating and Air-Conditioning Systems (HVAC) by any Contractor shall be performed by a Licensed Contractor with Journeymen or Master Tradesmen

as defined under State Regulations and Code. This includes any Contractor installing HVAC systems, piping and ductwork.

E. All sheet metal, insulation and pipe fitting work shall be installed by workers normally engaged in this type work.

F. All automatic control systems shall be installed by workers normally engaged or employed in this type work.

G. All electrical work shall be accomplished by licensed contractors with Journeymen or Master Electrician as defined under State Regulations and Code. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 9 - SUPERVISION OF WORK:

9.1 REQUIREMENTS

A. The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 10 - CONDUCT OF WORKERS:

10.1 REQUIREMENTS

A. The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that worker. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or dehabilitating drugs on the job site is strictly forbidden.

PART 11 - COOPERATION AND COORDINATION WITH OTHER TRADES:

11.1 REQUIREMENTS

A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work

of other trades. Make the necessary changes in the work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 12 - GUARANTEES AND WARRANTIES:

12.1 REQUIREMENTS

A. The Contractor shall guarantee all equipment, apparatus, materials, performance, and workmanship entering into their Contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective for a minimum of two years in addition to the time frames outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.

B. All compressors shall have five-year warranty - 5-year parts and labor.

C. All VFDs shall have two-year warranty – 2-year parts and labor.

D. Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 13 - COST BREAKDOWNS (SCHEDULE OF VALUES):

13.1 REQUIREMENTS

A. Within thirty (30) days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

B. The breakdown shall be minimally as follows. Material and labor shall be listed separately. Pay special attention to required withholding (minimum of ½ % of associated mechanical contract value installation scope) for startup, testing, documentation, acceptance, owner training, etc.:

1. Mechanical Shop Drawings
2. Motor Load Coordination with other subcontractors
3. Mechanical Record Drawings & Acceptance
4. Mechanical O&M Manuals & Acceptance
5. Mechanical Owner Training & Acceptance
6. Mechanical Startup, Testing, Management Plan, Documentation, Acceptance, Owner Training, etc.
7. Coordination Drawings
8. Mechanical Identification Materials & Labor
9. Insulation (Piping) Materials & Labor
10. Insulation (Ductwork) Materials & Labor
11. HVAC Piping Materials & Labor
12. HVAC Piping Testing, Cleaning, Documentation, Acceptance, etc.
13. HVAC Piping Purging, Flushing, Cleaning
14. Geothermal Materials & Labor
15. Geothermal Grouting Materials & Labor
16. Geothermal Flushing, Purging, Testing, Documentation, Site Survey Submittal, Acceptance, etc
17. Sheetmetal Equipment
18. GRDs Materials & Labor
19. Sheetmetal Materials & Labor
20. Sheetmetal Shop Fabrication
21. Filters and Racks Materials & Labor
22. Spare Filters
23. Heat Pump Equipment & Labor
24. Heat Pump Startup, Testing, Documentation, Training, Acceptance, etc.
25. Water to Water Heat Pump Equipment & Labor
26. Water to Water Heat Pump Startup, Testing, Documentation, Training, Acceptance, etc.
27. Dedicated Outside Air Handling Unit Equipment & Labor
28. Dedicated Outside Air Handling Unit Startup, Testing, Documentation, Training, Acceptance, etc.
29. Chemical Treatment Materials & Labor
30. Chemical Treatment Startup, Testing, Documentation, Training, Acceptance, etc
31. Controls Shop Drawings
32. Controls Materials & Labor
33. Controls Power Sub-Metering, Startup, Testing, Documentation, etc.
34. Controls Graphics
35. Controls Startup, Testing, Documentation, etc.
36. Controls Training and Acceptance
37. Test and Balance Materials & Labor
38. Test and Balance Initial Report, Final Report and Acceptance

PART 14 - CHANGES IN MECHANICAL WORK

14.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 15 - CLAIMS FOR EXTRA COST

15.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 16 - MATERIALS AND WORKMANSHIP

16.1 REQUIREMENTS

A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.

B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

C. Use extreme care in the selection of equipment and its installation to ensure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.

D. Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

E. All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity. Pumps shall have a data plate indicating horsepower, static pressure head and flow rate.

PART 17 - HAZARDOUS MATERIALS:

17.1 REQUIREMENTS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building or site.

B. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, ensure that their workers are aware of this potential and what they are to do in the event of suspicion. The

Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

C. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

D. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.

E. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

F. No asbestos or mercury containing materials shall be installed in this project.

PART 18 - COORDINATION DRAWINGS

18.1 REQUIREMENTS

A. Detailed coordination drawings shall be required for this project. A specific line-item shall be included on the schedule of values by each Trade for “preparation of coordination drawings”. The Construction Manager shall closely monitor progress and quality of the preparation of the electronic coordination drawings and may withhold pay requests as deemed appropriate.

B. Coordination Drawings shall be provided on this project by each Trade (Mechanical, Fire Protection, Electrical). Drawings shall be 30x42 sheet size and shall be at ¼” scale and shall match the drawing setup as included in the Architectural Drawings. The Architect and Engineer may supply electronic drawings files of the Contract Documents upon the Contractor’s request and release.

C. The Engineer’s Model is not without MEP/FP clashes. It is the responsibility of the Contractors to prepare fully coordinated drawings for construction. Any clashes should be resolved as part of the Coordination Effort at no additional cost.

D. The basis for the Coordination Drawings shall be the sheet metal ductwork fabrication shop drawings, all electrical feeder conduits and other conduits 2” and larger, heat pump system piping and other major components in the ceiling cavity. The Coordination Drawings shall be prepared by the Mechanical Contractor with cooperation of all the contractors. The Coordination Drawings shall indicate (1) systems above ceilings in finished areas, (2) systems supported from the structure in finished areas without ceilings, (3) systems in the mechanical

rooms, and (4) all wall, roof, floor penetrations. These drawings shall indicate all ductwork as double lined with bottom elevations noted.

E. The sheet metal fabrication shop drawings shall be completed in a timely manner so as not to conflict with construction schedule and phasing plan. At the Contractor's discretion, these drawings shall be completed in phases to correspond with the project construction work sequencing. The Mechanical Contractor shall furnish an electronic copy of these ductwork shop drawings to all other Trades, specifically the Fire Protection and Electrical and other Contractors as requested by the Construction Manager for the purpose of including other trades work on the Coordination Drawings.

F. Pre-Coordination Meetings with all necessary trades should be performed. During these meetings, the Contractors shall discuss locations/elevations where piping, conduits, cable path, etc will be installed with respect to the sheetmetal fabrication drawings and other trades. The sheetmetal ductwork and gravity piping systems shall be given the first priority. Within 30 days of the meeting, each Trade shall provide the Mechanical Contractor electronic drawings of all of their systems (with elevation noted), coordinated with the ductwork and other trades for them to incorporate into the Coordination Drawings. Coordination Meetings may be required so that all conflicts can be resolved between Trades. All conflicts shall be resolved between all Trades at the Construction and Coordination Meetings and the Mechanical Contractor shall then amend the Drawings to include the Final Coordinated Work.

G. It is realized that not all systems can be completely detailed. The coordination drawings shall include the following at a minimum:
   1. All supply/return/exhaust ductwork.
   2. All above slab sanitary and roof drainage piping.
   3. HVAC, fire protection and domestic water piping which are 2" in size and greater, excluding insulation.
   4. Electrical conduits which are 1.5" in size and greater.
   5. Cable tray and bridal ring paths.
   6. Multiple smaller piping/conduits hung on a common trapeze hanger.
   7. All wall, roof, floor penetrations.

H. After completion of the Final Coordination Drawings, a Final Review with the all Trades shall occur to provide any final comments and approval by all Trades. Other interim coordination meeting will be required to insure successful coordination drawings. Any additional coordination items will be updated by the Mechanical Contractor. The Final Approved Coordination Drawings shall be distributed electronically (on CD) to each Trade by the Mechanical Contractor. The Mechanical Contractor shall also furnish a complete 30x42 paper set of drawings to the jobsite main office and shall utilize them for updates of field conditions/deviations that occur during construction. Final Approved Coordination Drawings shall also be distributed to the Contractor, Owner, Architect and Engineer for their Records. This process shall be completed prior to starting any work.

I. Each Contractor shall insure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on Coordination Drawings kept at the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to

the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the Contractor, Owner, Architect and Engineer for their Records.

J. The contractor's final coordination drawings shall be coordinated with actual field conditions, as examined and verified by the contractor following completion of demolition. The contractor shall complete coordination drawings in phases as required to accommodate sequencing of construction, shop drawing review and approval, etc. as required for the contractor to maintain the construction schedule.

K. The mechanical contractor is responsible to the Construction Manager for the shop drawing layout of the following rooms and details:
   1. Concrete pads and foundations
   2. Equipment room layouts with actual equipment
   3. Roof layouts
   4. Trench locations and sizes
   5. Dimensioned floor drain locations
   6. Congested areas above ceilings adjacent to mechanical and electrical room
   7. Dimensioned ductwork shop drawings

PART 19 - TEMPORARY SERVICES

19.1 REQUIREMENTS

A. The Contractor shall arrange any temporary water, electrical and other services which may be required to accomplish the work. Refer also to General and Special Conditions.

B. All temporary services shall be removed by Contractor prior to acceptance of work.

PART 20 - SURVEY, MEASUREMENTS AND GRADE:

20.1 REQUIREMENTS

A. The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 21 - PROTECTION OF EQUIPMENT

21.1 REQUIREMENTS

A. The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense. All ductwork with open ends shall be covered with plastic during construction.

PART 22 - REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT

22.1 REQUIREMENTS

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

PART 23 - EQUIPMENT SUPPORT

23.1 REQUIREMENTS

A. Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Do not support items from roof/floor deck or bridging.

PART 24 - DUCT AND PIPE MOUNTING HEIGHTS

24.1 REQUIREMENTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

PART 25 - BROKEN LINES AND PROTECTION AGAINST FREEZING

25.1 REQUIREMENTS

A. No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Insulation on piping does not necessarily ensure that freezing will not occur.

PART 26 - WEATHERPROOFING

26.1 REQUIREMENTS

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 27 - FINAL CONNECTIONS TO EQUIPMENT

27.1 REQUIREMENTS

A. The Contractor shall finally connect to mechanical services for any terminal equipment, kitchen equipment, etc., provided under this and other divisions of the work. Various equipment connections indicated are based upon “basis of design” equipment selections. Should alternate equipment be purchased by the Construction Manager, then this Contractor shall make the necessary provisions in the Bid for any and all differences. Change Orders shall not be considered for any differences due to alternate equipment purchase. Such connections shall be

made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineer prior to installation.

PART 28 - ACCESSIBILITY

28.1 REQUIREMENTS

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.

C. Whether shown on the Plans or not, the Contractor shall provide in the Bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. Change orders for access panels will not be accepted.

PART 29 - SCAFFOLDING, RIGGING AND HOISTING

29.1 REQUIREMENTS

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

PART 30 - CONCRETE WORK

30.1 REFER TO THE SCOPE OF THE GENERAL TRADES CONTRACTOR. REFER TO DIVISION 3 SPECIFICATIONS.

PART 31 - RESTORATION OF NEW OR EXISTING LANDSCAPING, PAVING, SURFACES, ETC.:

31.1 REQUIREMENTS

A. The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, landscaping, existing or new building surfaces and appurtenances, and any other items damaged or removed by their operations. Replacement and

repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and/or Engineer.

PART 32 - MAINTENANCE OF EXISTING UTILITIES AND LINES

32.1 REQUIREMENTS

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily. Provide a seven (7) day written notice to Engineer, Architect and Owner prior to interrupting any utility service or line.

B. Known utilities and lines as available to the Engineer are shown on the Plans. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.

C. 32.3 If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation in the respective area.

D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

E. The Contractor shall repair to the satisfaction of the Owner and Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted with ten feet of gas lines, fuel lines, electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only in accord with utility company, agency or other applicable laws, standards or regulations.

G. Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

PART 33 - CLEANING

33.1 REQUIREMENTS

A. The Contractor shall, at all times, keep the area of their work presentable to the public and clean of rubbish and debris caused by their operations; and at the completion of the work, shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

C. Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not “dried-in”. If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

PART 34 - TEMPORARY USE OF EQUIPMENT:

34.1 REQUIREMENTS

A. The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Owner and Engineer. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

B. Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

C. Systems used during construction shall be cleaned per NADCA ACR 2006 guidelines from visible surface containments within the HVAC system including complete air distribution systems, air handling equipment and components and filters.

D. A pre-start-up conference shall be held with the Architect, Owner, Construction Manager and the Mechanical Contractor. Equipment shall not be started until after this meeting.

E. For Heat Pump Units during all phases of construction:
   1. At a minimum, four complete sets of filter media are required for each unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.
   2. On the outside of all return air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
   3. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.

F. For Outside Air Units during all phases of construction:
   1. The outside air unit shall be made operational, tested, etc. as specified during construction by the Contractor. Four complete sets of filters are required for the unit; Install one set of filters during construction; the remaining install one set of filters at substantial completion. Leave the remaining filters in boxes in appropriate mechanical room as a spare set for the Owner. Dispose of all construction filters.
   2. On the outside of all exhaust air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
   3. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.

PART 35 - NOISE, VIBRATION OR OSCILLATION

35.1 REQUIREMENTS

A. Noise levels from mechanical equipment and systems shall not exceed the following sound pressure levels / noise criteria per ASHRAE Guidelines and as follows:

B. Classrooms, Instructional Spaces and Conference Rooms – NC 30 or less

C. Offices & Gym – NC 35 or less

D. Public Areas, Corridors & Toilet Rooms – NC 40 or less

E. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, or exceeds the noise criteria limits as scheduled, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.

F. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

G. The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 36 - EQUIPMENT/CONTROLS STARTUP & VERIFICATION: (GC 12/8/25)

36.1 REQUIREMENTS

A. The Contractor shall include in the bid to provide equipment and controls startup and verification for ALL Mechanical Systems specified for this project.

B. A pre-start-up conference shall be held with the Architect, Engineer, Owner, Construction Manager, Mechanical Contractor, Electrical Contractor, Controls Contractor, Test and Balance Contractor, and the Manufacturer's providing startup services. The purpose of this meeting will be to discuss the goals, procedures, etc. for start-up

C. Specific line-items shall be included on the schedule of values by each Trade for "equipment and controls startup". This line-item value shall be approved by the Engineer. The Engineer, Owner and the Engineer's Field Inspector(s) shall closely monitor progress and quality of the equipment and controls startup and may withhold pay requests as deemed appropriate.

D. Specific startup/verification Specifications are included throughout the Mechanical Specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians, not third-party contractors, and shall complete and submit start-up reports/checklists. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up. All information shall be completed by the Contractor and submitted to the Owner/Engineer prior to acceptance of the equipment.

E. Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer's Checklists and the Commissioning Agent's pre-functional checklists as part of verification and start-up. Factory startup is required for all HVAC equipment. Unless noted otherwise, as part of the verification process, equipment suppliers shall perform start-up

by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include the following:

F. Heat Pumps

G. Water-to-Water Heat Pump Unit

H. Outside Air Unit

I. Terminal Units

J. Variable Frequency Drives

K. Water Flow Meters/BTUH Meters

L. System Pumps

M. Except for the equipment specified in this Specification Section, the manufacturer's recommended startup procedures and checklists will be acceptable for use in the project. Where "manufacturer" startup is not specified, then this Contractor shall perform startup services in strict accordance with manufacturer's instructions. All startup/verification process shall be thoroughly documented by the Contractor and shall include the time and date when performed.

N. The Contractor shall "zip-tie" a start-up report to each piece of equipment in a clear plastic cover. Once start-up completion is verified by the Engineer the Contractor shall remove all reports and consolidate them into close-out documentation. The Contractor shall be responsible for completion of System Verification Checklist (SVC) / Manufacturer's Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.

PART 37 - PINSPECTION, APPROVALS AND TESTS

37.1 REQUIREMENTS

A. Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.

B. The Contractor shall provide as a part of this Contract any required Agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.

C. The Contractor shall advise each Inspecting Agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing work. Failure of the Inspecting Agency to inspect the work in the stage following and submit the

related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

D. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such Agency Inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

E. Approval by an Agency Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

F. Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the Agency Inspectors to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 38 - ABOVE-CEILING AND FINAL PUNCH LISTS

38.1 REQUIREMENTS

A. The Contractor shall review each area and prepare and complete their own punch list for each of the subcontractors as required for the Project Schedule.

B. Seven (7) days notice shall be given to the Engineer and Commissioning Agent for review of above ceiling work that will be concealed by tile or other materials. Seven (7) days notice shall be given to the Engineer for review of below ceiling work and final inspection.

C. When all work from the Contractor's punch list is complete at each of the major Project Stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven (7) days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review. The Contractor’s representative may be requested at the inspections.

D. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $200.00 per hour for extra trips required to complete either of the above ceiling, below ceiling or final punch lists.

PART 39 - OPERATING INSTRUCTIONS AND TRAINING

39.1 REQUIREMENTS

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of one (1) day of eight (8) hours and as specified for other systems. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.

B. Each Contractor shall video each training session and furnish the video via thumb-drive (3 sets required). Also, furnish three digital sets on thumb-drive and three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

C. Each Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

D. Per Connecticut General Statutes, Title 10, Chapter 170, Section 10-231e, each Contractor shall provide to the Owner’s staff sufficient training and acceptance for the maintenance of all HVAC systems specifically regarding indoor air quality including geothermal heat pump units, dedicated outside air system, exhaust fans, filtration, etc and any inter-related systems.

PART 40 - RECORD DRAWINGS

40.1 REQUIREMENTS

A. The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

B. All underground utilities/piping installed as part of this project shall be surveyed by a land surveyor licensed in the State. This shall include underground geothermal piping mains and vertical bore locations. The survey shall include actual pipe depths to top of pipe every 100 feet

in length. The survey shall also include benchmarks dimensions relative to above grade, fixed structures.

C. The survey information shall be included in the closeout documentation.

PART 41 - COMMISSIONING - CONTRACTOR RESPONSIBILITIES:

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

B. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

C. Cooperate with the CxA for resolution of issues recorded in the Issues Log.

D. Attend commissioning team meetings.

E. Integrate and coordinate commissioning process activities with construction schedule.

F. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.

G. Review and accept commissioning process test procedures provided by the Commissioning Authority.

H. Complete commissioning process test procedures.

PART 42 - BUILDING ENVELOPE PRESSURE TESTING - CONTRACTOR RESPONSIBILITIES

42.1 REQUIREMENTS

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform building envelope pressure testing process activities including, but not limited to, the following:

B. Provide a plan for sealing the mechanical systems to allow proper testing of the building envelope system.

C. Sealing of all mechanical system building envelope penetrations (ducts, louvers, etc.).

D. Cooperate with the CxA for monitoring the process.

E. Attend building envelope pressure testing coordination meetings.

PART 43 - HVAC DEMOLITION & SALVAGE

43.1 REQUIREMENTS

A. It is the intent of the project to completely remove all components of the existing HVAC system within the building whether specifically noted or otherwise. This project is considered a "renovate-as-new" project and therefore none of the existing systems will be reused as part of this project. The general scope of the HVAC system demolition is indicated on the drawings. Where HVAC units are removed, also remove all associated ductwork, branch piping, hangers, insulation, concrete pads, controls, etc. Contractor shall field verify existing conditions prior to bid.

B. Refer to the demolition drawings for general indication of equipment, piping and ductwork to be demolished. If other equipment, piping or ductwork is found during construction which is not indicated on the drawings, it must also be removed.

C. Remove all temperature controls, panels, accessories, etc. that are accessible or become accessible during construction that serves demolished systems. Remove all pneumatic control tubing, control wiring and conduits in the facility unless noted otherwise.

D. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing by qualified tradesmen of all holes, etc. in the ceiling, wall, roof and floors where HVAC equipment and systems are removed.

E. The Contractor shall have a licensed refrigerant recovery technician evacuate all refrigerants from all refrigeration equipment being removed in accordance with EPA guidelines and regulations. The Contractor shall take all necessary precautions to not accidentally vent refrigerants to the atmosphere. The refrigerant shall become the property of the Contractor.

F. It is the intent of this section to deliver to the Owner all components which may be economically reused by them. The Contractor shall make every effort to remove reusable components without damage including window air-conditioners, temperature control air compressors and DDC panels.

G. Components to be delivered to the Owner shall be specifically identified by the Owner's representative prior to beginning the demolition. The Contractor shall prepare a letter of transmittal of all salvaged items and obtain the Owner's signature and date of receipt.

PART 44 - CT HIGH PERFORMANCE BUILDINGS (CTHPB)

44.1 REQUIREMENTS

A. Contractor shall comply with all applicable submittals, criteria, procedures, requirements, materials and systems associated with the Connecticut High Performance Building Standard (CTHPB).

B. Refer to CTHBP Checklist and Specification Section 018113.23 – Sustainable Design Requirement for additional information.

PART 45 – LEED REQUIREMENTS

A. Comply with applicable LEED and project sustainability requirements associated with Division 23 work.

B. Provide documentation required to support LEED credits and prerequisites related to HVAC systems, including energy performance, water and energy metering coordination, enhanced commissioning, refrigerant management, indoor air quality, thermal comfort, acoustics, and renewable energy integration, as applicable.

C. Coordinate with the Contractor, Owner, Commissioning Authority, LEED consultant, and other trades to support LEED documentation, installation requirements, testing, and verification.

D. Provide HVAC systems, controls, and related components necessary to support project sustainability goals for ventilation, filtration, controllability, metering interface, and occupant comfort.

E. Participate in enhanced commissioning, testing, training, and corrective action activities required for Division 23 systems and related LEED compliance.

END OF SECTION

SECTION 230300 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1. Refer Specification Section 019113 General Commissioning Requirements.
2. Refer to the Owner’s OPR for additional items related to as-builts and O&Ms.

C. The Contractor shall prepare and submit shop drawings, product data, certified equipment drawings, installation instructions, and operation and maintenance data for all plumbing systems and equipment in accordance with Division 01 requirements and the project submittal schedule.

D. Submittals shall be prioritized to support the construction schedule, including early submission of long-lead and critical-path equipment.

E. Provide all shop drawings and submittals in electronic/PDF format through proper channels. The Engineer’s comments will be returned in electronic format.

F. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

G. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

H. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the Construction Manager and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

I. The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.

J. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the

contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

K. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.

L. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.

M. Submittals for mechanical equipment shall include all relevant performance and construction data, including but not limited to flow rates, pressure ratings, materials, finishes, and accessories.

N. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

O. All submittals for mechanical equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

P. All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.

Q. Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

R. Indicate compliance with CT High Performance Building Standards as applicable.

S. Indicate compliance with LEED v4.1 Standards as applicable.

PART 2 - SHOP DRAWINGS

2.1 REQUIREMENTS

A. Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

(2.1.A.1) Air Filtration & Components

(2.1.A.2)	Chemical Treatment
(2.1.A.3)	Ductwork Accessories/Volume Dampers
(2.1.A.4)	Sheetmetal Standards
(2.1.A.5)	Exhaust Fans
(2.1.A.6)	HVAC Piping Valves and Fittings
(2.1.A.7)	Kitchen Hood, Exhaust fan
(2.1.A.8)	Firestopping
(2.1.A.9)	Geothermal Heat Pump Units
(2.1.A.10)	Geothermal Piping and Specialties
(2.1.A.11)	Insulation
(2.1.A.12)	Outside Air Handling Unit (and custom base rail curb)
(2.1.A.13)	Variable Air Volume Terminal Boxes
(2.1.A.14)	Pumps
(2.1.A.15)	Hydronic Specialties (Tanks, Air Separators, Filters)
(2.1.A.16)	Register, Grilles, Diffusers and Louvers
(2.1.A.17)	Temperature Controls
(2.1.A.18)	Unit Heaters
(2.1.A.19)	Variable Frequency Drives
(2.1.A.20)	Sound Attenuators
(2.1.A.21)	Automatic Smoke Vents
(2.1.A.22)	Geothermal Piping
(2.1.A.23)	Grout Mixture and Procedures
(2.1.A.24)	Written Flushing, Purging, Pressure, and Flow Testing Plan
(2.1.A.25)	Test and Balancing Plan, Procedure and Reports
(2.1.A.26)	Wellfield Shop Drawing indicating Layout and Sizing
(2.1.A.27)	Sheetmetal Shop Drawings
(2.1.A.28)	Piping Shop Drawings

2.2 SPECIAL NOTES

A. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for all items marked above. These documents shall include at least:

1. Detailed operating instructions
2. Detailed maintenance instructions including preventive maintenance schedules.
3. Addresses and phone numbers indicating where parts may be purchased.
4. Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.
5. Master air filter list including equipment identification, filter size, filter quantity, and supplier contact information.

B. Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system. Refer to Specification Section – AUTOMATIC TEMPERATURE CONTROLS FOR HAVC for additional requirements.

C. The Contractor shall submit project specific UL listed firestopping installation drawings to the Authority having jurisdiction.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Upon substantial completion of the project, the Contractor shall submit to the Engineer a PDF version of the Certified Air and Hydronic Balance Report.

3.2 INSTALLATION

A. Installation shall comply with manufacturer's written instructions and applicable codes and authority having jurisdiction (AHJ) requirements.

3.3 USE OF APPROVED SUBMITTALS

A. All work shall be installed in accordance with reviewed submittals. Where discrepancies exist between the Contract Documents and reviewed submittals, the more stringent requirement shall govern. Notify the Engineer of such discrepancies prior to installation.

3.4 FIELD VERIFICATION

A. Verify field conditions, dimensions, and utility requirements prior to installation and fabrication.

B. Do not proceed with installation where conflicts exist until such conflicts are resolved.

3.5 COORDINATION

A. Coordinate installation of plumbing systems and equipment with other trades, including structural, architectural, mechanical, and electrical work.

B. Ensure proper access, service clearances, and routing prior to installation.

3.6 CLOSE OUT DOCUMENTS

A. Submit final, complete operation and maintenance manuals incorporating all approved submittals and field changes.

B. Manuals shall reflect as-installed conditions and include final equipment selections, settings, and configurations.

END OF SECTION

SECTION 230513 – COMMON MOTOR ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall insure a complete, 100% functional, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected. Refer to Specification Section – HVAC EQUIPMENT for additional requirements. All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

C. Review the Specification Section – TEMPERATURE CONTROLS AND SEQUENCE OF OPERATIONS FOR HVAC to determine controls, including variable frequency drives, to be furnished.

D. Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for any discrepancies. A final coordination meeting shall be held with the Construction Manager, Mechanical Contractor, Electrical Contractor and their sub-contractors.

PART 2 - MOTORS

2.1 REQUIREMENTS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications and drawing schedules.

B. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

C. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

D. Motors shall be capable of frequency of starts as indicated by automatic control system and not less than five (5) evenly time spaced starts per hour for manually controlled motors.

E. Motors shall have a 1.15 service factor for poly-phase motors and 1.35 service factor for single phase motors.

F. Motors shall have a temperature rating for 40 deg C ambient environment with maximum 90 deg C temperature rise for continuous duty at full load with 1.15 service factor and Class B insulation.

G. Unless otherwise noted or required by application, motors shall confirm to NEMA Standard MG 1 (Table 12-10) for general purpose, continuous duty, horizontal, T-frame, single speed, design “A” or “B”. Utilize design "C" motors where required for high starting torque.

H. Motor frames shall be NEMA Standard No. 48 or 56. Use driven equipment (fans, pumps, etc.) manufacturer's standards to suit specific application.

I. Provide inverter rated motors where variable frequency drives are utilized. Motor shall be premium efficiency type with Class F insulation and shall conform to NEMA MG 1 parts 30 and 31. Inverter duty rated motors shall have a temperature rating for 40 deg C ambient environment with maximum of 105 deg C temperature rise.

J. Motor bearings shall be ball or roller bearings with inner and outer shaft seals. Bearings shall be re-greaseable, except permanently sealed where motor is normally inaccessible for regular maintenance. Bearings shall be designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.

K. Motor enclosure type shall be open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation. Enclosures shall be guarded drip-proof type motors where exposed to contact by employees or building occupants. Enclosure shall be weather protected Type I for outdoor use or Type II where not housed.

L. Provide built-in thermal overload protection and, where required, internal sensing device suitable for signaling and stopping motor at starter.

M. Provide energy efficient motors with a minimum efficiency in accordance with NEMA MG 1, Table 12-10 for 1800 rpm, enclosed motors. If efficiency not specified, motors shall have a minimum efficiency as listed below:

1 hp - 85.5%	5 hp – 89.5%	20 hp – 93.0%
1.5 hp – 86.5%	7.5 hp – 91.7%	25 hp – 93.6%
2 hp – 86.5%	10 hp – 91.7%	30 hp – 993.6%
3 hp – 89.5%	15 hp – 92.4%	40 hp – 94.1%

N. On the motor nameplate, indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - MOTOR STARTERS

3.1 REQUIREMENTS

A. Provide motor starters where indicated on the mechanical equipment schedules or elsewhere in the Contract Documents.

B. Motor starters shall be NEMA style. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.

C. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall provide starters capable of limiting inrush currents. These shall be the reduced voltage open-transition type. Do not utilize closed transition starters unless specifically indicated.

D. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.

E. Contacts shall be silver-alloy, double-break type except NEMA size 8 and 9 shall be single-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.

F. Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, except for size 8 and 9 which shall be hand wound. Provide coil clearing contact as required.

G. Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.

H. Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated for automatic control.

I. Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push button or similar means. Class 10 or Class 30 overloads may be used depending on type of motor duty encountered.

J. Provide at least one N.O. auxiliary contact (field-convertible to N.C. operation) with each starter. All starters shall have space for two additional single-pole contacts.

K. All starters shall be thru-wiring type.

L. Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 7½ H.P. or larger.

PART 4 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

4.1 REQUIREMENTS

A. All mechanical equipment shall be provided for single point electrical connection unless noted otherwise.

B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, Part C, and other applicable sections of the N.E.C.

C. It shall be the Contractor's responsibility to assure that all mechanical equipment requiring electrical connections be provided with all required proper wiring, electrical protective devices, disconnecting means and electro-mechanical starting units to properly match the mechanical equipment requirement.

D. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per Code and Project requirements.

E. Refrigeration condensing units with internal compressors shall be furnished with integral starter.

F. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of this Contractor.

G. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

H. Observe the following standards for manufacture of equipment and in selection of components: (1) Starters, control devices and assemblies - NEMA (I.E.C. style not acceptable), (2) Enclosures for electrical equipment – NEMA, (3) Enclosed switches – NEMA, (4) All electrical work, generally NFPA 70, (5) All electrical work in industrial occupancies - J.I.C. standards, (6) All electrical components and materials - U.L. listing required.

I. Where scheduled on the drawings, provide disconnect switches and contactors. Disconnect switches shall be fusible type or circuit breaker type.

PART 5 - REQUIREMENTS FOR MECHANICAL EQUIPMENT 3/4 H.P. OR LESS

5.1 REQUIREMENTS

A. This section describes requirements for small mechanical equipment such as VAV boxes, unit heaters, exhaust fans, heat pumps, cabinet heaters, DDC temperature control panels, condensate pumps, and in-line recirculating pumps.

B. Small equipment with motor(s) of 3/4 H.P., single phase or less are generally not required to be furnished with starter(s), unless otherwise noted. For such equipment, provide integral contactor or horsepower-rated relay where controlled by DDC controls, thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment.

C. Provide transformer within unit as required to provide low voltage A.C. for thermostat control.

D. Provide internal fusing for unit motor and other loads in fuse block or in-line fuse holder.

E. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction.

END OF SECTION

SECTION 230517 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall be responsible for all openings, sleeves, trenches, etc., that may be required in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the Construction Manager and all other trades. Coordinate with the Construction Manager, any openings which they are to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.

C. The Contractor shall plan their work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall then do all cutting and patching required for the installation of their work, or pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workers of the responsible Contractor must be corrected or rectified at their own expense.

D. The Contractor shall notify other trades in due time where they will require openings or chases in new concrete or masonry. Set all concrete inserts and sleeves for their work. Failing to do this, Contractor shall cut openings for the work and patch same as required at their own expense.

E. the Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly corrected to the satisfaction of the Engineer.

F. All work improperly performed or not performed as required by the Mechanical Trades in this section, shall be corrected by the Construction Manager at the responsible Contractor’s expense.

PART 2 - SLEEVES

2.1 REQUIREMENTS

A. Cast iron or Schedule 40 steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing. Utilize “Link-Seal” at these locations.

B. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation.

C. Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Utilize “Link-Seal” at these locations.

D. Vertical sleeves in roofs shall be flashed and counter flashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed. Where sleeves pass through roof construction, sleeves shall extend minimum of 12" above the roof.

E. Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated.

PART 3 - CUTTING

3.1 REQUIREMENTS

A. All rectangular or special shaped openings in plaster, gypsum board or similar materials, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth, even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, louvers, etc.

B. The Mechanical Contractor shall coordinate all openings in masonry walls with the Construction Manager; and, unless otherwise indicated in the Contract Documents, shall provide lintels for all openings required for the mechanical work such as louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:
   1. New Openings under 48" in width: Provide one 3½"x3½"x3/8" LLV steel angle for each 4" of masonry width. Lintel shall have 8" bearing on each end.
   2. New Openings over 48" in width: Consult with structural engineer.

C. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.

D. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

PART 4 - PATCHING AND REPAIRING

4.1 REQUIREMENTS

A. Patching and repairing made necessary by work performed under this Division shall be included as a part of the work and shall be done by skilled workers of the trade or trades for work cut or damaged. The work shall be performed in strict accordance with the provisions herein before specified to match adjacent surfaces and in a manner acceptable to the Engineer and Owner.

B. Where portions of existing sites, lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced back to original or better condition to the satisfaction of the Engineer.

C. Piping and ductwork passing through floors, ceilings and walls in finished areas shall be fitted with chrome plated brass escutcheon trim pieces of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe/duct around which it is installed.

D. Flanged metal collars shall be provided around all ducts, flues, pipes, etc. at all wall penetrations; both sides. Penetrations through any wall will require the installation of flanged collars. Openings shall not be any larger than 2” in any direction than the piping/duct passing through the wall. Openings larger than this requirement shall also be infilled to match adjacent construction. Fill void with insulation for sound reduction.

PART 5 - FIRESTOPPING

5.1 REQUIREMENTS

A. The Contractor shall submit project specific UL listed firestopping installation drawings to the local building inspectors for their approval as required. Acceptable manufacturers include Hilti, 3M, Metacaulk or equal. Coordinate firestopping systems with other trades.

B. All mechanical pipes and ducts penetrating fire rated floors and walls shall be firestopped by this Contractor. All firestopping products and assemblies installed shall be UL listed. Piping materials and ductwork gauges shall be as required for the UL listed assembly.

C. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.

D. Where the installation of ductwork requires the penetration of non-rated floors, the space around the duct or pipe shall be tightly filled with an approved non-combustible material.

E. Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type of penetration (one-hour fire rated

gypsum wall board with insulated metal pipe penetration, etc.) Provide copies to the local building inspector.

F. The manufacturer of the firestopping materials shall provide on site training for the installing Contractor. The training session shall demonstrate to the Contractors the proper installation techniques for all the firestopping materials. Contact the Engineer prior to conducting this training session.

G. Firestopping materials include (but are not limited to) wraps, strips, caulks, moldable putties, restricting collars with steel hose clamps, damming materials, composite sheets, fire dam caulks, steel sleeves, etc.

H. The following indicates the 3M penetration detail for uninsulated pipe penetration of various wall and floor construction types:
   1. One- or two-hour fire rated concrete floor - 3M #5300-MPC8.
   2. One- or two-hour fire rated solid or block concrete wall - 3M #5300-MPC16 or 3M #5300 MPC26.
   3. One-hour fire rated gypsum wallboard - 3M #5300-MPC7.
   4. Two-hour fire rated gypsum wallboard - 3M #5300-MPC7.

I. The following indicates the 3M penetration detail for insulated pipe penetrations of various wall and floor construction types:
   1. One- or two-hour fire rated concrete floor - 3M #5300-IMP2.
   2. One- or two-hour concrete block wall - 3M #5300-IMP2.
   3. One-hour fire rated gypsum wallboard - 3M #5300-IMP4.
   4. Two-hour fire rated gypsum wallboard - 3M #IMP7.

J. HVAC ducts penetrating a one- or two-hour fire rated wall or floor shall be firestopped per 3M #5300-HVD1.

K. Multiple pipes penetrating fire rated floors and walls may be firestopped as a group. Submit UL listed details for specific applications if this method of firestopping is chosen.

END OF SECTION

SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated. All thermometers, pressure gauges and/or compound gauges shall be provided with “gauge cocks or ball valves” to allow the gauge to be removed and replaced without shutting down system.

1.2 SUMMARY

A. This section includes the following types of meters and gauges
   1. Temperature gauges and fittings
   2. Pressure gauges and fittings

B. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 specifications.

1.3 QUALITY ASSURANCE

A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.4 SUBMITTALS

A. Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:
   1. Product Data for each type of thermometer and gauge
   2. Calibration Certificates
   3. Operation and Maintenance Manuals
   4. Instrument ranges and locations indicated on shop drawings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. Thermometers and Wells: Trerice, WIKA, Ashcroft, Winters
   2. Pressure Gauges: Trerice, WIKA, Ashcroft, Winters
   3. Test Plugs: Trerice, Sisco, Watts, Peterson Equipment Co

B. All instruments shall be factory calibrated.

C. All components shall be rated for system design pressure and temperature.

D. Install instruments to be readable from normal operating position.

E. Provide instruments compatible with building automation system where indicated.

2.2 THERMOMETERS

A. Type: Bimetal dial-type, adjustable angle, stainless steel case and stem.

B. Dial Size: Minimum 2-1/2-inch diameter (3-inch typical; 4-1/2-inch preferred in mechanical rooms).

C. Accuracy: ±1% of full scale.

D. Scale: Dual scale (°F/°C), permanently etched.

E. Range shall be selected for system served, 0°F–180°F for geothermal water

F. Stem Length: As required for proper immersion.

G. Provide thermometers installed in separable stainless steel wells for all piping applications. Direct immersion without wells is not permitted.

2.3 DIGITAL THERMOMETERS

A. Provide digital thermometers where indicated on drawings.

B. Range: -50°F to 300°F.

C. Accuracy: ±1% or ±1°F, whichever is greater.

D. Display: Minimum 3/8-inch LCD.

E. Power: Self-powered (solar) or battery as applicable.

2.4 THERMOMETER WELLS

A. Material: Brass or stainless steel.

B. Rating: Suitable for system design pressure and temperature.

C. Provide extension length to clear insulation.

D. Provide threaded cap with retaining chain.

2.5 PRESSURE GAUGES

A. Type: ASME B40.1, bourdon tube.

B. Case: Stainless steel with glass or polycarbonate lens.

C. Dial Size: Minimum 2-1/2-inch (4-1/2-inch preferred in mechanical rooms).

D. Connection: 1/4-inch NPT, bottom connection unless noted otherwise.

E. Accuracy: ±2% of full scale.

F. Range: Selected so normal operating pressure is approximately mid (0–100 psi unless noted otherwise)

G. Provide gauges rated for system design pressure.

2.6 PRESSURE GAUGE ACCESSORIES

A. Provide gauge cock or ball valve at each pressure gauge for isolation and removal.

B. Provide snubbers where required to prevent pulsation or vibration damage.

C. Provide siphons for steam service only.

2.7 TEST PLUGS

A. Provide test plugs with 1/4-inch NPT fitting to accept 1/8-inch OD temperature or pressure probes.

B. Body: Solid brass, nickel-plated, with dual self-sealing valve cores.

C. Core Material:
   1. Neoprene for temperatures up to 200°F.
   2. EPDM (Nordel) for temperatures between 200°F and 275°F.

D. Length:
   1. Minimum 3-inch length for insulated piping.

2. Minimum 1-1/2-inch length for uninsulated piping

E. Cap: Provide gasketed, color-coded cap with retaining strap.

F. Pressure Rating: Minimum 1000 psig at 140°F.

PART 3 - EXECUTION

3.1 THERMOMETER INSTALLATION

A. Install thermometers in locations and orientations to be readable from a standing position at floor level.

B. Install thermometers in piping using separable wells; direct immersion is not permitted.

C. Install thermometer wells in piping tees at locations indicated. Orient wells to ensure proper immersion and readability.

D. Fill wells with thermal conductive material (oil or graphite) and secure cap.

E. Provide extension lengths to clear insulation.

F. Instruments installed on hydronic systems shall not be installed at high points subject to air accumulation or low points subject to sediment unless specifically intended.

3.2 INSTALLATION OF PRESSURE GAUGES

A. Install pressure gauges in piping tees with gauge cock or ball valve for isolation.

B. Locate gauges for maximum readability from normal operating position.

C. Install gauges at a minimum at the following locations:.
1. Top of piping risers.
2. Additional locations indicated on drawings and schematics

D. Provide snubbers where required to prevent pulsation or vibration damage.

E. Do not install gauges directly on vibrating piping; provide remote mounting with flexible tubing where required.

F. Instruments installed on hydronic systems shall not be installed at high points subject to air accumulation or low points subject to sediment unless specifically intended.

3.3 INSTALLATION OF TEST PLUGS

A. Install test plugs in piping tees at locations indicated and where required for testing and balancing.

B. Locate test plugs for accessibility and readability.

C. Install test plugs adjacent to each location where temperature or pressure measurement is required by the controls or balancing specifications.

D. Ensure test plugs extend beyond insulation and provide access for probe insertion.

E. Secure caps after installation.

F. Provide test plugs at all hydronic equipment connections, coils, and major branch takeoffs unless otherwise indicated.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces.

C. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.5 CONNECTIONS

A. Install meters and gauges to allow adequate clearance for servicing, removal, and maintenance.

B. Coordinate final locations with piping, equipment, and insulation to ensure accessibility and proper operation.

C. Comply with Division 23 piping requirements for installation of associated piping, fittings, and specialties.

D. Coordinate final locations with controls contractor to ensure compatibility with BAS sensors and access for calibration.

END OF SECTION

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

1.2 QUALITY ASSURANCE

A. Each Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Mechanical Systems.

B. The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

C. Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.

D. All valves shall comply with applicable codes and standards, shall be new, and shall be rated for the intended service, pressure, and temperature.

E. Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

1.3 STANDARDS

A. Valve Bodies, Shells and Seats: Factory-tested.

B. Standard for 125 psi and 150 psi saturated steam rated valve pressure containing parts: ASTM B62.

C. Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.

D. Iron Body Valves
   1. Pressure-containing parts: ASTM A126, Grade B.
   2. Face-to-face and end-to-end dimensions: ASME B16.10.
   3. Design, workmanship, materials, and testing: MSS SP-70 and MSS SP-71.

E. Butterfly valves: face-to-face and end-to-end dimensions shall conform to MSS SP-67.

F. Valve Stems: ASTM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

G. Pressure Castings: Free of impregnating materials.

H. Manufacturer's name or trademark and working pressure stamped or cast into body.

1.4 JOB CONDITIONS

A. Coordinate the exact application and location of this work with the work of other trades prior to installation within various piping systems. Verify all positions and elevations. Provide additional offsets and section of piping as required to position valves for equipment clearance and accessibility as well as system and valve operational conditions.

B. Valve manufacturer verify indicated figure or model numbers so that selection meets required description and conditions specified. Specified data for valve shall take precedence over indicated figure or model number. Provide proper seat and seal material for applicable temperature, pressure and service indicated for each valve application.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the following or approved equal: Nibco, Crane, Jenkins, Milwaukee, DeZurik, Armstrong, Bell & Gossett, Apollo, Watts, and Wilkins

2.2 HVAC HYDRONIC PIPING APPLICATIONS:

A. Gate Valve (2" and under): Use ball valves as specified.

B. Check Valves (2" and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.

C. Check Valves (2½" and larger): Check valve shall have cast iron body and cast-iron bolted bonnet the disc and seat ring shall be bronze. Check valve shall be horizontal swing with renewable seat and disc. Valve shall be rated for 200 psi working pressure. Check valve shall be Nibco F-918 for flanged ends or Nibco T-918 for threaded ends. Threaded ends valve allowed for sizes 3" and less only.

D. Two Piece Ball Valves (2" and under): Ball valve shall have bronze body, ball and reinforced, watertight seat. Valve shall be two-piece construction. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends. Provide extended handles for all ball valves installed in insulated piping systems.

E. Ball Valves (2½"-3"): Ball valve shall have bronze body, ball and reinforced, watertight seat. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open

to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-FP-600 for threaded ends and Nibco S-FP-600 for solder ends. Provide extended handles for all ball valves installed in insulated piping systems.

F. Butterfly Valve (4" and larger): Butterfly valves shall be lug-style or grooved-end type as required by piping system, with cast iron body, aluminum bronze or stainless steel disc, EPDM seat suitable for hydronic service, and extended neck for insulated piping. Valves shall be bubble-tight shutoff, rated for minimum 200 psi working pressure, and suitable for dead-end service where installed at equipment connections. Valves 4 inches and 5 inches shall have lever operators. Valves 6 inches and larger shall have gear operators. Provide chain-wheel operators for valves installed more than 8 feet above finished floor.

G. Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.

H. Strainers (2½" and larger): Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout and be rated for 200 psi working pressure. Provide blowdown connection with valve and cap where strainers are installed at pump suction or where indicated.

I. Flexible Connection: Pumpsaver SMP or equal braided stainless-steel pump connector(s). Construction to be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s), and a stainless-steel ring-ferrule/band (material gauge not less than .048") must be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. End fittings shall be flat-face plate steel flanges with 150# ANSI drilling and outside diameter. Fittings must be attached using a 100% circumferential TIG weld. Braided stainless steel pump connector(s) must be suitable for operating temperatures up to 850 degrees F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor. Each braided stainless-steel pump connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure. Flanged pump connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start up.

J. Automatic Air Vent: Armstrong Model 79 automatic air vent for vertical mounting with brass body and polypropylene float. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Pipe discharge to nearest floor drain.

K. Manual Air Vent: Armstrong Model 505A manual air vent with brass body. Install with 12" length of 1/4" soft copper discharge piping.

L. Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.

M. Hose Kits and Balance Valves: Refer to 23 3700 HVAC Equipment Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Valve installation shall meet the following:

1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
2. Locate valves for easy access and provide separate support where necessary.
3. Install valves in horizontal piping with stem at or above center of pipe.
4. Install valves in position to allow full stem movement.
5. Install chain wheels on operators for all butterfly valves 6" and larger and more 8 foot above floor. Extend chains to 5 foot above finished floor.
6. Install check valves for proper direction of flow and as follows:
    a. Swing Check Valves: In horizontal position with hinge pin level.
    b. Valves: In horizontal or vertical position, between flanges.
    c. Lift Check Valves: With stem upright and plumb.
7. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff service, 2 inches and smaller: Ball valves.
2. Shutoff service, 2-1/2 inches and larger: Butterfly valves.
3. Equipment connections: Provide isolation valves at each piece of equipment to permit servicing or removal without draining the entire system.
4. Branch connections and risers: Provide shutoff valves where required for system isolation and balancing of phased shutdowns.
5. Pump discharge: Provide check valve and shutoff valve.

6. Pump suction: Provide shutoff valve and strainer where indicated or required by equipment manufacturer.
7. High points of piping systems: Provide automatic or manual air vents.
8. Low points of piping systems and bases of risers: Provide drain valves.
9. Butterfly valves used for dead-end service shall be lug-style valves rated for such service.
10. Throttling service shall be by balancing valves or control valves; butterfly and ball valves shall not be used for final balancing unless specifically indicated otherwise.

END OF SECTION

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.

C. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

PART 2 - MATERIALS AND EQUIPMENT

2.1 Hangers, Clamps, Attachments Schedule:

A. ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason or approved equal.
1. All hangers, clamps and attachments shall be manufactured products.
2. Pipe Rings (2-inch pipe and smaller) – adjustable swivel split ring or split pipe ring.
3. Pipe Clevis (2.-inch pipe and larger) – adjustable wrought clevis type.
4. Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
5. Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
6. Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
7. Brackets (All pipe sizes) – medium weight steel brackets.
8. Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
9. Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
10. Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
11. U-bolts (All pipe sizes) – standard u-bolt.
12. Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
13. Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
14. Protection Saddle (All pipe sizes) – 180-degree coverage, sheet metal pipe protection saddle.
15. Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
16. Concrete Channel Inserts (All pipe sizes) – continuous heavy-duty slot inserts Unistrut.
17. Adjustable Spot Inserts (All pipe sizes) – continuous heavy-duty spot insert Unistrut.
18. Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall confirm to ASTM A36

2.2 HANGER RODS:

A. Hanger rods or single rod hangers shall conform to the following:

PIPE SIZE	HANGER ROD DIAMETER STEEL PIPE	HANGER ROD DIAMETER COPPER, PLASTIC, HDPE PIPE
2” and smaller	3/8”	3/8”
2-1/2” through 3-5/8”	1/2”	1/2”
4” and 5”	5/8”	½”
6”	3/4”	5/8”
8” through 12”	7/8”	3/4”
14”	1”	7/8”

B. Rods for double-rod hangers may be reduced in size, but in no case shall the minimum rod diameter be less than 3/8 inch.

C. Hanger rods and accessories installed in interior dry locations shall have ASTM B633 electroplated zinc finish.

PART 3 - INSTALLATION

3.1 REQUIREMENTS

A. Unless otherwise specified, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be performed by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs.

B. Supporting and hanging shall be done so that excessive load will not be placed on any one hanger or structural member and as required to allow for proper pitch and expansion of piping.

C. Hangers and supports shall be placed near joints, turns, and branches, with additional supports provided where required to prevent sagging or excessive movement.

D. For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power-driven devices may be used when approved in writing by the Architect/Engineer.

E. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction.

F. When piping is routed in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping or ductwork from bridging angles.

G. Trapeze hangers are not allowed, unless specifically approved by the Engineer.

H. Install all miscellaneous steel other than designed building structural members as required to

provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.

I. Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.

J. Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

K. Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.

L. Support all ceiling hung equipment with approved vibration isolators.

M. Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

N. All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

O. Under no conditions will perforated band iron or steel wire driven hangers be permitted.

P. Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.

Q. Support plastic pipe at intervals at a minimum of six (6) foot intervals for piping 4" and smaller; support a minimum of eight (8) foot intervals for larger piping. Smaller plastic piping systems, 2" and smaller, supports shall not to exceed four (4) feet. Support all piping at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times. In addition, all piping installation shall conform to manufacturer's installation instructions.

R. All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3” and smaller and ten (10) foot intervals on all other piping. (continued) Small vertical pipes (1” and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Reference 230529 for additional piping support requirements.

S. Ensure that all bolts and nuts are tightened.

END OF SECTION

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.
11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Seismic-restraint accessories.
18. Mechanical anchor bolts.
19. Adhesive anchor bolts.
20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
      a. See Evaluations for a discussion on seismic-restraint capacities and rating services.
      b. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
      c. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
   4. Elastomeric Isolation Pads: Include vertical weight ratings, physical sizes and depth associated with each size of water source heat pump.

B. Shop Drawings:
   1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
   1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic and wind forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.
      a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
   4. Seismic and Wind-Restraint Details:
      a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Welding certificates.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For restrained-air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Provide vibration isolation for major equipment as scheduled or specified herein, and furnish all additional isolation devices, supports, and installation measures required for associated piping, ductwork, and incidental components as necessary to achieve the specified vibration and noise control performance.

C. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are

preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
1. Basic Wind Speed: 130 Miles per Hour.
2. Building Classification Category: III.
3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:
1. Site Class as Defined in the IBC: E.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
   a. Component Importance Factor: 1.0
   b. Component Response Modification Factor: 2.5
   c. Component Amplification Factor: 2.5.
3. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
   a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.3 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: To be used for all water source heat pumps.
1. Acceptable manufacturers: Mason Industries, Vibro-Acoustics, Kinetics Noise Control, or approved equal.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed or Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.
   a. Surface Pattern: Ribbed or Waffle pattern.
   b. Infused nonwoven cotton or synthetic fibers.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:.
   1. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries; Amber/Booth Company; Kinetics Noise Control; Vibration Eliminator Co., Inc.; or approved equal.
   2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig
   7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
   1. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries; Amber/Booth Company; Kinetics Noise Control; Vibration Eliminator Co., Inc.; or approved equal.
   2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
      a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
      b. Top housing with leveling bolt and threaded mounting holes and internal leveling device, elastomeric pad.

2.6 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch thick neoprene.
   1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
   2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.7 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.
   1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.8 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries; Kinetics Noise Control; Vibration Eliminator Co., Inc.; Amber/Booth Company; Acoustical & Vibration Specialties; or approved equal.
   2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.9 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
   1. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries; Kinetics Noise Control; Vibration Eliminator Co., Inc.; Amber/Booth Company; Acoustical & Vibration Specialties; or approved equal.
   2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
   8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
   9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.10 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
   2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
   3. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

2.11 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.12 RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.13 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.14 VIBRATION ISOLATION EQUIPMENT BASES – (END-SUCTION PUMPS)

A. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries; Kinetics Noise Control; Vibration Eliminator Co., Inc.; Amber/Booth Company; Spring Air Systems; or approved equal.

B. Concrete Inertia Base: Factory-fabricated welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

      a. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
   4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.15 RESTRAINED ISOLATION ROOF-CURB RAILS – (DOAS-1)

A. Manufacturers: Subject to compliance with requirements, provide products by Mason Industries, Kinetics Noise Control, Amber/Booth Company, Cambridgeport Air Systems or approved equal.

B. Curb mounted rooftop units shall be isolated on 12-inch high roof top spring isolated noise control curb consisting of galvanized curb sections with integral vertical and laterally restrained isolators formed to fit the contractor-supplied rooftop equipment.

C. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

D. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces.

E. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

F. The isolation springs shall be of the vertical and laterally restrained type. The springs shall be designed to be laterally stable and properly selected to provide minimum specified deflection with 50% additional travel to solid. Isolation springs shall be powder coated for corrosion resistance and have a minimum static spring deflection of 2”. Spring selection shall be based on actual equipment operating weight, including accessories, coil sections, and all attached components supported by the curb.

G. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

H. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

I. Curb shall match the pitch of the roof (0.25"/1' pitch)

J. Curb rails shall provide continuous support in accordance with rooftop unit manufacturer's requirements and shall be coordinated with the equipment base rail configuration.

K. The curb shall include a coordinated weather proof piping and conduit penetration enclosure to match the rooftop unit.

L. All acoustic installation hardware shall be provided by the isolation curb manufacturer.

M. Spring isolators shall be selected for uniform deflection under the actual operating load of the unit, and the curb assembly shall be designed to avoid metal-to-metal contact between the supported equipment and building structure.

N. Curb shall be factory assembled, tested, and rated for the scheduled unit loads.

O. All steel components shall be galvanized, coated, or otherwise protected against corrosion for exterior rooftop service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION ISOLATION SCHEDULE

A. Provide vibration isolation for HVAC equipment, piping, and ductwork as indicated below. Where specific equipment is not listed, provide vibration isolation in accordance with the manufacturer's recommendations and as required to prevent transmission of objectionable vibration to the building structure.

B. Minimum vibration isolation requirements shall be as follows:
   1. End-Suction Pumps: Provide concrete inertia base with open-spring isolators with 1" static deflection. Provide flexible pipe connectors at pump suction and discharge connections. Support suction and discharge piping independently of pump casing. Coordinate inertia base size with pump and motor assembly.

2. Floor-Mounted Pumps, Base-Mounted Equipment, and Similar Rotating Equipment: Provide open-spring isolators, housed-spring isolators, or restrained-spring isolators, as required for equipment location and seismic/wind restraint requirements. Isolators shall be rated for 1.5” static deflection, with concrete inertia base for end suction types.
3. Inline Pumps: Provide spring hangers for suspended inline pumps. Where inline pumps are floor-supported or pipe-mounted, provide resilient supports or spring isolators with 1.5” static deflection. Do not support pump weight from adjoining piping unless specifically permitted by pump manufacturer.
4. Water Source Heat Pumps / Heat Pumps: Provide elastomeric isolation pads beneath unit support rails or factory-recommended mounting points. Pads shall be sized for uniform loading and selected based on actual unit operating weight and minimum for 0.75” deflection.
5. Horizontal Heat Pumps Above Ceiling: Provide spring hangers or elastomeric hangers at each support point rated for 0.75” static deflection. Provide flexible duct connectors at supply and return connections and flexible piping connections where hard-piped hydronic connections are provided. Maintain required service clearances and access.
6. Ceiling-Suspended Fans, Inline Exhaust Fans, and Cabinet Fans: Provide spring hangers or elastomeric hangers at each hanger rod rated for 0.75” static deflection. Provide flexible duct connectors at inlet and discharge connections. Where fans are located above noise-sensitive spaces, provide spring hangers.
7. Roof-Mounted Exhaust Fans: Provide factory-fabricated vibration isolation roof curb, spring-isolated curb, or elastomeric isolation curb suitable for exterior service. Isolator assembly shall be restrained for wind and seismic loads. Coordinate curb with roof construction, fan base, and flashing requirements. Elastomeric curb isolation pad installed between roof mounted equipment and supporting curb. Minimum 0.5" thick elastomeric layer. Minimum 1.75" elastomeric layer width. Nominal 40-60 durometer neoprene or high density compressed molded fiberglass individually coated with moisture impervious membrane. Elastomeric layer surface finish shall allow a weather proofed seal at top and bottom joint. Isolation layer shall be adhered to support curb and equipment with mastic adhesive without need of rigid connection. Assembly shall be sealed weather tight at all joints with silicone caulk. Kinetics KIP-RT or similar.
8. Roof-Mounted DOAS Units: Provide restrained spring isolation roof curb rails unless otherwise indicated. Spring deflection shall be selected based on actual operating weight of the unit, including accessories, coils, filters, energy recovery sections, and attached components. Isolators shall be rated for 2.5" static deflection internal steel springs for each fan within unit, with neoprene isolators for the casing.
9. Piping Connected to Vibration-Isolated Equipment: Provide spring hangers or resilient supports for piping within 50 pipe diameters of vibration-isolated equipment, unless otherwise indicated. First three pipe supports adjacent to pumps, heat pumps, chillers, air-handling units, terminal boxes, air separators and other rotating equipment shall be isolated. Provide flexible connectors at equipment connections where required. All piping inside equipment room and a minimum of 50' from connection to equipment shall be vibration isolated.
10. Hydronic Piping Mains and Branches: Provide resilient inserts or isolation pads at pipe supports where piping is supported from or attached to noise-sensitive structure. Provide seismic restraints independent of vibration isolation devices unless isolator assembly is rated for combined vibration and seismic restraint.
11. Ductwork Connected to Vibration-Isolated Equipment: Provide flexible duct connectors at fan, AHU, DOAS, heat pump, and exhaust fan connections. Support ductwork independently so equipment casings are not loaded by duct weight.

12. Ductwork Above Noise-Sensitive Spaces: Provide resilient hangers or neoprene isolation inserts where ductwork is subject to vibration from fans, terminal units, or equipment connections.
13. Seismic and Wind Restraints: Provide restrained isolators, snubbers, cables, braces, or other restraint devices where required by code, equipment location, and delegated design. Restraints shall not short-circuit vibration isolation during normal operation.
14. VAV Boxes / EVAV Boxes: Provide flexible duct connectors at inlet and discharge connections where recommended by the manufacturer or where required to prevent vibration transmission. Support boxes independently from ductwork. Provide neoprene isolation washers and resilient inserts.
15. Provide Air Separators, Expansion Tanks, Dirt Separators, and Similar Hydronic Accessories: Provide resilient pads or neoprene isolation washers at floor-mounted supports where connected to vibration-isolated piping or equipment. For suspended units, provide elastomeric hangers or spring hangers where installed near pumps or vibration-isolated equipment. Support accessories independently of connected piping unless specifically permitted by the manufacturer.
16. Cabinet Unit Heaters, Ceiling-Mounted Electric Unit Heaters, and Similar Terminal Heating Equipment: Provide neoprene isolation washers, resilient inserts, or elastomeric hanger elements at mounting points where equipment is suspended from structure or mounted to walls/ceilings. Support units independently of ductwork, piping, conduit, and ceiling systems. Where units include integral fans, provide vibration isolation suitable for the fan/motor assembly and prevent metal-to-metal contact between unit casing, mounting brackets, and building structure. For ceiling-mounted units above noise-sensitive spaces, provide elastomeric hangers or spring hangers as required to prevent objectionable vibration transmission.

C. Isolation type, static deflection, and restraint requirements shall be confirmed by the vibration isolation manufacturer based on actual equipment weight, speed, operating characteristics, support configuration, and project seismic/wind design criteria.

D. Do not install rigid connections across vibration isolation assemblies. Maintain clearance around isolators, snubbers, anchor bolts, piping, conduit, and ductwork to prevent metal-to-metal contact during normal operation

3.3 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.4 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Equipment Restraints:
   1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
   2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch .
   3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction that provides required submittals for component.

D. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   3. Brace a change of direction longer than 12 feet.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least [**four**] <**Insert number**> of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.7 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.8 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053, "Miscellaneous Cast-in-Place Concrete."**]

END OF SECTION

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED INFORMATION

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

PART 2 - MATERIALS AND PRODUCTS

2.1 TAGS AND CHARTS

A. Provide and install on appropriate valves on the mechanical system a valve tag made of bronze or baked phenolic tag fitted to each valve so that it cannot be removed. Each tag shall be embossed with an identifier. Valve numbering scheme shall be coordinated with the Engineer and reflected in Record Documents. Identifiers include bypass valves, normally open/normally closed valves, zone isolation, etc.

B. Provide in the operation manual valve tag information indicating valve identifier, the valves service, normal position and its location.

C. All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. water, domestic hot water, main HVAC valves, etc.).

D. Label all control panels, BAS panels, and control devices with system served and panel designation consistent with control drawings.

E. Provide piping and duct identification in accordance with ANSI A13.1-2015 and SMACNA standards.

2.2 PIPING IDENTIFICATION

A. All piping installed shall be identified according to the chart hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping shall be identified on twelve (12) foot centers. All piping shall be minimally identified once above all

room ceilings and where it passes thru walls or floors. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking.

B. Identify piping at:
1. Each valve and equipment connection
2. Changes in direction
3. Pipe penetrations
4. At each floor level
5. Adjacent to access points

C. Provide markers on outside of insulation. Provide protective covering or adhesive suitable for insulation jacket.

D. The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

Outside Diameter	Label Length	Letter Size
¾" – 1 ¼"	8"	½"
1 ½" – 2"	8"	¾"
2 ½" – 6"	12"	1 ¼"
8" – 10"	24"	2 ½"
Over 10"	24"	3 ½"

E. The following chart describes the pipe service and label identification which shall be used for various pipes.

PIPE	ABBREVIATION
Geothermal Supply	G.S.
Geothermal Return	G.R.
Condensate	C.D.

F. Provide color coding of piping systems in accordance with ASME A13.1. Submit color chart for Engineer review prior to installation

2.3 EQUIPMENT IDENTIFICATION:

A. Unless otherwise specified, all equipment shall be identified. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. In finished rooms and mechanical rooms, equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 1" high white letters on the front of each piece of equipment.

B. A. Provide color-coded markers:
1. Red – Fire dampers
2. Yellow – Control valves
3. Blue – Control dampers

C. Provide legend in O&M manuals. All heat pumps shall have the room numbers served, electrical panel number and circuit number identified on the lamacoid plate. Coordinate with the Electrical Contractor.

D. All VAVs and EVAVs shall be identified with neck size and room served with lamacoid plate.

E. All mechanical equipment, pumps, VFDs, Outside Air Units, electric unit heaters shall have the, electrical panel number and circuit number identified on the lamacoid plate. Coordinate with the Electrical Contractor.

2.4 DUCTWORK IDENTIFICATION:

A. All ductwork shall be identified as to the service of the duct and direction of flow. Include equipment designator on SA & RA ductwork. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts also need to be identified.

B. Use pre-printed, self-adhesive pipe markers with integral arrows (Setmark or equal). Field painting shall not be used unless specifically approved.

C. Ductwork shall be labeled a minimum of 12-foot centers.

D.

DUCTWORK		ABBREVIATION
1.	Supply Air Ductwork	SA + Equipment Identifier
2.	Return Air Ductwork	RA + Equipment Identifier
3.	Exhaust Air Ductwork	EA + Equipment Identifier
4.	Outside Air Ductwork	OA + Equipment Identifier
5.	Kitchen Exhaust Air Ductwork	KEA + Equipment Identifier
6.	Art Exhaust Air Ductwork	ART EA

2.5 ACCESS THROUGH LAY-IN CEILINGS

A. Mark at each location of the lay-in ceiling panel, on T-bar, which is nearest access to equipment, valves, dampers, etc., with flexible vinyl tape with pressure sensitive adhesive backing and printed markings (P-touch labels) with name of scheduled device (i.e. - VAV, valve, damper, etc...). Coordinate labeling (device name, type, etc.) with Owner.

2.6 RECORD DRAWINGS AND CLOSEOUT

A. Provide valve schedules, tag lists, and identification directories in O&M manuals and Record Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install identification after completion of insulation and painting.

B. Coordinate identification with other trades for visibility and access.

C. Replace damaged or illegible identification.

END OF SECTION

SECTION 230700 – HVAC INSULATION FOR EQUIPMENT, DUCTWORK, AND PIPING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.

C. Application of insulation materials shall be performed in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.

D. Insulation shall be installed by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineer shall be removed and properly installed at the expense of the Contractor.

E. Insulation thicknesses shall comply with the latest version of ASHRAE 90.1 and IECC at a minimum.

F. Insulation shall comply with UL GREENGUARD which provides independent third party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product related pollutants. Certification is based upon criteria used by EPA, OSHA, and WHO.

G. All insulation materials shall be installed per the latest edition of the National Commercial and Industrial Insulation Standards.

H. The Contractor shall photograph any installations prior to concealment. This includes duct risers in chases.

PART 2 - MANUFACTURERS

2.1 ACCEPTABLE MANUFACTURERS

A. Johns Manville, Keene Corp., Knauf, Owens-Corning, Armstrong, Armacell World Industries.

PART 3 - MATERIALS

3.1 STANDARDS

A. Insulations, jackets, facings, adhesives, mastics, tapes, fitting materials, etc. shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.

B. All products and their packaging shall bear a label indicating above requirements are not exceeded.

C. Fiber glass pipe insulation shall meet the requirement of the Greenguard Gold level standard.

D. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds. Products shall be Certified UL GREEGUARD Gold or Indoor Advantage Gold.

E. Insulation materials applied to carbon steel shall be Mass Load Corrosion Rate (MLCR) tested per ASTM 1617.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. All insulation installed outdoors or in exposed locations shall be provided with UV-resistant, weatherproof jacketing. Provide aluminum jacket or PVC jacketing with sealed seams.

H. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Earthwool 1000 Degree Pipe Insulation with ECOSE Technology or Earthwool Redi-Klad 1000 Degree Pipe Insulation with ECOSE Technology. Type I, 850 Deg F (454 Deg C) or Type IV 1000 Deg F (528 Deg C)

I. Materials: Glass Mineral Wool bonded with a thermosetting resin. EPD Certified by UL Environment, UL/ULC Classified for Earthwool Pipe; FHC 25/50 per ASTM E 84 for Redi-Klad. Living Building Challenge - Declare Red List Free for Redi-Klad Pipe; or unjacketed Earthwool Pipe only. Comply with ASTM 585, ASTM C 411, ASTM C795, and ASTM C 547, Type I, and Type IV, with factory-applied ASJ+-SSL+ or ASJ-SSL.

J. Glass Mineral Wool Blanket Insulation: Glass Mineral Wool bonded with a thermosetting resin. Comply with ASTM C 553, Types I, II, and III, ASTM C 1136 Type II, and ASTM C 1290, Type I. UL/ULC Classified FSK, FHC 25/50 per ASTM E 84 for PSK only. UL GREENGUARD Gold Certified and UL Environment Validated to be formaldehyde free. Product shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Atmosphere Duct Wrap with ECOSE Technology.

K. Glass Mineral Wool Board Insulation: Glass Mineral Wool bonded with a thermosetting resin. UL/ULC Classified per UL 723 for unfaced, ASJ, ASJ+ and FSK; FHC 25/50 per ASTM E 84 for PSK only. Comply with ASTM C 612, Type IA or Type IB. UL GREENGUARD Gold and Verified by UL Environment to be formaldehyde free. Living Building Challenge – Declare

Red List Free. For duct and plenum applications, provide insulation with factory-applied ASJ, with factory-applied ASJ+ jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Earthwool Insulation Board with ECOSE Technology.

L. Glass Mineral Wool Pipe and Tank Insulation: Glass Mineral Wool bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb./cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in. /h x sq. ft. x deg F (0.042 W/m x C) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Earthwool Pipe and Tank Insulation with ECOSE Technology or Kwik-Flex Pipe and Tank Insulation.

3.2 APPLICATION REQUIREMENTS

A. Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.

B. Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.

C. Do not insulate access doors, fire/smoke dampers, or equipment requiring service clearance. Terminate insulation neatly at these locations and maintain access.

D. Insulate all hydronic specialties including strainers, air separators, and accessories where connected piping is insulated.

E. All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork are to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.

F. Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.

G. Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!

H. All piping and ductwork operating below ambient dew point shall be insulated with a continuous vapor barrier system. All seams, penetrations, and terminations shall be sealed vapor-tight.

I. All insulation shall be installed with joints butted firmly together.

J. The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

3.3 PIPING SYSTEMS

A. All HVAC piping systems shall be insulated entirely in accordance with the specifications list herein.

B. Seal insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. This applies to hot water lines only as cold-water lines require continuous insulation and vapor barrier.

C. Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over is, etc. to insure no condensation drip or collection.

D. Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.

E. Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool.

F. Metal insulation shields and inserts are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 ° arc. Insulation shields shall be the following size:

Pipe Size	Shield Gauge	Shield Length
2” and less	20	12”
2 ½”- 4”	18	12”
5”- 10”	16	18”
Over 10”	14	24”

G. Insulated pipes 2” in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond extend beyond the hanger and shall be at least 6” in length.

H. Provide premolded PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the

circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One additional insert shall be used for each additional 1" of pipe insulation above 1-1/2". All joints shall be fully sealed.

3.4 PIPE INSULATION MATERIAL

A. Insulation shall be Owens-Corning model 25ASJ/SSL or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of 0.02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer's recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

B. Geothermal Heat Pump Piping
   1. 1-1/2" thick on all metallic piping

C. Condensate Drain Lines
   1. 1/2" thick.

3.5 DUCTWORK SYSTEMS

A. Duct sizes indicated are the net free area inside clear dimensions.

B. Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection.

C. External insulation for supply and outside air ductwork: Owens/Corning, All Service Fiberglass Duct Wrap, "Faced Duct Wrap - Type 100" or approved equivalent, 2" thick fiberglass duct wrap, factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. The installed R value shall be a minimum of 6.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch.
   1. Insulate all supply ductwork for all heat pump units (VHP/HHP) for the entire project.
   2. Insulate return air ductwork for all heat pump units (VHP/HHP) located in the Main Mechanical Room, in the Gymnasium Platform and Kitchen & Cafeterias units. No other return air ductwork locations require insulation for heat pump units (VHP/HHP).
   3. Outside air supply ductwork downstream of OA unit (under positive pressure) and exhaust air ductwork upstream of OA unit (under negative pressure) **does not** require insulation unless noted otherwise. All other duct including louver plenums requires installation per the above.
   4. Insulate all negative pressure exhaust air ductwork.

D. Internal duct liner: Duct liner shall be 1" thick fiber-free, black, flexible, closed-cell, non-particulating, formaldehyde-free elastomeric insulation (AP Armaflex FS Duct Liner or equal) K=0.27 BTU in./hr. ft^2 °F @ 75°F. Install per manufacturer's instruction using manufacturer's accessories and products including low VOC spray contact adhesive. Provide and install duct liner only where indicated.
   1. The first 10 feet of supply and return ductwork for heat pump units (VHP/HHP), shall utilize 1-1/2" thick liner (R-6.0) in lieu of duct wrap for insulating and acoustic requirements. For all other applications, utilize 1" thick liner for acoustic requirements as noted on the drawings.
   2. Utilize 1" thick duct liner for all transfer ducts and assemblies.

3.6 OUTDOOR DUCT INSULATION AND JACKETING

A. All ductwork located outdoors, in unconditioned penthouses, or otherwise exposed to weather, UV radiation, or mechanical damage shall be provided with a complete weatherproof insulation and jacketing system.

B. Insulation shall be minimum 2-inch thick rigid board or duct wrap as specified herein, suitable for exterior applications, and installed with a continuous vapor-retarder system.

C. Provide factory-applied or field-applied aluminum jacketing over all exterior duct insulation. Aluminum jacketing shall be minimum 0.016-inch thick, stucco embossed, with factory-applied moisture barrier. All longitudinal and circumferential seams shall be lapped, sealed, and secured with stainless steel bands or screws in accordance with manufacturer's recommendations.

D. All seams, penetrations, terminations, and joints shall be fully sealed watertight. Provide sealant compatible with jacketing and insulation system to prevent water intrusion.

E. Insulation system shall be installed to prevent water infiltration, air gaps, and sagging. All horizontal duct surfaces shall be installed with positive drainage to shed water.

F. Provide additional protection at locations subject to physical damage, including but not limited to roof level, low elevations, and areas near access paths. Protection shall include thicker jacketing, reinforcing bands, or metal shields as required.

G. Terminate insulation and jacketing neatly at duct connections, dampers, access doors, and equipment, maintaining weatherproof integrity while allowing full operation and maintenance access.

H. All exterior insulation systems shall be capable of withstanding wind, rain, snow, and UV exposure without degradation for the life of the system.

I. Contractor shall repair or replace any insulation or jacketing system that exhibits water intrusion, deterioration, or failure during the warranty period at no additional cost to the Owner.

3.7 MECHANICAL EQUIPMENT

A. Air separator, expansion, and storage tanks:
   1. Owens-Corning "Thermal Insulating Wool - Type II" or approved equivalent. Insulation shall be constructed of non-combustible, flexible wool. Insulation shall be 2" thick. K = 0.24 Btu in/hr.fr² °F @ 100°F. Insulation shall be attached in strict accordance with the manufacturer's recommendations. All insulation shall be jacketed with 6 oz. canvas with fire retardant lagging.

B. For tanks, pumps, and equipment, Armacell engineered foam may be used. Total insulation thickness of 2". K=0.27 Btu in/hr ft^2 °F @ 75 °F. Install per manufacturer's instructions utilizing black adhesive (low voc) with a minimum of 2" insulating tape.

C. Insulate pump volutes as part of the piping system as referenced in Part 5.

END OF SECTION

SECTION 230995 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, 230100 COMMON WORK RESULTS FOR HVAC, and 019113 GENERAL COMMISSIONING REQUIREMENTS and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

1.2 GENERAL REQUIREMENTS

A. The Engineer, or authorized representative, shall be notified by the Contractor two weeks in advance of any tests called for in these Specifications or required by others.

B. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow the work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

C. Prior to the commencement of any Testing, Adjusting, and Balancing (TAB) activities, the Contractor shall coordinate and conduct a TAB coordination meeting. The meeting shall include the Commissioning Authority (CxA), TAB Contractor, Automatic Temperature Controls (ATC) Contractor, Mechanical Contractor, Plumbing Contractor, Construction Manager (CM), and the Engineer of Record. The purpose of the meeting shall be to review TAB procedures, system readiness, documentation requirements, scheduling, access/logistics, and coordination with controls and commissioning activities. TAB work shall not begin until this meeting has been completed and all parties are in agreement with the testing approach.

1.3 SYSTEM READINESS FOR TAB

A. The following must be completed prior to the start of TAB scope:
   1. All equipment shall be installed, started, and operating in accordance with manufacturer requirements.
   2. All ductwork and piping systems shall be complete, leak tested, and insulated.
   3. All controls shall be installed, calibrated, and fully operational.
   4. All balancing dampers, control valves, and access doors shall be installed and accessible.
   5. All filters shall be installed and clean.
   6. Hydronic systems shall be flushed, filled, vented, and free of air.
   7. Temperature control systems shall be fully functional and operating in normal mode prior to the start of testing, adjusting, and balancing.

PART 2 - TESTING REQUIREMENTS

2.1 PIPING TESTS

A. Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

B. Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.

C. Thermometers and gauges shall be checked for accuracy (+/-5%). If instruments prove defective, they shall be replaced.

D. Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

E. Measured water flow rates (GPM) and associated pressure drops shall be within (+/-5%) of the design values. Adjustments shall be made as necessary to achieve this tolerance.

2.2 HEATING, VENTILATING AND AIR CONDITIONING TESTING:

A. The test and balance of this system shall be by a Contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The Test and Balance contractor shall report all deficiencies to the Engineer.

B. Mechanical Contractor shall provide all start-up documents to Test and Balance Contractor prior to any test and balance services.

C. All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.

D. System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.

E. All fan belts shall be adjusted for proper operation of fans.

F. Testing shall occur after completion of installing the ceiling systems.

G. All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor. Accuracy shall be within (+/-5%).

H. Refer to Specification Section GROUND-LOOP HEAT-PUMP PIPING and Specification Section TEMPERATURE CONTROLS AND SEQUENCE OF OPERATIONS FOR HVAC for additional requirements.

I. Provide a preliminary test report to the Engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be hand written. Any systems that are not found to operate within the design tolerances by the Test and Balance Contractor shall be immediately be reported to the Engineer via telephone call to attempt to determine a resolution while the Test and Balance Contractor is still on site. Additional compensation will not be accepted for additional trips.

J. Anticipate visiting the site again after the Engineer has reviewed the report. The Engineer may request up to two (2) additional site visits for onsite troubleshooting where additional measurements may be required.

K. For the purpose of placing the Heating, Ventilating and Air Conditioning systems in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, 7th Edition, for air and hydronic systems as published by the Associated Air Balance Council.

L. The following systems shall be tested and balanced:
1. The supply, return, outside and exhaust air duct systems associated with the OA unit and heat pumps. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the heat pump and air handling units. Show accurate representation of units.
2. Balance all air terminal units and airflow dampers to setpoints indicated on the drawings.
3. The outside air system is designed with a high level of diversity. All terminal units and airflow dampers will need to be grouped and set to minimum flows while other groups are balanced. Refer to Control Sequences on the drawings and refer to the airflow schematic. TAB Contractor shall simulate diversified operating conditions as required to verify system performance under minimum, maximum, and part-load conditions.
4. Outside and exhaust air in each room to within 5% of design air flow rate.
    a. Outside air quantities shall be verified using approved measurement methods (flow hood, pitot traverse, or airflow station), and coordinated with control sequences.
5. Heat pump total air flow and discharge and inlet pressures. Coordinate minimum damper setpoints with ATC contractor for heat pump units with motorized volume dampers.
6. Determine and record heat pump geothermal heat exchanger pressure loss and compare to submittal data to verify flow exceeds minimum.
7. Hydronic and domestic pumps total water flow.
8. Balance heat pump chiller loop, circulating pump and associated coil air flows.
9. Verify calibrations of the duct static pressure and water pressure sensors for all systems and field determine minimum and maximum setpoints.
10. Balance each geothermal wellfield row.
11. Balance each heat pump unit and adjust ECM motor to design airflow. Record inlet and outlet static pressure, including filters. Measure outside air flow at each heat pump and space.
12. Verify operation of all variable speed drives (VFDs/ECMs) and confirm minimum and maximum speeds correspond to design conditions.
13. Balance all supply and return air grilles to within 10% of design air flow rate.
14. Balance all exhaust air and ventilation fans and record inlet static pressure including kitchen exhaust fan.

M. The flushing and purging of the geothermal system shall be witnessed and approved. Refer to Specification Section GROUND-LOOP HEAT-PUMP PIPING and Specification Section HVAC WATER TREATMENT, CLEANING FILLING, AND PURGING for additional requirements.

N. Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM (+/-5%).
   1. Hydronic systems shall be balanced using calibrated balancing valves and flow measurement devices. Circuit setters shall be set, locked, and recorded.

O. Determine and record water flow rate of each geothermal circulating pump. Estimate flows based on pump curves and pressure loss.
   1. Hydronic systems shall be balanced using calibrated balancing valves and flow measurement devices. Circuit setters shall be set, locked, and recorded.

P. Upon completion of TAB, all balancing dampers and valves shall be marked, locked, and recorded in final report.

Q. TAB Contractor shall coordinate with ATC Contractor to verify and document all control setpoints, sequences, and sensor calibrations required to achieve design flows and system operation.

R. Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

S. Test and Balance agency shall provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor shall purchase and install all sheaves and belts as required. This includes new and existing equipment.

T. Complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.

U. The Contractor shall provide and coordinate work to provide sufficient time before final completion date so that tests and balancing can be accomplished and provide immediate labor and tools to make corrections when required without undue delay.

V. The Contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

W. The Test and Balance Contractor shall be present during the Engineer’s final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

X. The Mechanical Contractor shall promptly correct all deficiencies identified by the TAB Contractor at no additional cost. TAB shall not be considered complete until all deficiencies are resolved and verified.

Y. TAB shall be performed in full coordination with commissioning activities. TAB results shall be used to support functional performance testing and final system acceptance. Systems not meeting design intent shall be rebalanced and corrected at no additional cost.

END OF SECTION

SECTION 231203 - AUTOMATIC SMOKE VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer Specification Section 019113 General Commissioning Requirements.

1.2 SUMMARY

A. Work Included: Provide factory-fabricated double-leaf automatic smoke vents.

B. Smoke vents shall be provided in accordance with IBC Section 910 and NFPA 204 where required.

C. Coordinate vent sizing, spacing, and location with code analysis and fire protection design.

D. provide manual release mechanisms required by code or AHJ.

E. Where indicated or required, coordinate with Division 26/28 to provide interface with fire alarm system for monitoring and/or remote release.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years' experience manufacturing similar products.

B. Installer: A minimum of 2 years' experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should

a part fail to function in normal use within this period, the manufacturer shall furnish a new part at no charge.

1.6 SUBMITTALS

A. Product Data: Manufacturer's data for each type of smoke vent.

B. Shop Drawings: Indicate size, layout, curb details, and integration with roofing system.

C. Certifications: UL listing and compliance with applicable codes.

D. Operation and Maintenance Data: Include reset instructions and maintenance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturers are Bilco, Babcock-Davis, Wasco

B. Basis-of-Design Manufacturer: Type ACDSV Double-Leaf Automatic Roof Fire Vent by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.

C. Acceptable manufacturers shall provide products that meet or exceed the performance, construction, and operation of the basis-of-design.

2.2 AUTOMATIC ROOF FIRE VENT

A. Furnish and install where indicated on plans: metal fire vent Type ACDSV, refer to drawings for size and location of vents. Length denotes hinge side. Any roof fire vent shall be double leaf. The roof fire vent shall be preassembled from the manufacturer.

B. Performance characteristics:
   1. Vent(s) shall be UL listed.
   2. Covers shall be reinforced to support a minimum live load of 40 psf (195 kg/m^2) with a maximum deflection of 1/150th of the span or 90 psf (439 kg/m^2) wind uplift.
   3. Corrosion resistant gas springs shall open the vent covers simultaneously when latch is manually released or when heat breaks the UL listed fusible link. Opening shall be in a controlled manner to avoid damage to surrounding roof surfaces.
   4. Entire roof fire vent shall be weathertight with fully welded corner joints on cover and curb.
   5. Latch mechanisms shall hold the covers in the closed position without overstressing the fusible link and withstand 90 psf (439 kg/m^2) wind uplift forces acting on the cover.

6. Latch operation: When heat parts the UL listed fusible link, the latch shall release instantaneously, allowing vent covers to open. The latch shall be designed for easy resetting, after a fire or test, so that the covers cannot be latched closed unless the mechanism has been reset properly. The manufacturer shall provide instructions for resetting the latch with each unit.
7. Sound Transmission Rating: Vent(s) shall carry STC-50 and OITC 46 sound ratings.
8. ISO 140-18 Rainfall Sound Rating – 37.5 db.

C. Covers: Shall be 14-gauge (1.9mm) galvannealed steel with a 5-3/4" (146mm) beaded flange with formed reinforcing members.

D. Gasket: Dual EPDM gaskets shall be permanently adhered to the underside of the covers.

E. Cover insulation: Shall be mineral wool of 4" (102mm) in thickness, fully covered and protected by a 12-gauge (2.75mm) galvanneal steel liner.

F. Curb: Shall be 12" (305mm) in height and of 10-gauge (3.5mm) galvannealed steel with a fixed center channel. Curb shall be formed with a 6-7/8" (175mm) flange with 7/16" (11mm) holes provided for securing to roof deck. The curb shall be equipped with integral metal capflashing of 14-gauge (1.9mm) galvannealed steel and feature the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single-ply roofing membrane securely in place.

G. Curb insulation: Shall be 4" (102mm) mineral wool insulation, fully enclosed by a 10-gauge (3.5mm) galvannealed steel liner.

H. Lifting mechanisms: Corrosion resistant gas springs open covers automatically against a 10 lb/ft^2 ($49Kg/m^2$) snow/wind load. Gas springs shall have built in dampers to assure a controlled rate of opening and automatically lock the covers in the fully open position. A release mechanism shall be provided to allow the covers to be closed.

I. Latch mechanism: Shall be the BILCO Thermolatch® II positive hold/release mechanism with a separate latching point for each cover controlled by a single UL listed 165°F (74°C) fusible link. Fusible link shall be curb mounted on a non-hinged end to allow the latching mechanism to be easily reset from the roof level.

J. Hardware: Corrosion resistant gas springs and hot dip galvanized steel stop cables. All other hardware is zinc plated/chromate sealed.

K. Finish: Factory finish shall be alkyd base red oxide primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units' level, plumb, and in proper alignment with adjacent work.
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Test fusible link and install replacement fusible link after testing.
   3. Repair finishes damaged during installation.
   4. Restore finishes so no evidence remains of corrective work.

B. Coordinate installation with roofing, structural, and fire alarm systems. Installation shall maintain roof warranty and structural integrity.

C. Coordinate with roofing manufacturer for warranty compliance.

D. Installation shall not void roof warranty.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

3.4 FIELD QUALITY CONTROL

A. Test operation of each smoke vent in presence of Owner, Engineer, and AHJ where required.

B. Verify proper release, full opening, and reset capability.

C. Replace fusible links after testing.

END OF SECTION

SECTION 232200 – HVAC PIPING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Each Contractor's attention is also directed to Specification Section HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT, HVAC INSULATION FOR EQUIPMENT, DUCTWORK, AND PIPING, HVAC WATER TREATMENT, CLEANING, FILLING AND PURGING.

1.2 GENERAL REQUIREMENTS

A. Unless otherwise indicated, all materials shall be new and of the best grade and quality for the type specified.

B. Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineer prior to submission of the bid.

C. All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.

D. Equipment Connections: Piping shall be installed so that no strain is imposed on equipment connections. Align piping with equipment connections without forcing, and provide offsets or flexibility as required. Final connections shall be made only after equipment is set and properly aligned.

E. The piping indicated shall be installed complete and shall be of the size indicated. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineer. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project.

F. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.

G. All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3" and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1" and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Reference 230529 for additional piping support requirements.

H. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. Refer to Specification Section HVAC INSULATION, EQUIPMENT, DUCTWORK AND PIPING.

I. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted.

J. In metal buildings or buildings with light gauge trusses, support piping with standard pipe hangers with C-clamp connection to main structural members (not purlins), use angle steel cross pieces between main structural members where required to provide rigid support.

K. Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation. This includes temporary support required during Construction.

L. In general, piping shall be installed concealed except in mechanical rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur, they shall be kept as close to walls as possible.

M. Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and tapped with a hammer to remove scale and dust and inspected to ensure that no foreign matter is lodged therein.

N. All hot and cold-water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.

O. Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing. If in doubt, consult Engineer.

P. Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If in doubt, consult Engineer.

Q. Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.

R. Dielectric unions shall be provided at all connections of dissimilar materials.

S. Nipples shall be of the same material, composition and weight classification as pipe with which installed.

T. Eccentric reducers shall be used where required to permit proper drainage and venting of pipe lines; bushings shall not be permitted.

U. High points of closed loop chilled / hot water (2-pipe system) and geothermal systems shall have manual air vents as required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.
   1. Manual air vents shall be installed at all high points not otherwise vented through equipment.
   2. Drain valves shall be installed at all low points and at each isolated section of piping.

V. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be ½" size ball valves with 3/4" hose thread end and vacuum breaker. Label each drain valve.

W. Plastic piping or any material with a flame and smoke spread rating not approved for plenum use shall not be permitted.

X. Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineer.

Y. When running any type of pipe below a footing, perpendicular to the footing, the area underneath the footing and in the zone of influence shall be backfilled with concrete. The zone of influence is the area within a 45-degree angle projecting down from the top edge of footing on all sides of the footing.

Z. When running any type of pipe below a footing, parallel to the footing, the area underneath the zone of influence shall be backfilled with 4” of crushed stone or sand bedding under the pipe. Each pipe section shall be anchored into unexcavated earth on both ends with deadman anchor system. The remainder of the trench in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45-degree angle projecting down from the top edge of the footing on all sides of the footing.

AA. Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and best practice.

BB. Prior to final connection to equipment, all piping shall be inspected and verified clean and free of debris.

1.3 PIPE JOINING METHODS

A. Copper Solder Joints
   1. Clean tube and fittings and ream pipe ends prior to joining.
   2. Use lead-free solder (95/5 or approved equal) and compatible flux.
   3. Install in accordance with ASTM B828.
   4. Do not use soldered joints for pipe sizes larger than manufacturer recommendations or where otherwise restricted.
   5. Mitered joints, field-fabricated bends, or use of unapproved fittings is prohibited.

B. Copper Press-Connect Joints
   1. Use only manufacturer-approved press tools and jaws.
   2. Install in accordance with ASTM B1029 and manufacturer requirements.
   3. Provide fittings with factory-installed sealing elements suitable for temperature and fluid.
   4. Clearly identify press fittings prior to installation; mixed systems are not permitted without Engineer approval.
   5. Mitered joints, field-fabricated bends, or use of unapproved fittings is prohibited

C. Steel Threaded Joints
   1. Permitted for pipe sizes 2 inches and smaller unless otherwise indicated.
   2. Threads shall be clean-cut and full depth.
   3. Apply thread sealant suitable for service.

D. Steel Grooved Joints
   1. Install grooved couplings in accordance with manufacturer’s instructions.
   2. All grooved components shall be from a single manufacturer.
   3. Gaskets shall be suitable for system temperature and fluid.

E. Steel Welded Joints
   1. Perform welding in accordance with ASME B31.9.
   2. Welders shall be qualified for the procedures used.

F. All press-connect fittings and valves within a system shall be of the same manufacturer unless otherwise approved by the Engineer.

G. Do not mix joining systems within the same piping system without Engineer approval.

H. Provide unions or flanges at equipment to allow removal without cutting pipe.

I. Install piping so that joints are accessible for inspection and maintenance.

J. Apply approved pipe dope for service intended to all male threaded joints. The dope shall be listed for intended use.

PART 2 - MATERIALS

2.1 UNIONS, FLANGES AND WELDED TEES

A. Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.

B. Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.

C. Tee connections for welded pipe shall be assembled with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

D. Weld-o-let, thread-o-let and T-drill branch connections are acceptable.

PART 3 - SPECIFICATIONS STANDARDS

3.1 REQUIREMENTS

A. All piping and material shall be new and shall conform to the following minimum applicable standards:
   1. Steel Pipe: ASTM A53/A53M.
   2. Copper Tube: Type K, L, or M; ASTM B88. Type DWV copper tube; ASTM B306.
   3. Wrought Steel Butt-Welding Fittings: ASME B16.9.
   4. Cast Copper Alloy Solder Joint Pressure Fittings and Wrought Copper Fittings: ASME B16.18 and ASME B16.22.
   5. Cast Copper Alloy Solder Joint Drainage Fittings (DWV): ASME B16.23.

B. Install piping to allow access to valves, strainers, coils, and equipment service points. Do not route piping in a manner that obstructs access to serviceable components.

PART 4 - PITCH OF PIPING

4.1 REQUIREMENTS

A. All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:

B. Condensate Drain Lines from Cooling Equipment:
   1. Install condensate drain piping with a continuous downward pitch of not less than 1/4 inch per foot in the direction of flow. Do not allow sags, traps (unless required), or standing water in piping.
   2. Provide traps at each cooling coil or unit as required by the equipment manufacturer and static pressure conditions. Coordinate trap depth with fan pressure.
   3. Route condensate piping to approved drainage locations as indicated. Where not indicated, coordinate with Engineer. Discharge shall be visible where practical.
   4. Provide cleanouts at changes in direction and at intervals required for maintenance.
   5. Condensate piping shall not be directly connected to sanitary systems without an approved air gap or trap primer arrangement in accordance with plumbing code.
   6. Support condensate piping at intervals sufficient to prevent sagging and maintain required pitch.
   7. Insulate condensate piping where subject to sweating or where installed in concealed spaces that could result in damage to building finishes.
   8. Where condensate pumps are required, coordinate electrical power, controls, and alarm connections.

C. All Other Lines: Provide ample pitch to a low point to allow 100 percent drainage of the system.

PART 5 - HVAC PIPING APPLICATIONS

5.1 HVAC HYDRONIC PIPING

A. System Types:
   1. Geothermal Heat Pump Water
   2. Condensate Piping

5.2 INTERIOR GEOTHERMAL HEAT PUMP LOOP PIPING

1. 2” and Smaller: Type "L" hard copper tubing with wrought copper fittings and 95/5 solder or Type “L” hard copper tubing with copper mechanical fittings.
2. 2-1/2” and Larger: Schedule 40 black steel pipe with screwed or grooved fittings or Type “L” hard copper tubing with wrought copper fittings and 95/5 solder or Type “L” hard copper tubing with copper mechanical fittings.
3. Type “L” copper with mechanical press-connect couplings and fittings with 125# rating manufactured by Apollo Xpress, Viega Propress, or equal. Install gaskets as recommended by the manufacturer. Piping system shall be rated for minimum of 220 degrees F water temperature. System to confirm to ASME B16.18 or B16.22 seals and press fittings shall incorporate multiple leak path design
4. Schedule 40 Victaulic 107/W07 or approved mechanical grooved pipe couplings and fittings with a minimum 125# rating. Install gaskets as recommended by the manufacturer. Piping system shall be rated for minimum of 250 degrees F water temperature. Mechanical grooved piping may <u>not</u> be used if system water temperature exceeds 250ºF. All grooved components must be of one manufacturer.

B. Condensate Drain Lines: Type "M" copper tubing with sweat fittings and 95/5 solder.
   1. Type M copper tubing shall be permitted for condensate piping only and shall not be used for hydronic or geothermal heat pump loop piping.

C. Exterior Geothermal Piping: Refer to Specification Section – GEOTHERMAL (EARTH COUPLED) LOOP PIPING SYSTEM.

D. Air Vent Discharge Lines: Type "L" soft copper; wrought copper fittings, 95/5 solder. Pipe to a suitable drainage location.

END OF SECTION

SECTION 232500 – HVAC WATER TREATMENT, CLEANING, FILLING, AND PURGING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Review the Specification Section – COMMON WORK RESULTS FOR HVAC. List and provide all documentations called for therein.

C. Refer Specification Section 019113 General Commissioning Requirements.

1.2 REQUIREMENTS

A. Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, 100% functional, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected.

B. The water treatment company shall employ qualified service technicians experienced in the installation, monitoring, and maintenance of closed-loop hydronic and geothermal systems. Technicians assigned to this Project shall have a minimum of three (3) years of field experience with closed-loop water treatment programs and shall be trained in chemical handling, system sampling, and analysis procedures.

C. The water treatment company shall maintain local or regional service capability and shall provide on-site technical support for system cleaning, flushing, filling, purging, initial treatment, and follow-up service. The company shall be capable of responding to service requests within 48 hours during the warranty period.

D. All water quality testing and analysis shall be performed by a certified laboratory or by the water treatment company using recognized industry-standard testing procedures and calibrated equipment. Test methods shall be consistent with applicable standards such as ASTM, AWWA, or other recognized industry practices.

E. The water treatment company shall demonstrate specific experience with closed-loop geothermal heat pump systems. Experience limited to open cooling tower or boiler water treatment programs shall not be considered sufficient. Provide documentation of at least three (3) similar projects of comparable size and complexity utilizing closed-loop geothermal or hydronic systems.

F. Provide a water treatment program for the closed loop geothermal piping systems. It is the Contractor's responsibility to contact the Engineer 2 weeks in advance to any treatments performed on the systems. It is the Engineer's discretion whether or not this process should be monitored after notification.

G. A pre-installation meeting shall be held with the Construction Manager, Engineer, Mechanical Contractor, Pipe Fitter Foreman, Geothermal Contractor and Chemical Treatment Contractor to discuss goals and expectations for cleaning, flushing, purging and chemical treatment.

H. Chemicals, equipment, testing services, and chemical application shall be supplied by a single water treatment company for undivided responsibility. The water treatment company shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years. The water treatment company shall have regional water analysis laboratories, service department, and full-time representatives located within the trading area of the job site or facility.

I. Furnish initial supply of the closed loop chemicals for each system. This contractor shall retest the systems after 3, 6 and 12 months to verify the proper dosage is in each system. Provide all closed loop chemicals and anti-freeze for the first year. Each system's water shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition. Provide any laboratory and technical assistance required to achieve a successful program.

J. As a condition of acceptance and project closeout, a summary of water quality and treatment shall be provided in writing to the Owner and/or Engineer after the water treatment services have been completed. The closeout documentation shall include dates for warranty testing.

K. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

L. The water treatment contractor shall include all labor, materials, chemicals, testing, and service required to maintain the specified water quality for a period of one (1) year from date of Substantial Completion. All costs associated with this service shall be included in the base bid.

M. Provide a minimum of three (3) scheduled service visits at approximately 3, 6, and 12 months after system startup. Additional visits shall be provided as required to maintain system water quality within specified limits.

N. At each service visit, perform system inspection, field testing, and adjustment of chemical treatment as required. Provide and install all additional chemicals necessary to maintain specified water quality. No additional compensation shall be provided for corrective chemical additions.

O. Provide a written service report after each visit documenting test results, system condition, chemical levels, and any corrective actions taken. Reports shall be submitted to the Owner and Engineer within five (5) business days of each visit.

P. Provide emergency service response during the warranty period for any system found to be outside specified water quality limits or exhibiting biological growth, corrosion, or fouling. Respond to service calls within 48 hours and take immediate corrective action to restore system to compliance.

Q. Failure to maintain system water quality within specified limits shall require additional service visits, testing, flushing, or chemical treatment as necessary at no additional cost to the Owner.

R. Water Quality Minimum Performance Requirements:
1. Closed Loop Geothermal systems shall maintain a pH value within 8.0 – 10.0.
2. Total Aerobic Plate Count - Maintain a maximum value of 1000 organisms/ml.
3. Total Anaerobic Plate Count - Maintain a maximum value of 100 organisms/ml.
4. Nitrate Reducers - Maintain a maximum value of 100 organisms/ml.
5. Sulfate reducers - Maintain a maximum value of 0 organisms/ml.
6. Iron Bacteria - Maintain a maximum value of 0 organisms/ml.

1.3 SUBMITTALS

A. Provide the following as part of submittal and closeout documentation:
1. Water treatment program submittal
2. Chemical product data and SDS
3. Anti-freeze certification and concentration report
4. Lab test reports
5. Field test reports
6. Start-up / initial treatment report
7. 3, 6, and 12 month service reports
8. Final closeout letter stating system meets spec requirements
9. Fill/purge log with dates, pressures, flow rates, glycol %, and air removal confirmation

PART 2 - CLEANING AND FLUSHING

2.1 HYDRONIC PIPING

A. This project consists of the following Hydronic Piping Loops
1. Closed Loop Geothermal System (Interior)
2. Closed Loop (Earth Coupled) Geothermal System (Exterior)

B. There are several precautions which must be observed during its installation. This contractor is advised to read all of the manufacturer’s instructions prior to commencing the installation. This cleaning and flushing of the systems must be accomplished. Refer to Specification Section HVAC EQUIPMENT for geothermal system requirements.

C. All water circulating systems for the project shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil and any and all other material foreign to the water. During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully

protected. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt removed.

D. All piping systems shall be flushed with clean water at high velocity to remove construction debris, including dirt, sand, pipe shavings, and foreign material. Flushing shall be performed with loop filter in operation until system fluid is visibly clean.

E. Interior steel piping systems shall be chemically cleaned to remove oils, mill scale, pipe compounds, and installation-related contaminants.

F. Chemical cleaning shall be performed using an alkaline cleaner compatible with system materials and recommended by the water treatment contractor. Trisodium phosphate or equal may be used where appropriate.

G. Buried HDPE geothermal piping and system components not suitable for chemical cleaning shall be isolated or bypassed during chemical cleaning operations.

H. Following chemical cleaning, the system shall be thoroughly flushed until all cleaning solution, debris, and residue are removed.

I. After flushing is complete, clean all strainers, filters, dirt separators, and pump suction diffusers prior to proceeding with purging and final treatment.

PART 3 - CLOSED LOOP CHEMICAL TREATMENT

3.1 REQUIREMENTS

A. Provide a 3/4" valved and capped port for injection of the closed loop chemicals into the system. Also, provide a bypass chemical pot feeder for each loop.

B. Prior to final treatment, the system shall be flushed and purged until free of debris and air in accordance with Part 4 of this Section. Interior steel piping shall be chemically cleaned as specified. Buried HDPE piping and components not suitable for chemical cleaning shall be isolated or bypassed.

C. After flushing, purging, and chemical cleaning (where applicable), treat the system with biocide as required to control biological activity. Biocide shall be applied at manufacturer-recommended dosage.

D. Following biocide treatment, charge the system with final propylene glycol solution including corrosion inhibitor package suitable for mixed-material closed-loop systems.

E. After final fill, perform microbiological testing. If bacteria counts exceed specified limits, repeat treatment until acceptable levels are achieved.

F. Final treated fluid shall remain in the system for operation and shall not be diluted or replaced without approval of the water treatment contractor.

3.2 LOOP FILTER

A. Provide and utilize system loop filter during all flushing, cleaning, and purging operations. Filter shall be installed at the mechanical room in a location that allows full system flow through the filter.

B. Filter shall be sized for full purge flow and capable of removing fine construction debris, including dirt, sand, pipe scale, and plastic shavings.

C. Operate filter continuously during flushing and purging operations until system fluid is clean and free of visible debris.

D. Clean filter elements as required to maintain flow. Minimum of three (3) full cleanings shall be performed during flushing and purging operations.

E. After completion of flushing and prior to final fill and chemical treatment, filter shall be cleaned and left in place (if permanent) or removed (if temporary), as indicated on the Drawings.

F. Failure to utilize loop filtration or failure to achieve clean system fluid shall require re-flushing at no additional cost.

PART 4 - SYSTEM FILLING & PURGING PLAN

4.1 REQUIREMENTS

A. All piping circuits originate from mechanical pump room. System consists of heat pump mains and branch circuits plus 10 wellfield circuits.

B. Temporarily connect the supply and return piping in the mechanical pump room at the purge valve location and close main line valve to isolate the building from the wellfield. Note that central filter pump can be used, after initial purging and for maintenance, as the purge pump (Wellfield in reverse direction). Refer to drawings for additional information.

C. The interior piping and the wellfield shall be purged individually. The building purging pump is capable of purging the interior loop purging after the system has been purged.

D. Test source water before filling. Contractor shall account for hardness, chlorides, iron, manganese, pH, conductivity, etc. Contractor shall submit treatment recommendations based on actual fill water.

E. Purging shall not be considered complete until all of the following conditions are met:
   1. System is free of visible air. No air discharge, surging, or intermittent flow shall be observed at purge connections.
   2. System pressure is stable and does not fluctuate during operation of the purge pump.
   3. Minimum purge velocity has been achieved in each circuit in accordance with specified requirements.
   4. Purging has been maintained for a sufficient duration to ensure complete air removal from all piping, coils, and equipment.

5. All strainers, filters, dirt separators, and pump suction diffusers have been cleaned after flushing and purging operations.
6. No visible debris, sediment, or discoloration is present in system fluid.
7. System fluid is clear and acceptable for final treatment as determined by the Engineer or water treatment provider.
8. System has been filled to final operating pressure, vented, and left in a stable condition. Final system pressure shall be set, recorded, and submitted as part of closeout documentation.
9. Any system not meeting the above criteria shall be re-flushed and re-purged at no additional cost until acceptable conditions are achieved.

F. Provide sample valves / test ports at each main closed loop or at pump room headers. Install in locations accessible for future testing.

G. Piping shall be pressure tested and accepted prior to final cleaning, filling, glycol addition, and treatment.

H. Obtain a minimum flow based on 2 to 3 fps in each circuit as indicated on the plans. Refer to plans for additional information.

I. This procedure shall be carried out a minimum of three times to ensure entrained air is removed.

J. Clean pump suction diffusers, strainers, Y-strainers, dirt separators, and filter baskets after flushing and again at final acceptance.

K. Provide permanent side-stream or full-flow loop filter as indicated in schedules and plans. Coordinate with water treatment and flushing requirements.

L. The water treatment contractor shall perform and document the following:
1. Test source water prior to filling and base treatment program on actual water quality.
2. Provide written post-flush report confirming system is clean and free of debris.
3. Provide final water chemistry report verifying compliance with specified requirements.
4. Verify glycol concentration using calibrated refractometer and document results.
5. Provide bacteria analysis report demonstrating compliance with specified limits.
6. Provide written service reports for all required follow-up visits (3, 6, and 12 months).

M. System shall not be considered complete until a final written certification is submitted stating that the system has been:
1. Cleaned, flushed, and purged in accordance with the Contract Documents.
2. Chemically treated and filled to the specified glycol concentration.
3. Tested and verified to meet all water quality requirements.
4. Left fully operational, stable, and ready for normal service.

N. Final treatment/fill/purge to be complete and acceptance shall occur before equipment startup and TAB/commissioning.

O. Failure to provide required documentation or meet specified conditions shall require corrective action and re-testing at no additional cost.

4.2 FINAL TREATMENT SEQUENCE

A. After flushing, chemical cleaning (where applicable), and purging are complete, and system is free of debris and air, initiate final chemical treatment.

B. Add biocide as required to eliminate biological contamination. Biocide shall be added at manufacturer-recommended dosage and shall remain in the system unless otherwise directed by the water treatment contractor.

C. Following biocide treatment, charge system with final propylene glycol solution including corrosion inhibitor package.

D. After final fill, test system water to confirm compliance with specified chemical and microbiological limits. Adjust treatment as required.

E. System shall not be placed into permanent operation until final water chemistry has been verified and accepted.

END OF SECTION

SECTION 232923 – VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer Specification Section 019113 General Commissioning Requirements.

1.2 GENERAL INFORMATION

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical, and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

1.3 WARRANTY

A. Provide manufacturer’s standard warranty for Variable Frequency Drives; however, warranty period shall be not less than two (2) years from the date of VFD start-up. Warranty shall include parts and labor. Warranty labor shall be provided by the Manufacturer or authorized local service representative.

1.4 SUBMITTALS

A. Submit product data for each VFD including:
   1. Manufacturer’s catalog data and technical specifications.
   2. Dimensional drawings and enclosure details.
   3. Wiring diagrams, including power and control connections.
   4. Point-to-point terminal diagrams.
   5. BACnet integration details and point list.
   6. Short circuit current rating (SCCR) documentation.
   7. Harmonic mitigation data demonstrating compliance with project requirements.

B. Submit operation and maintenance manuals including:
   1. Installation instructions.
   2. Startup procedures.
   3. Maintenance requirements.
   4. Replacement parts list.
   5. Warranty Information

C. Submit factory startup report and commissioning documentation.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

A. General

1. Furnish Variable Frequency Drives for control of variable torque loads having the capacity indicated on the mechanical plan equipment schedules and features detailed below. All VFD units furnished shall be the product of a single manufacturer. Mechanical Contractor shall carefully review field constraints for mounting of new drives and shall coordinate requirements with Electrical Contractor before submitting VFD for Engineer approval.
2. VFDs shall be furnished by the Mechanical Contractor for wiring by the Electrical Contractor.
3. Note on equipment schedule which units shall have a NEMA 1 enclosure. All VFDs that are installed outside shall have a NEMA 3R enclosure. Provide output filters is required due to the distance that VFD is installed from the equipment served.
4. Provide all VFDs with BACNET MSTP or IP interface with type of protocol finalized during submittal phase.
5. If required due to distance of VFD from fan/pump being served, provide input/output filters as required by VFD Manufacturer for full operation of VFD. The Mechanical Contractor shall determine if the furnished VFDs require this protection.
6. The Mechanical Contractor shall carefully review any physical constraints for mounting of VFDs and access/service clearance in the MERs.
7. All VFDS shall be rated for 65 kAIC at a minimum.
8. The variable frequency AC drive shall convert 3 phase, 60 Hz input power to an adjustable AC frequency and voltage for controlling the speed of AC induction motors. The control scheme shall closely approximate actual sine wave current utilizing 6-pulse technology. The output voltage is to vary proportionally with the output frequency to maintain a constant Volts/Hertz value up to 66 Hz.
9. The VFD units shall be designed to control variable torque motors using a transistorized PWM inverter section. The inverter shall use Insulated Gate Bipolar Transistors (IGBT); standard bipolar transistors will not be accepted. Carrier frequency (switching rate) of the IGBT shall be adjustable between 3-12 kHz.
10. The submittal package for VFDs shall include detailed dimensional drawings, technical data sheets, and compliance to IEEE 519.
11. Furnish with O&M Manuals the address of the manufacturer's closest parts stocking location is to be provided with the VFD shipment.
12. VFD drive units shall be powered from scheduled 3 phase sources, with a voltage tolerance of -/+10%, 60 Hertz (+/- 2 Hz). VFD drive units shall be capable of operating in an ambient condition with a temperature range of 0 - 40oC with a relative humidity of 5 to 90% (noncondensing).
13. VFDs shall be provided as factory-assembled, factory-wired, and factory-tested units including enclosure, disconnect, bypass (where specified), reactors, control devices, and accessories. Field-assembled components will not be accepted unless specifically approved by the Engineer.
14. Motors controlled by VFDs shall be suitable for inverter-duty operation. Coordinate motor insulation system and construction with VFD output characteristics. Where motor lead lengths, motor construction, or application require protection from reflected wave voltage, provide dv/dt filters, load reactors, or sine wave filters as recommended by the VFD manufacturer. All required protection devices shall be included as part of the VFD package.

15. Provide VFDs with integral DC bus choke or minimum 5 percent AC line reactor. Where required to meet project electrical system power quality requirements, provide additional harmonic mitigation equipment including passive filters, active filters, or low harmonic drives as recommended by the manufacturer. Harmonic mitigation required for a complete and compliant installation shall be included in the base bid.
16. VFD assemblies shall have a minimum SCCR as indicated, but not less than 65 kA, and shall be fully UL listed and labeled as a complete assembly. SCCR shall be based on the combination of all internal components and the overcurrent protective device provided.
17. Coordinate all control interfaces with the Temperature Controls Contractor. Provide all required communication modules, licenses, and programming necessary for full integration with the Building Automation System. Where BACnet communication is provided, include all points required for monitoring and control as indicated on the drawings and sequences. Hardwired control points shall be provided where required for safe and reliable operation.

B. Manufacturers: Subject to compliance with requirements, provide Variable Frequency Drives manufactured by one of the following: ABB; Danfoss; Yaskawa; Eaton; Schneider Electric; Toshiba; or approved equal. All VFDs provided under this Section shall be of a single manufacturer unless otherwise approved by the Engineer.

C. VFD Operating Characteristics
1. The VFD units shall have a minimum full-load rating correlating with the full-load amp motor ratings of the associated motor(s) being controlled. It is the responsibility of the Mechanical Contractor to coordinate verify motor full load motor amperage.
2. The VFD units shall be capable of operation at 110% load for one minute.
3. The VFD units shall operate at a minimum full-load efficiency of 97% at rated load and speed.
4. The VFD units shall have a minimum kW/kVa power factor of 95% at rated load and frequency and throughout the speed range of operation.
5. The variable frequency drive shall have the operating characteristics below:
    a. +/- 0.6 Hz frequency regulation with analog speed command, 0oC to 40oC ambient.
    b. 0 to 66 Hz operating frequency range.
    c. Active current limit function to provide nominal 110% torque for one minute.
    d. Bus discharge to 50V maximum within 60 seconds or less per NEMA and NFPA standards.

D. VFD Features
1. VFD shall include the following features:
    a. DC bus choke or input line filters.
    b. DC bus capacitor.
    c. Full-wave diode bridge rectifier to supply fixed DC bus voltage.
    d. Auto restart after power loss or fault (minimum 3 times).
    e. Loss-of-power ride through for at least 15 milliseconds.
    f. Lockable door-mounted power disconnect switch with fast acting input fusing. Switch shall function in both the drive mode and bypass mode. A door-mounted, locking circuit breaker may be substituted for the disconnect switch and input fusing.
    g. Ground fault protection.
    h. Solid State motor thermal overloads.
    i. Output short protection.
    j. Over-current protection.
    k. Over-temperature protection.

l. Over-voltage and under-voltage protection.
m. Phase loss protection.
n. Transient surge protection.
o. Critical frequency rejection.
p. Short circuit protection.
q. Power semiconductor protection.
r. Output Contactors.
s. 120 Volt Control Transformer.
t. Minimum 5% AC Input Line Reactor
u. Manual bypass section and (3) isolation contactors
v. Common run stop feature
w. Run permissive circuit
x. VFDs shall be UL listed and labeled
y. Assembly shall comply with NEC requirements
z. Enclosure rating per installation location
aa. Components factory assembled and tested

2. Provide the following VFD Remote Control/Monitoring Options:
   a. Drive "stop/start" from remote EMS contact closure.
   b. VFD "Run" status output contact.
   c. "Fault" dry contact for remote annunciation at EMS of drive fault status.
   d. Isolated signal conditioner card to receive floating 4-20 ma speed control signal from EMS.
   e. Percent motor speed shall be provided to EMS by a proportional 4-20 ma signal generated by the VFD.
   f. Power input rate (kW) to VFD shall be provided to EMS by a proportional 4-20 ma signal generated by the VFD. Amperage will not be accepted. True power reading is required.

E. Drive Diagnostics
   1. The following faults are to be displayed on the drive front panel:
      a. Overcurrent.
      b. Ground fault.
      c. Undervoltage.
      d. Overvoltage.
      e. Overtemperature.
      f. Semiconductor fault (each leg).

F. Local Drive Operator Control
   1. A drive operator control panel shall be mounted on the front of the enclosure and shall include the following functions:
      a. Hand/Off/Auto selector switch.
      b. Manual bypass including Drive/Off/Bypass manual selector switch and contactors as required to permit operation of the motor while the VFD is taken offline for service.
      c. Auto/Manual speed switch and potentiometer.

G. Local Drive Parameter Monitoring
   1. The following drive-mounted displays are to be provided on the enclosure:
      a. Digital display of drive output frequency and power.
      b. Drive run pilot light.
      c. Drive output current or % load.

H. Drive Parameter Adjustment
   1. The following set-up adjustments are to be provided as a minimum:
      a. Minimum speed (frequency 0-60 Hz).
      b. Maximum speed (frequency 40-66 Hz).
      c. Acceleration rate (0.4-50 seconds for 0-60 Hz).
      d. Deceleration rate (0.4-50 seconds for 0-60 Hz).
      e. Adjustable Volts/Hertz.

PART 3 - EXECUTION

3.1 VFD FIELD SERVICES

A. VFD Manufacturer or (authorized local service representative) of the VFD unit shall provide a factory-trained service representative for start-up service. The factory-trained representative shall perform the procedures in the Start-up, Operation and Maintenance manual provided by the VFD manufacturer.

B. Start-up services shall be provided at the request and convenience of the Owner. The start-up services shall be performed when the ATC/EMS Subcontractor is present at the site. This will enable complete check-out of all EMS/VFD interfaces. The VFD start-up technician may, at his discretion, do the VFD start-up adjustments on a separate occasion when the ATC/EMS Subcontractor is not present. But he must then return for final check-out when the ATC/EMS Subcontractor is prepared for the interface checkout. As part of the Start-up services, the VFD Technician shall identify any 'nuisance' frequencies and shall lock these out.

C. After the above services have been performed, the same factory-trained will provide up to four hours of on-site training for Owner personnel. Provide operating or instruction manuals, training in equipment operation, and troubleshooting of the VFD drive unit.

D. The Contractor shall submit a VFD start-up report to the Engineer at the conclusion of his work. The standardized report shall note the status of all adjustable parameters. The report shall also note if there are any deficiencies in the installation of associated materials and equipment by the Electrical Subcontractor or ATC/EMS Subcontractor.

3.2 CONTRACTOR RESPONSIBILITIES

A. Contractor shall coordinate with electrical characteristics of the project.

B. Where required to meet project power quality requirements, provide harmonic mitigation components as recommended by manufacturer.

C. Harmonic mitigation shall be included in base bid where required for compliant operation.

3.3 INSTALLATION

A. Install VFDs in accordance with manufacturer's written instructions and applicable codes.

B. Coordinate mounting location to provide required working clearances, ventilation, and access for service.

C. Verify environmental conditions are within manufacturer's allowable limits prior to installation.

D. Coordinate conduit entry locations and power/control wiring with Electrical Contractor.

E. Verify motor nameplate data and cable lengths prior to startup and provide required filters where applicable.

3.4 FIELD QUALITY CONTROL

A. Verify proper installation, wiring, and grounding prior to energization.

B. Verify correct motor rotation and proper operation in both drive and bypass modes.

C. Verify all protective functions including overload, phase loss, over/under voltage, and fault reporting.

D. Verify proper response to BAS commands and feedback signals.

E. Confirm all adjustable parameters are set in accordance with manufacturer recommendations and project requirements.

END OF SECTION

SECTION 233200 - SHEET METAL

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC, HVAC INSULATION FOR EQUIPMENT, DUCTWORK, AND PIPING and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

1.2 GENERAL REQUIREMENTS

B. This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's Duct Manual and Sheet Metal Construction for Low Velocity Ventilating and Air Conditioning Systems. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.

C. Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not “dried-in”. If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

D. Provide coordinated shop drawings indicating duct routing, elevations, sizes, fittings, access door locations, dampers, and coordination with structure and other trades prior to fabrication.

E. Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new conditions. Notify the Engineer if there are any discrepancies for resolution.

F. Provide a SMACNA duct cleanliness level “C” per the latest SMACNA standards.

G. Ductwork shall be constructed to meet SMACNA Leakage Class 6 for low pressure systems and Leakage Class 3 for medium and high pressure systems unless otherwise indicated.

H. Provide seismic bracing for ductwork in accordance with IBC, ASCE 7, and SMACNA Seismic Restraint Manual. Coordinate with Section 230548.

I. Flexible duct shall be fully extended, supported at maximum 3'-0" intervals, with maximum sag of 1/2" per foot. Compression of duct is not permitted. Flexible duct shall only be installed in one

change of direction. Flexible duct shall not be installed above hard ceilings except for final connections to diffusers, registers, and grilles.

PART 2 - LOW VELOCITY DUCTWORK

2.1 CONCEALED DUCTWORK HEAT PUMP UNITS

A. Ductwork, plenums and other appurtenances shall be constructed of one of the following: Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating. Aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14.

B. Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard and per the following table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum. Penetrations through fire rated walls/floors require heavier gauges to meet UL listed penetrations.

Rectangular Width	Duct Gauge
3-12 inches	26 Ga.
13-30 inches	24 Ga.
31-54 inches	22 Ga.
55-84 inches	20 Ga.

C. All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water-based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15" wg. Apply per manufacturer's recommendations. Contractors shall insure no exposed sharp edges or burrs on ductwork.

D. Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

E. All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

F. Cross-break all ducts where either cross-sectional dimension is 18" or larger.

G. Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from purlins or other weak structural members where no additional weight may be applied. If in doubt, consult the Structural Engineer.

H. Double turning vanes shall be installed in square turns and/or where indicated.

I. Provide a “high efficiency” type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.

J. Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.

K. Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.

L. The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.

M. Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.

N. All fans and other vibrating equipment shall be suspended by independent vibration isolators.

O. Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

P. The Sheet Metal Contractor shall furnish qualified labor to assist the Air Balancing Contractor during testing and balancing of the system.

Q. Insulated Flexible Air Duct: Thermaflex G-KM or equal. Flexible air duct shall be one (1) inch thick fiberglass insulation with CPE liner permanently bonded to a coated spring steel wire helix supporting a fiberglass scrim and fiberglass insulating blanket. Flexible air duct shall be listed under UL Standard 181 as a Class I flexible air duct complying with NFPA 90A and 90B. Maximum flame spread = 25 and maximum smoke developed = 50. Minimum insulating value is R-6.0. Flexible duct shall be used only for GRD runouts and no section shall be more than five feet in length.

R. Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

S. Turning Vanes: Fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.

T. Access Doors in Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 2” thick double-wall insulated with continuous hinge and cam lock.

Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils and downstream side of VAV boxes and CAV boxes. Provide access doors at all duct-mounted sensors, airflow measuring stations, and control devices.

U. Architectural Access Doors in Ceilings or Walls: Refer to General Trades Package and Specification Section 083113.

V. Provide fire dampers, smoke dampers, and combination fire/smoke dampers as required by code and as indicated on drawings. Dampers shall comply with UL 555 and UL 555S. Dampers located in systems with fans operating during fire conditions shall be dynamic rated for the system operating pressure and velocity. Provide factory sleeves, breakaway connections, and installation in accordance with UL listings and SMACNA requirements.

W. Volume Dampers (Rectangular): Ruskin MD35 or Air Balance, Pottorff, rectangular volume dampers. Frames shall be 18-gauge galvanized steel. Blades shall be opposed blade 18-gauge galvanized steel with triple crimped blades on 6” centers. Linkage shall be concealed in jamb. Bearings shall be ½” nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point. Security Architectural Access Doors in Ceilings or Walls: Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24”x24” in size and constructed with 12-gauge steel for door and frame. Provide with primer finish to accept specified finish. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.

X. Volume Dampers (Round): Ruskin MDR525 or Air Balance, Pottorff round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 22-gauge steel and 5" long. Damper blades shall be 20 gauge crimped galvanized steel. Axle shall be 3/8"x5” square plated steel. Bearing shall be 3/8” nylon. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

Y. Pressure-Independent Constant Airflow Regulator / Automatic Balancing Damper: Provide factory-calibrated, pressure-independent constant airflow regulators for air quantities indicated on the drawings. Dampers shall automatically maintain preset airflow within plus or minus 10 percent over the manufacturer’s rated operating pressure range, minimum 0.2 to 1.0 inches w.g., unless otherwise scheduled. Units shall be self-contained mechanical type requiring no electric or pneumatic power and shall be suitable for supply, return, or exhaust air service as applicable. Casing shall be galvanized steel sized for round duct installation and shall include integral airflow adjustment scale, locking device, and permanent label indicating setpoint. Units shall be field adjustable within the manufacturer’s published airflow range and shall maintain the adjusted setpoint after locking. Provide access to all constant airflow regulators for inspection, adjustment, and replacement. Coordinate straight duct requirements, access, and installation limitations with manufacturer’s

recommendations. Where pressure-independent constant airflow regulators are indicated, separate manual balancing dampers at the same location are not required unless noted otherwise. Provide TROX, Nailor, Ruskin, Greenheck, ALDES, or approved equal.

Z. Motor Driven Smoke Dampers – Air Foil Blade: Provide Ruskin SD60 smoke damper where required by the locations of smoke partitions or as shown on the plans, whichever is more stringent. Other acceptable manufacturers are Air Balance or Pottorff. All smoke dampers shall be three inches larger than HVAC duct in each direction. Frame shall be a minimum of 18-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Each smoke damper shall be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close under HVAC system operating conditions) with pressures of at least the maximum possible of the HVAC system in the closed position, and the system maximum duct air velocity in the open position. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Actuator to be mounted outside of air stream. The pressure drop shall not be greater than .16" wg @ 2500 FPM when tested by an independent laboratory. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

AA. Motor Driven Control Dampers – Outdoor Rated Air Foil Blade: Provide outdoor-rated control dampers with airfoil blades for outside air and exhaust ductwork exposed to weather, basis of design Ruskin CD60, or approved equal by Air Balance or Pottorff. Damper frame shall be minimum 16-gauge galvanized steel. Blades shall be one-piece airfoil type, minimum 16-gauge equivalent galvanized steel, with blade and jamb seals suitable for low-leakage outdoor service. Bearings, jamb seals, linkage, and hardware shall be stainless steel or other corrosion-resistant materials suitable for exposed outdoor installation. Dampers shall be suitable for operation at a minimum duct velocity of 2000 FPM and at the maximum scheduled system pressure.

PART 3 - HIGH VELOCITY DUCTWORK

4.1 CONCEALED OUTSIDE AIR AND EXHAUST DUCTWORK

A. High pressure/velocity ductwork shall be utilized for all supply ductwork between air handling units and VAV/CAV boxes. Provide Eastern Sheet Metal Model “CB” or equal takeoff fitting for each VAV/CAV branch. Straight tees are not allowed.

B. All round ductwork for systems above 2” W.G. shall be Eastern Sheet Metal, United McGill or Semco or equal as required by the latest SMACNA.

C. Ductwork shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Coordinate with General Contractor. Ductwork shall be constructed of the following minimum gauges:

Rectangular Width	Duct Gauge
3-12 inches	24 Ga,
13-30 inches	22 Ga.
31-54 inches	20 Ga.
55-84 inches	18 Ga.

D. Duct dimensions indicated are required inside clear dimensions.

E. All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water-based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15”wg. Apply per manufacturer's recommendations.

F. Ductwork shall be installed per the latest SMACNA Manuals, whichever is applicable. Note duct penetrations through UL listed assemblies may require heavier gauges.

G. All hanger straps shall be 18 ga. minimum with reinforcement angles. Maximum hanger spacing shall not exceed SMACNA requirements and shall be reduced where required to prevent sagging or deflection.

H. Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

I. Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated floors and walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type. Install dampers with sleeves, breakaway connections, and clearances in accordance with UL listing and SMACNA requirements.

J. Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric. Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.

K. Pressure Relief Doors: Provide a pressure relief door in the supply air ductwork at each air handling unit. It shall be sized to relieve the duct air pressure below the rated pressure construction of the ductwork and above the working pressure of the fan. The supply air relief door shall be Ruskin PRD18 or equal. Provide a vacuum relief door in the return air ductwork at each return air fan. It shall be located where shown on the drawings. It shall be sized to relieve the duct vacuum below the rated construction of the ductwork and above the working negative pressure of the fan. The return air relief door shall be Ruskin NRD18 or equal. Automatic fan shutdown upon damper

closure shall not be an acceptable protection for either overpressure or vacuum conditions. All duct relief dampers shall be of the automatic resetting type.

L. Architectural Access Doors in Ceilings or Walls: Refer to General Trades Package and Specification Section 083113. Provide access doors at all fire dampers, smoke dampers, combination dampers, duct detectors, airflow stations, and control devices.

M. Access Doors; In Ductwork: All access doors in round or oval high velocity ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers. Security Architectural Access Doors in Ceilings or Walls:

Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24”x24” in size and constructed with 12-gauge steel for door and frame. Provide with primer finish to accept specified finish. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project. Access door sizes shall be as follows:

DUCT DIAMETER	OPENING SIZE
3-4 inches	4"x10"
5-6 inches	6"x10"
7-24 inches	10"x16"
26-36 inches	16"x16"
Over 36 inches	16"x22"

N. Motor Driven Smoke Dampers – Air Foil Blade: Provide Ruskin SD60 smoke damper where required by the locations of smoke partitions or as shown on the plans, whichever is more stringent. Other acceptable manufacturers are Air Balance or Pottorff. All smoke dampers shall be three inches larger than HVAC duct in each direction. Frame shall be a minimum of 18-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Each smoke damper shall be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close under HVAC system operating conditions) with pressures of at least the maximum possible of the HVAC system in the closed position, and the system maximum duct air velocity in the open position. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Actuator to be mounted outside of air stream. The pressure drop shall not be greater than .16" wg @ 2500 FPM when tested by an independent laboratory.

O. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

PART 4 – EXPOSED DUCTWORK

4.1 EXPOSED DOUBLE WALL SPIRAL INSULATED DUCTWORK

A. Provide factory-fabricated, round, double-wall insulated spiral ductwork for exposed locations indicated to receive field-applied paint finish.

B. Inner and outer duct walls shall be constructed of galvanized steel sheets conforming to ASTM A653, lock-forming quality, with minimum G90 zinc coating. Inner duct wall shall be solid galvanized steel. Outer duct wall shall be smooth galvanized steel suitable for field preparation and painting by Division 09. Where required for compatibility with specified paint systems, provide paint-grip outer shell.

C. Double-wall round spiral ductwork and fittings shall be constructed to SMACNA standards for medium-pressure service and shall be rated for a minimum positive pressure class of 6 inches w.g. Inner liner, outer shell, joints, reinforcements, and fittings shall be of thickness required by SMACNA for the size, pressure class, and installation conditions indicated. Where construction options differ, provide heavier construction.

D. Provide 1-inch thick fiberglass insulation between duct walls unless otherwise indicated. Insulation shall comply with ASTM C1071 and NAIMA AH124 and shall have maximum flame spread and smoke developed ratings of 25 and 50, respectively. Insulation shall be securely retained and protected against erosion, settling, delamination, and displacement.

E. Inner liner shall be continuous solid metal construction. Outer shell shall be continuous metal construction. Fittings, taps, elbows, reducers, tees, branches, and accessories shall be double-wall construction matching straight ductwork in material, insulation thickness, pressure class, and appearance.

F. All ductwork connections, fittings, joints, seams, and appurtenances shall be sealed in accordance with SMACNA Seal Class A. Sealant shall be UL 181 listed, UL 723 classified, NFPA 90A and 90B compliant, permanently flexible, nonflammable, and suitable for the pressure class specified. Contractor shall ensure there are no exposed sharp edges or burrs on ductwork.

G. Duct dimensions indicated are required clear inside dimensions of the inner liner. Plan duct layouts for adequate insulation thickness, fitting allowance, support spacing, and coordination with adjacent construction.

H. Elbows and fittings shall be constructed in accordance with SMACNA. Elbows shall be long-radius type where practical unless indicated otherwise or limited by available space. Segmented fittings shall be reinforced as required to prevent breathing, vibration, and visible deformation.

I. Ducts shall be supported by rods, trapezes, bands, or other approved means in accordance with SMACNA recommended practices. There shall be no fewer than one set of supports for each section of ductwork. Supports shall be installed to prevent sagging, vibration, and visible misalignment. Do not suspend ducts from structural members not intended to support imposed loads.

J. Exposed ductwork shall be installed true to line and level with consistent joint spacing and uniform alignment. Exterior surfaces shall be smooth and suitable for field-applied paint finish and shall be

free of dents, scratches, ripples, oil residue, labels, sealant smears, and other imperfections visible through paint.

K. Provide access doors, test openings, balancing dampers, and miscellaneous duct accessories where indicated, where required by SMACNA, and where required for operation, balancing, and service. Accessories in exposed ductwork shall match adjacent duct construction and appearance.

L. Coordinate final surface preparation, primer compatibility, and finish requirements with Division 09. Remove temporary labels and markings from exposed surfaces prior to painting.

M. Subject to compliance with requirements, provide products by Spiral Manufacturing, Sheet Metal Connectors, Inc. (SMC), Semco, Lindab, or approved equal.

PART 5 – OUTDOOR EXPOSED DUCTWORK

5.1 DUCTWORK SYSTEMS

A. Provide outdoor ductwork systems that are fully weatherproof, UV-resistant, and suitable for continuous exterior exposure.

B. Outdoor ductwork shall be designed to prevent air leakage, water infiltration, condensation, and degradation due to environmental exposure.

C. Coordinate all outdoor duct routing, supports, and penetrations with architectural, structural, and roofing systems.

5.2 MATERIALS AND CONSTRUCTION

A. Ductwork shall be constructed of the following materials:
   1. Galvanized steel, minimum G90 coating, with protective exterior coating system.
   2. Aluminum duct (3003 alloy) may be used where indicated or for corrosion-prone environments.
   3. Where exposed to coastal or corrosive environments, provide aluminum or stainless steel ductwork.

B. Duct construction shall comply with SMACNA HVAC Duct Construction Standards for the applicable pressure class, with a minimum construction of:
   1. High pressure: 6” WG minimum

C. Reinforcement, seams, and joints shall be suitable for exterior exposure and shall prevent oil-canning, vibration, and deformation.

5.3 SEALING AND WATERPROOFING

A. All duct joints, seams, and penetrations shall be sealed watertight

B. Sealant shall be:
   1. UL 181 listed
   2. UV-resistant and weatherproof
   3. Suitable for exterior applications and temperature extremes

C. Apply sealant continuously at all longitudinal seams, transverse joints, and duct penetrations.

D. Provide additional external waterproofing (mastic or approved coating) at all joints exposed to weather.

5.4 DRAINAGE AND SLOPE

A. Outdoor ductwork shall be installed to prevent water accumulation. Horizontal ductwork shall be sloped a minimum of 1/8 inch per foot toward designated drain locations where condensation or water intrusion may occur. Provide drain connections at low points where required to ensure proper removal of accumulated moisture.

5.5 SUPPORTS AND ROOF CURBS

A. Support ductwork on roof curbs, sleepers, or structural steel supports. All supports shall be hot-dip galvanized or otherwise corrosion resistant, provide a minimum of 6 inches clearance above the roof surface, and be coordinated with the roofing system to maintain the roof warranty. Wood blocking in contact with roofing shall be pressure-treated. Do not support ductwork directly on the roofing membrane.

5.6 PENETRATIONS AND FLASHING

A. All roof and wall penetrations shall be fully flashed and sealed watertight. Coordinate all flashing systems with the roofing contractor to ensure compatibility with the roofing assembly. Provide counterflashing and pitch pockets where required to maintain a continuous weatherproof installation.

5.7 ACCESS DOORS

A. Access doors shall be double-wall insulated, gasketed, weatherproof, and constructed of materials matching the duct construction. Provide hinged access doors with corrosion-resistant hardware. Install access doors in a manner that prevents water intrusion and maintains the integrity of the duct system and insulation.

5.8 FINISHES

A. Exterior ductwork and jacketing shall be suitable for continuous exposure without additional protection unless otherwise indicated. Where ductwork is exposed to view, coordinate finish and color with the Architect. Provide factory-applied or field-applied coating systems where required for corrosion protection or aesthetic purposes. All outdoor ductwork shall be insulated and jacketed in

accordance with Section 230700. Jacketing shall be aluminum or stainless steel, fully weatherproof and UV resistant.

PART 6 - AIR LEAKAGE TESTING

6.1 DUCTWORK SYSTEMS

A. It is the intent of this section to ensure the ductwork installed has minimal air leakage. Air leakage testing shall be accomplished by an AABC certified company. Refer to the Test & Balance specifications. Whenever the systems are being leak tested by the Test & Balance Contractor, a representative from the Mechanical Contractor shall be present to assist.

B. Carefully select the ductwork construction requirements and the type of duct sealant to be used as required to meet the leakage allowances. The sheet metal duct pressure classification is a minimum only. The Contractor shall select the appropriate sheet metal pressure classification, duct sealant class and duct sealant materials to meet the project air leakage allowances.

C. The entire outside and exhaust air ductwork system shall be tested with some exceptions. On the outside air systems, the ductwork upstream of the VAV boxes shall be tested. Cap the duct at the inlet to the VAV box.

D. All exhaust air sheet metal ductwork associated with the outside air system shall be tested. Flexible ductwork shall not be tested. Cap the main duct prior to the central equipment fan connection. Also cap the branch ducts which serve the diffusers, after the round branch air volume with sheet metal caps. Seal caps well to damper to avoid air loss at this location. This air loss, from the caps, is included in the noted leakage rate.

E. A duct pre-installation conference shall be held prior to the installation of the ductwork. Present should be the Owner, Design Team, Test & Balance Contractor, General Contractor, Mechanical Contractor, Sheet Metal Contractor and Insulation Contractor. At this meeting, the Contractor shall advise all of the duct materials and sealant materials to be used to meet the air leakage allowances.

F. It is the intent to test ductwork systems to minimize leakage. The duct systems which will require testing are as follows:
   1. All outside supply systems.
   2. All exhaust systems.
   3. All kitchen exhaust system.
   4. The low-pressure heat pump supply & return ductwork on units 5 ton and larger.

G. Do not insulate the supply air systems prior to testing.

H. The maximum allowable leakage for outside air, return air, and exhaust air duct systems shall not exceed 5 percent of system design airflow when tested at the pressures indicated. Outside air systems shall be tested at 2.0 inches w.g. Return air and exhaust air systems shall be tested at 1.5 inches w.g.

I. The noted allowable leakage rate is the total allowable. It shall include leakage associated with the following:

1. All ductwork as described in above paragraphs.
2. Access doors
3. Volume dampers
4. Relief air doors
5. Smoke dampers
6. End caps used to seal ducts

J. If any duct system fails a test, the Contractor shall reseal the system. It shall than be retested until the duct system meets the leakage allotment at no additional cost to the Owner.

K. The Contractor shall provide and complete a duct pressure testing record sheet for each test performed.

L. The Contractor shall pretest each duct section in advance of the final witnessed tests. Upon completion of the pretests, the Contractor shall notify the Design Team and Cx that final testing can be scheduled.

PART 7 - SPECIALTY DUCTWORK

7.1 RANGE HOOD EXHAUST DUCT

A. Grease duct shall be welded liquid-tight carbon steel, minimum 16 gauge, or stainless steel, minimum 18 gauge, in accordance with IMC and NFPA 96 with liquid tight continuous external weld of all seams and joints where exposed. Where ducts are concealed, they shall be constructed of 16-gauge carbon steel with liquid-tight continuous weld of all seams and joints. Inside laps on duct joints shall project in a direction against the air flow. Provide and install per IMC 506.3.1.1.

B. Ducts shall be so constructed and sloped as to provide suitable drainage of water/grease to a collection point.

C. Hand holes for inspection and cleaning purposes, equipped with tight fitting sliding or swinging doors and latches, shall be provided in horizontal sections of exhaust ducts. Such openings shall be at the sides of the horizontal run in order to prevent dripping of residue. Spacing of such openings shall not exceed 20 feet and shall be located at all offsets. Openings shall have a minimum dimension of 20" in width with a height equivalent to the duct height minus one inch.

D. At the base of each vertical riser, a residue trap shall be provided with provisions for cleanout.

E. The Contractor shall install the kitchen rangehood exhaust duct systems and maintain the minimum code required clearances to combustibles. Provide UL listed and approved enclosure system of fire wraps/blankets installed per the manufacturer’s instructions from the second floor to the roof deck, preventing the use of a fire damper and to achieve the clearance to combustibles requirements.

F. At the Contractor’s option, a UL2221 Pre-manufactured Duct System equal to Metal Fab 3G shall be acceptable. Duct shall have a stainless-steel inner liner, aluminized outer liner and three-inch liner to maintain fire rating and comply with requirements of clearance to combustibles.

G. Shop drawings of the kitchen rangehood exhaust ductwork shall be made and submitted to the appropriate reviewing agency. Any fees associated with this submittal shall be borne by this Contractor.

7.2 DRYER VENT AND KILN DUCTWORK

H. All dryer ducting shall be a minimum of 4" in diameter. Kiln ductwork minimum of 6” diameter.

I. Kiln and dryer vent ductwork shall be rigid metal 20-gauge aluminum duct. Duct joints shall be installed so that the male end of the duct points in the direction of the airflow. Joints shall be secured with metal tape (not duct tape). Do not use rivets or screws in the joints or anywhere else in the duct as these will incur lint collection.

J. For dryer venting, length of concealed rigid metal ducting shall not exceed the allowable length of 25 feet. Deduct 5 feet from the allowable length for every 90-degree elbow and 2.5 feet for every 45-degree fitting per IMC requirements. These lengths may vary per local codes and dryer manufacturer’s recommendations. Provide a complete, working in-line booster fan system, including power, if the maximum allowable duct length is exceeded.

K. Flexible transition hose connection at the dryer shall be the aluminum flexible duct type. Do not use the plastic or vinyl.

L. Termination of kiln and dryer venting shall be to the exterior with a proper hood or roof jack equipped with a backdraft damper. Hood/jack shall be painted with suitable exterior grade paint and color per the Owner’s direction. Small orifice metal screening shall not be part of the hood or roof jack as this will trap lint and block the opening. The hood opening shall point down and maintain a minimum of 12 inches of clearance between the bottom of the hood and the ground or other obstruction.

END OF SECTION

SECTION 233700 - HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Provide all HVAC equipment complete and in proper operating condition, installed where indicated, connected, and placed in operation in strict accordance with the manufacturer's written instructions and recommendations. Coordinate electrical characteristics, power connections, and disconnect means with Division 26. Equipment shall be factory finished and, where applicable, factory insulated. Electrical equipment shall be listed and labeled by UL or another nationally recognized testing laboratory where such listing standards exist.

C. Provide all manufacturer's standard warranties and any additional warranties required by the Contract Documents. Warranty periods shall begin at Substantial Completion unless otherwise indicated. Refer to Section 230100/Common Work Results for HVAC for additional warranty requirements.

D. Refer to Specification Section COMMON WORK RESULTS FOR HVAC for minimum required Schedule of Values breakdown.

E. Review the Specification Section for SHOP DRAWINGS, OPERATION AND MAINTENANCE MANUALS, AND SPARE PARTS, and provide all documentation required therein.

F. Each Contractor shall be responsible for completion of system verification checklists, manufacturer's pre-start and start-up checklists, and all documentation required by the Contract Documents. Refer to Section 230100/Common Work Results for HVAC and Section 019113 General Commissioning Requirements for additional requirements.

G. Where required by the manufacturer or Contract Documents, equipment start-up shall be performed by the manufacturer's factory-authorized representative, and written start-up documentation shall be submitted. Unless otherwise specified, this requirement applies to the following equipment furnished under this Section:
   1. Geothermal Heat Pumps Units
      a. Vertical
      b. Horizontal
   2. Outside Air Unit
   3. Variable Air Volume Terminal Boxes
   4. Exhaust Variable Volume Terminal Boxes
   5. Electric Unit Heaters

6. Exhaust Fans

H. All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90.1 and all provisions of the International Energy Conservation Code 2021.

I. Verify that all equipment proposed for this Project can be installed in the space allocated, connected as indicated, placed into operation, and serviced without removing permanent construction unless specifically indicated otherwise. Coordinate required service clearances, access, lifting requirements, and electrical disconnect means with all trades. Provide factory-mounted disconnect switches where scheduled or where available as a standard manufacturer option; otherwise coordinate field-provided disconnects with Division 26 in accordance with NEC requirements.

J. Determine from the Bid Documents the date of completion of this project and ensure that equipment delivery schedules can be met so as to allow this completion date to be met.

K. Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, 100% functional, wired, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected. Refer to Specification Section – COMMON MOTOR ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT for additional requirements. All equipment shall be furnished for a single point electrical connection along with factory or integral disconnect switch unless specifically indicated otherwise. Field disconnects maybe acceptable, upon coordination with Division 26, and accepted by owner and engineer.

L. Review the Specification Section – TEMPERATURE CONTROLS AND SEQUENCE OF OPERATIONS FOR HVAC to determine controls, including variable frequency drives, to be furnished. Where manufacturer's temperature controls are specified, they shall be in full compliance with NFPA 90A including automatic smoke shut down and interlocked provisions. Controls must be compatible with BAS and provide all points necessary for monitoring, control, and alarms and coordinate control transformers, relays, safeties, and interface devices.

1.2 SUBMITTALS

A. Submit certified performance data for each scheduled unit including scheduled capacity, entering and leaving conditions where applicable, airflow, external static pressure, sound data, electrical data, efficiency ratings, and operating limitations.

B. Submit manufacturer's product data and technical specifications for each unit and accessory describing materials of construction, components, factory options, controls, safeties, and accessories.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit electrical characteristics including voltage, phase, MCA, MOCP, disconnect provisions, power connection locations, control connection points, and manufacturer's recommended

overcurrent protection. Submit sequence of operation, control diagrams, wiring diagrams, safety interlocks, and start-up instructions.

E. Submit operation and maintenance data including manufacturer's descriptive literature, installation instructions, operating instructions, maintenance procedures, recommended spare parts list, troubleshooting information, start-up forms, and wiring/control diagrams.

F. Submit controls interface requirements and BACnet points list where manufacturer-provided controls are furnished.

G. Submit manufacturer start-up reports and warranty documentation at project closeout.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products per manufacturer's recommendations.

B. Comply with manufacturers installation instructions for rigging, unloading and transporting units.

C. Protect units from physical damage, dirt, dust, moisture, and weather during storage and installation. Leave factory shipping covers, seals, and protective wrappings in place until installation. Replace damaged equipment or components at no additional cost.

PART 2 - PRODUCTS

2.1 GEOTHERMAL HEAT PUMPS

A. Acceptable manufacturers shall be Daikin, Johnson Controls/York, Trane, Bosch/FHP, and WaterFurnace, subject to compliance with the Contract Documents.

B. Provide one fully coordinated mockup installation of one typical horizontal unit and one typical vertical unit, including unit supports, condensate piping, piping package/hose kit, controls interface, access clearances, filter arrangement, and associated appurtenances. Mockups shall be reviewed by the Engineer prior to proceeding with remaining installations.

C. Furnished equipment shall fit within the space allocated on the Drawings and shall maintain all required service and removal clearances. Any additional coordination, trim, supports, offsets, or accessories required due to manufacturer-specific dimensions or access requirements shall be provided at no additional cost to the Owner.

D. Equipment shall be specifically designed for applications within conditioned interior areas. Capacities shall be rated in accordance with AHRI for geothermal applications. Equipment shall be ETL/UL/NRTL approved. All equipment shall have decals and labels to aid in servicing and indicate caution areas.

E. Equipment shall be completely factory assembled and tested, piped, internally wired, and factory charged with the manufacturer's standard refrigerant, which shall be R-32 or R-454B

unless otherwise approved. Units shall be specifically listed and labeled for use with the furnished refrigerant and shall comply with all applicable requirements for A2L refrigerants, including factory labeling, charge limitations, and safety provisions. Threaded female water inlet and outlet connections, condensate connection, duct collars where applicable, and all safety controls shall be furnished and factory installed.

F. Provide a terminal strip with clearly identified screw terminals for control wiring. Units shall include a factory-installed condensate overflow safety device that disables cooling operation and/or compressor operation upon high condensate level. Provide factory-installed control interface provisions to allow BAS enable/disable, occupancy control, alarm indication, and other external interlocks as indicated.

G. Cabinets shall be constructed of galvanized steel with factory-applied finish. Interior surfaces exposed to the air stream shall be insulated with minimum 1/2-inch fiberglass or closed-cell insulation, securely adhered, protected against erosion, and complying with applicable flame spread and smoke-developed requirements. Provide removable access panels for service of filters, motor, blower assembly, compressor, controls, and drain pan.

H. The drain pan shall be constructed of stainless steel and insulated to prevent sweating. The bottom of the drain pan shall be sloped on two planes which will direct the condensate to the drain connection. When the unit is installed per the manufacturer's instructions, the drain pan shall be tested as follows: (1) Temporarily plug the drain pan, (2) fill the drain pan with 2" of water or the maximum allowed by the drain pan depth, whichever is smaller, (3) remove the temporary plug and verify the drain pan removes the water within 3 minutes.

I. Compressors shall be high-efficiency, hermetically sealed type, scroll where available or as scheduled, with internal vibration isolation and overload protection. Provide factory sound attenuation features including sound blankets where available as standard for the scheduled unit configuration. Units with multiple compressors shall be furnished where indicated on the Drawings.

J. The air-to-refrigerant heat exchanger shall be constructed of staggered copper tubes with die formed corrugated aluminum fins mechanically bonded to the tubes. The air-to-refrigerant heat exchanger shall have a working pressure rating of 400 PSIG. Multiple compressor equipment shall provide a single air-to-refrigerant heat exchanger for each compressor.

K. The water-to-refrigerant heat exchanger shall be of a high quality co-axial coil for maximum heat transfer and insulated to prevent condensation at low temperatures. The copper coil shall be fluted to enhance heat transfer and minimize fouling and scaling. The coil shall have a working pressure of 600 psig on the refrigerant side and 400 psig on the water side.

L. Reversing valve shall be manufacturer's standard pilot-operated type suitable for heat pump service.

M. Refrigerant tubing shall be constructed of copper. All low temperature refrigerant lines shall be insulated with an elastomeric insulation that has a 3/8" thick wall, flame spread rating of less than 25 and smoke density rating of less than 50, as tested in accordance with ASTM-84. The elastomeric insulation shall have a UL 94V-5 rating.

N. The equipment shall be provided with a thermal expansion valve. This device shall allow operation of the equipment in the range of 25 to 110º F entering fluid temperatures and 45 to 90º F entering air temperatures. The equipment shall only operate with one variable (enter water temperature, entering air temperature, cfm or gpm) at an extreme condition. All other variables must be within the nominal range of operation.

O. The equipment shall be provided with factory supplied high and low pressure Schrader ports for easy refrigerant pressure or temperature testing.

P. Fan and motor arrangement shall be as scheduled. Motors shall have permanently lubricated bearings and internal thermal overload protection. Horizontal units shall be field-convertible for discharge arrangement where scheduled or where indicated by the Drawings. Fan and motor assemblies shall be removable for service without disassembly of the entire unit casing. Where ECM or programmable motors are provided, furnish all required manufacturer tools or interfaces necessary for startup and balancing.

Q. A factory tested and installed control box shall contain all necessary devices to allow heating and cooling operation of the equipment to occur. These devices shall be as follows: (1) 24 Vac, energy limiting class II transformer. (2) Blower motor controller shall be a 24 Vac relay. (3) Compressor controller shall be a 24 Vac contactor. All three-phase operated equipment shall have a contactor that interrupts all three-phases providing power to the compressor. (4) Electrically operated safety lockout relay. This device shall prevent operation and anti-short cycling of the compressor during adverse conditions of operation. This device may be reset by either a remote thermostat or momentary interruption of power. (5) High pressure switch shall protect the compressor against operation at refrigerant system pressures in excess of 395 PSIG. (6) Low pressure switch shall prevent compressor operation underneath low charge or catastrophic loss of charge situations.

R. The Contractor shall completely assemble an Air Filter System for each unit and install ready to use. Heat pumps 4 tons and smaller require one 24” X 24” air filter system (one 24 X 24 filter). Heat pumps 5 tons through 10 tons require one 48” X 24” air filter system (two 24 X 24 filters). Heat pumps larger than 10 tons require one 72” x 48” air filter system (Six 24 X 24 filters). See plans for sizes and quantities. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for Temporary Use of Equipment Requirements and filter quantities.
   1. Side Access Filter Housing: Housings shall accommodate required quantity of 24” X 24” X 2” deep flat filters as noted above. Housings shall be factory assembled, have one hinged access door with quick access latches (operable without special tools), and be constructed on 18 gauge aluminized steel minimum.
   2. Filters shall be MERV 13, pleated and disposable. Provide 24” x 24” x 2” thick with an initial pressure drop shall be 0.30” at 500 fpm face velocity. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter shall be listed by Underwriters’ Laboratories as Class 2.
   3. Hose kits and piping package shall be as scheduled on the drawings. Single piece hose kits shall be provided for hose kits that are 1-1/2” or less in size. Two piece hose kits shall be provided for hose kits that are 2” and larger in size. Hose kits shall be the pipe runout size, not heat pump connection sizes. No exceptions!
      a. Provide a factory-assembled hose kit/piping package for supply and return connections for each heat pump. Kits shall be line sized. Kits submitted as the size of the heat pump connection are not acceptable. Kits may be mounted in any direction and shall not require straight sections of pipe either upstream or

downstream for proper operation. All hoses shall be equipped with end connections at terminal unit and shall be 24" long. All end connections shall be either permanently crimped swivel ends or butt welded to carbon steel end fittings to meet stated pressure ratings. Operational temperature shall be rated from fluid freezing to 200 degrees F. Minimum burst pressure shall be four times the working pressure. Furnish with field flushing connection fitting. Up to 1-1/4" shall be reinforced, fire retardant EPDM rubber, bonded to the inside wall of braiding. 1 ½" and larger shall be a corrugated type 321 stainless steel tube.

b. Each supply side (water inlet) hose kit/piping package shall include a single piece Y - valve body for sizes up to 1-1/2" and shall be constructed of hot forged brass with threaded inlets and outlets. 2" and larger sizes shall be two-piece and constructed of ductile iron with threaded inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure. Include single pressure/temperature test ports for verifying the pressure differential and system temperature. Include full flow design ball valve with blow out stems for shut off. Strainer shall be Y-type configuration furnished with hose connector blow down valve. Strainer screen shall be stainless steel mesh and easily accessible for cleaning without disconnecting hoses. All valves shall be labeled with flow direction, manufacturer and model number, unit tagging.

c. Each return side (water outlet) hose kit/piping package shall include a single piece Y - valve body for sizes up to 1-1/2" and shall be constructed of hot forged brass with threaded inlets and outlets. 2" and larger sizes shall be two-piece and constructed of ductile iron with threaded inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure. Include single pressure/temperature test ports for verifying the pressure differential and system temperature. Include full flow design ball valve with blow out proof stems for shut off. All valves shall be labeled with flow direction, manufacturer and model number, unit tagging. Include automatic flow control valves which shall be factory set to rated flow and shall automatically control the flow to within 10% of the rated value subject to the operating parameters of 2-80 psid, fluid freezing to 225°F, 2-7 fps. Also provide a three-wire, two-way, two-position control valve with actuator. Actuator shall be field installed by the ATC contractor.

S. Prior to utilization of equipment, start-up service shall be performed by factory authorized representative. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for additional requirements.

T. Provide factory-mounted disconnect switch where scheduled or where available as a standard option. Provide alarm/status contacts or communications gateway where indicated for BAS integration.

U. Coordinate condensate drain connection configuration, trap requirements, cleanouts, and overflow shutdown with the Drawings and manufacturer's recommendations.

V. Units shall meet or exceed the scheduled capacities, entering water temperatures, airflow, sound performance, and electrical characteristics indicated on the Drawings.

W. Units shall be selected for low sound operation suitable for school occupancy. Submit sound power data or octave band sound data for each scheduled unit.

X. Provide all factory-mounted sensors, safeties, relays, and interface components required for BAS monitoring, alarm reporting, occupancy control, and shutdown interlocks as indicated.

Y. Units shall be installable and serviceable within the spaces indicated without removing permanent construction. Filters, blower, motor, compressor, drain pan, control box, and valves shall remain accessible.

Z. Provide eight (8) hours of onsite training for this system. All training shall occur after building completion. Systems shall function properly and O&M staff shall be able to operate the system prior to turnover.

2.2 SEMI-CUSTOM DEDICATED OUTSIDE AIR UNITS (OUTDOOR TYPE):

A. Acceptable manufacturers shall be Innovent, Trane, AAON, and Valent, subject to compliance with the Contract Documents.

B. Dedicated Outdoor Air Units shall be capable of providing the scheduled airflows and capacities and shall be furnished with the components indicated on the Drawings and specified herein, including but not limited to supply fan sections, exhaust fan sections, VFDs, energy recovery wheel, dampers, packaged reversible heat pump system, face and bypass damper section, filter sections, and drain pans.

C. Provide factory built and factory tested air handling units of sizes, capacities and configurations as scheduled and as specified herein. Unit layout shall be dual path, providing one path for outside air with all components arranged in series as specified and providing one path for exhaust air with all components arranged in series as specified.

D. Units shall be furnished without a stand-alone factory-programmed building automation package unless specifically indicated otherwise. Manufacturer shall provide all factory-mounted safeties, internal operating controls, unit-mounted devices, and control interface components required for proper operation of the unit and refrigeration system. The Temperature Controls Contractor shall furnish and install all field control devices, actuators, sensors, interlocks, and BAS integration required by the sequence of operation. BACnet/IP interface to the building automation system shall be provided by the Temperature Controls Contractor unless specifically noted otherwise.

E. Alternate manufacturers seeking approval shall provide a pre-bid unit submittal to receive consideration. In requesting approval, alternate manufacturers shall provide three reference installations that have been in operation for a minimum of 5 years located within 300 miles of the jobsite for the engineer to contact. The reference installations shall be of similar application, design, features and construction to the specified equipment for this project and of equal capacity to the largest unit on this project. For each reference installation, provide an owner contact name, phone number, the equipment submittal for the unit(s), the manufacturer's representative and the date of installation.

F. Project is based on the specified equipment. Any additional re-engineering or installation costs associated with using alternate manufacturer's equipment shall be borne by the installing contractor.

G. Quality Assurance:
1. The unit shall be specifically designed, manufactured and tested for specialized energy recovery duty. Field assembled or modified standard commercial grade equipment shall not be accepted.
2. The product, including cabinet design, materials and major components, shall have a proven record of satisfactory use in installations of the specific application of this project for a minimum of 5 years.
3. Where a standard of quality is specified for a major component, provide one of the acceptable manufacturers and models specified herein.
4. NFPA Compliance. Units and components shall be designed, fabricated and installed in compliance with NFPA 90A.
5. UL Compliance. Electrical components used shall be listed and labeled by a nationally recognized testing laboratory.
6. NEMA Compliance. All motors shall comply with applicable NEMA standards.
7. AMCA Compliance. Fans shall be certified to bear the AMCA seal for air and acoustic performance per Standards 210 and 310. Dampers shall be tested and rated according to Standard 500D.
8. Air-to-air energy recovery components shall be tested in accordance with AHRI 1060. Complete unit shall be listed and labeled by ETL, UL, or another nationally recognized testing laboratory for the application and refrigerant provided. Unit listing shall comply with applicable safety standards for the furnished equipment and refrigerant.
9. Casings, panels, and frames, shall meet AHRI-1350 CB-1 requirements.

H. Duct connections shall be located as shown on the drawings. Duct connection sizes shall not have a higher face velocity or different aspect ratio than the specified unit. Air tunnels shall be arranged as shown on the drawings. Unit height and width shall not be less than the specified unit height and width.

I. Cabinet Performance:
1. Base Deflection. Design structural base to limit deflection to ¼” in length and width when rigging the unit according to manufacturer recommendations. Provide engineering calculations demonstrating compliance with this requirement.
2. Cabinet Deflection. Construct cabinet to limit deflection of the walls and roof to L/250 at 8" w.c. static pressure, or 1.5 times the maximum static pressure within the unit at design conditions, whichever is lower. Deflection ratings for panels only shall not be accepted.
3. Floor Deflection: Maximum floor deflection shall be L/500 (L=span in inches) when subjected to an 800 lb/sq ft. point load. Provide test data demonstrating compliance with this requirement.
4. Casing Air Leakage. Maximum casing leakage shall meet SMACNA duct leakage class (DLC) rating of 5.0. Provide calculations demonstrating compliance with this requirement.
5. Thermal Performance. All interior walls, floor, and ceiling shall be double wall and insulated with polyurethane injected foam insulation having a minimum R- value of 6.3 - 7.1/inch. Fiberglass or non-injected foam insulation is not acceptable and will be rejected.
6. Casing Insertion Loss (Acoustic rating). The panel insertion loss, per octave band, shall not be less than the following:

Frequency (Hz):	100	125	250	500	1000	2000	4000	8000
Insertion Loss (dB):	24	16	30	32	33	34	63	60

J. Base shall be constructed of welded 10 ga. structural steel G channel perimeter and C channel cross members with integral lifting lugs. Units without a welded structural steel base that utilize lifting provisions near the top of the cabinet shall be unacceptable. Bolted bases shall not be acceptable. Coat base exterior with 2 part epoxy primer and urethane modified enamel topcoat. Removable lifting lugs shall be provided. Weep holes shall be provided in base channels. Base height shall be a minimum of 8" to facilitate proper trapping of drains.

K. Frame shall be constructed of structural tube members designed to support flush-mounted double-wall panels. Vertical frame members shall be easily removable without the use of specialty tools or torches for replacement of large internal components. Welded frame shall not be accepted unless all internal components can be easily removed without cutting any welds. A closed-cell polyvinyl foam gasket with a thickness of 3/16” or greater shall be applied between all frame members and panels, providing a thermal break between the panels and the structural frame. Units without a structural tube frame shall be unacceptable. Frame Material: Extruded 6063 Aluminum Tube

L. Floor shall be 2” thick double-wall, foam injected panel construction for optimal support strength. Floor shall be a fastener free design, bonded to the unit base with a structural adhesive. All seams shall be finished with an adhesive sealant providing a watertight floor system. Use of tack welding, caulk or screws penetrating the entire floor panel anywhere in the floor shall not be accepted. The floor shall have a smooth and flat walk-on surface. A minimum 1" lip shall be provided around all floor penetrations. Walk-on grating shall be provided over all accessible floor mounted duct connections. Paneled floor shall be constructed of a minimum of .063" 5052-H32 mill-finished aluminum walk on surface and 22 gauge galvanized steel underside surface. 0.072” 3003-H22 mill-finished aluminum tread plate shall be provided over the foam-injected double wall floor.

M. Wall and Ceiling Panels shall have non-load bearing, fully removable, heavy gauge 2" double-wall panels which fully encapsulate the injected foam insulation. No individual panel shall exceed 36” width. Panel edges utilizing PVC edge wrappers to cover the insulation shall not be accepted. Panels shall be manufactured with an integral thermal break. Exterior Materials: Exterior skin shall be 5052-H32 mill-finished aluminum. Interior Materials: Interior skin shall be 5052-H32 mill-finished aluminum

N. Insulation shall be a product of a manufacturer specializing in insulating materials. All walls, floor, and ceiling shall be double wall and insulated with polyurethane injected foam insulation. Provide a data sheet from the insulation manufacturer confirming an R-value of 6.3 - 7.1 per inch. No insulation shall be exposed to the airstream. Non-injected foam board insulation or air handler manufacturer produced insulating material shall not be accepted. Fiberglass, mineral wool, and non-injected foam board insulation shall not be accepted.

O. Access Doors. Provide double wall doors with the same insulation and inner/outer wall material as the wall panels. Doors shall have an integral aluminum frame and shall be mounted into the structural frame of the unit. Door openings cut into casing panels shall not be accepted. Doors shall be full height (up to 72”) with industrial continuous stainless steel hinges. Bi-directional compression latches with integral roller cam and hex-screw locking assembly shall be provided. An EPDM type door gasket shall be provided in accordance with ASTM D 2000. Supply and exhaust airstreams shall not be covered by a single door. Access panels in lieu of access doors shall not be accepted. Rain gutters shall be provided over all access doors that are not the full

height of the unit casing. All doors that open with pressure shall be provided with a pressure relief safety latch. Access doors shall be provided for sections requiring routine maintenance.

P. Weather hoods: Provide weather hoods with expanded aluminum bird screens over all exposed inlets and outlets. Hoods may ship loose for installation in the field.

Q. Provide roof with standing seam construction which allows removal of individual sections for inspection purposes without removal of the entire roof. A double wall foam injected panel shall be provided below the roof liner creating 3 layers of metal between the conditioned air tunnel and ambient air. Pitch roof with sufficient slope to ensure water drainage. Units over 137" wide require double sloped roof designs. Roof overhang to be provided around complete perimeter of the unit. No penetrations shall be made through the roof unless specifically approved by the unit manufacturer and fully weatherproofed.

R. Energy Recovery Wheel:
   1. General: Energy recovery wheels shall be desiccant coated rotary air-to-air heat exchangers meeting the performance as listed in equipment schedules.
   2. Flame and Smoke Test and Rating: Energy Recovery Wheels shall have a flame-spread rating of 25 or less and smoke-developed rating of 50 or less as tested in accordance with ASTM E84.
   3. Energy Recovery Wheel Construction:
      a. Energy recovery wheels shall be manufactured of corrugated aluminum treated for corrosion resistance and shall include ion exchange resin desiccant to adsorb and transfer humidity in the vapor phase while avoiding adsorption and transfer of typical ambient non-water vapor molecules.
      b. The aluminum element and desiccant shall be treated with an EPA registered bacteriostatic agent capable of inhibiting growth or reproduction of bacteria on the wheel. Wheels shall be capable of cleaning by soft brush, vacuum-cleaner or low-pressure compressed air.
      c. Wheel surfaces shall be smooth to provide consistent seal gap between the wheel face and the cassette seal ring for the multi-pass seal.
      d. Wheels of more than 60 inches in diameter shall be of segmented construction with the wound element cut into pie shapes which are bolted together to form the wheel. Each pie shaped element shall be held in place by a structural encasement formed of corrosion resistant coated steel which surrounds the cut pie segments. Pies sections shall not require tuning or threaded tie-rods to adjust for out of roundness of the wheel.
      e. The encased pie segments shall be bolted to the hub, to each other and to the periphery rim. Each joint shall be sealed with high grade weather resistant low vapor emitting caulking to prevent air from bypassing the element.
   4. The cassette of the rotary heat exchanger shall have a built-in adjustable purge section providing a minimum cross contamination of exhaust air to the supply air. The purge angle and purge air volume shall be determined by the manufacturer considering the air face velocity, the wheel rotational speed and the differential air pressure between the entering outside air and the entering exhaust air streams at the respective wheel face. (See the air handling unit schedule for the value of the differential air pressure or use 3.0 inches w.c. for design purposes)
   5. The cassette frame shall be constructed of 11 gauge heavy wall welded tube to ensure rigidity and stability. Galvanized block-off and casing side panels shall be included to

form as unitized cassette. Side panels shall be removable to provide access to the wheel for future replacement. Removable motor compartment access panels shall be provided.

6. Cassettes for sizes 2400 and larger shall be shipped in split sections after factory assembly and mechanical testing. The bottom frame shall include the drive motor, drive belt and, half of the wheel pre-assembled to the hub. The hub shall be shaft/bearing mounted to the frame. The top frame shall include the other half of the wheel pre-assembled and suspended within the frame. Both sections shall include shipping restraints to be removed at the time of field assembly. Double ball bearing rollers shall be mounted on the frame to run against the wheel flange in order to maintain the seal gap and prevent wheel deflection against differential air pressure between the supply air and the exhaust air tunnels of up to 10 inches w.c.
7. Purge: The cassette shall be complete with an adjustable built-in purge section to limit carry-over of exhaust air to the supply air stream to 0.04% when operated under design conditions. The purge plate shall be mounted to a pivot and locked into position by secure fasteners for quick field adjustment. A multi-pass seal shall be installed on the swing arm similar to the seals described below. (Please see purge swing arm field adjustment instructions to ensure it is installed in a manner consistent with the factory warranty.) Rotation of the wheel shall be in the direction from the return air through the purge to the supply air side.
8. Seals: The supply and exhaust air stream shall be isolated from each other by means of adjustable multi-pass seals secured to the cassette panels and air separator tube. Multi-pass seals shall consist of a non-contact four or eight finger labyrinth seal. The selection of the seal shall be based on the differential pressure between the supply air plenum and the return plenum as measured in proximity to the wheel face. Multi-pass seals shall be installed with a 2 mm gap between the seal and the wheel flange.
9. Connections: The cassette casing shall include blank turned-in flanges to permit field attachment to air handler bulkheads. The heat wheel cassette shall be securely attached to the floor or raised section and the AHU bulkheads.
10. Corrosion resistant coating: All non-galvanized metal parts exposed to the air streams shall be painted with one coat of primer and one coat of corrosion resistant paint.
11. Wheel support and bearings: The energy recovery wheel shall be shaft mounted and supported by externally mounted pillow block ball bearings supported by the cassette frame. The pillow block bearings shall be provided with a grease fitting. The pillow block bearings shall be mounted to allow convenient service and replacement without the removal of the energy recovery wheel from the cassette.
12. Wheel drive system: The wheel shall be driven by a V-belt installed around the outside of the wheel. A gear motor, pulley and belt tensioner shall be installed and sized to drive the wheel through its complete speed range (1/4-20 rpm) for all seasons and speed control sequences. The gear-motor shall be VFD-rated for variable speed operation. The gear-motor is to be rated for 460/3/60 (480/3/60) power supply. The gear-motor shall be factory mounted in the bottom section of the cassette. The removable gear-motor service access cover shall be mounted in the Return Air section of the cassette.
13. Markings: The manufacturer shall include decals or other markings to indicate the direction of rotation.
14. Acceptable Manufacturers. Provide enthalpy wheel from Seibu Giken or approved equal provided that it meets or exceeds all requirements of this specification.

S. Fan Sections: Supply Blower; Exhaust Blower;

1. Standard of Quality. Fans shall be Greenheck APH, Twin City EPQN, or Cook model PLC with construction details as specified below.

2. Wheel. The fan wheel shall be non-overloading centrifugal type. Wheel shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
    a. Wheel shall be manufactured with a minimum of 12 continuously welded aluminum airfoil blades to move the blade pass frequency into the mid-octave bands.
    b. The entire wheel shall be constructed of aluminum to reduce the rotational weight of the wheel and reduce vibration. Blades shall be constructed of 6063-T5 extruded aluminum to ensure precision blade tolerances, improve efficiency and reduce vibration. Wheel hubs shall be cast of 319 aluminum alloy.
    c. Fan wheel shall not require finish coating.
    d. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.
3. Construction. Plenum fans shall be of the unhoused direct drive centrifugal type.
    a. Fan plate shall be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
    b. Panels and framework shall be constructed of heavy gauge, precision laser cut and die formed ASTM A-569 low carbon steel to provide a rigid structure to support the motor, shaft, bearings and wheel and reduce low frequency vibration.
    c. After fabrication, all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to ensure proper removal of grease, oil, scale, etc. Panels and framework shall be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be RAL 7023, concrete grey. Coating shall exceed 1,000-hour salt spray under ASTM B117 test method. No uncoated steel fan parts shall be allowed.
    d. Supply fan steel parts shall be coated with Hi-Pro Polyester urethane powder coating or 2 part epoxy primer and urethane modified enamel topcoat.
    e. Exhaust fan steel parts shall be coated with Hi-Pro Polyester urethane powder coating or 2 part epoxy primer and urethane modified enamel topcoat.
4. Motor. Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors shall be 3-phase NEMA T-frame, 60 Hz, with RPM as scheduled.
    a. Enclosure shall be Totally Enclosed Fan Cooled (TEFC).
    b. Supply motors housing shall be cast iron.
    c. Exhaust motors housing shall be cast iron.
    d. Service factor shall be 1.15.
    e. Insulation shall be Class F.
    f. Supply fan motors shall be variable frequency drive (VFD) compatible.
    g. Exhaust fan motors shall be variable frequency drive (VFD) compatible.
    h. Supply motors 10 HP and larger shall be provided with shaft grounding rings.
    i. Exhaust motors 10 HP and larger shall be provided with shaft grounding rings.
5. Performance. Conform to ANSI/AMCA Standards 210 and 300. Fans shall be tested in accordance with AMCA Publications 211 and 311 in an AMCA accredited laboratory and certified for air and sound performance. Fans shall be licensed to bear the AMCA ratings seal for air performance (AMCA 210) and sound performance (AMCA 300).
    a. Fan brake horsepower shall not exceed the scheduled brake horsepower at the total static pressure and airflow scheduled.
    b. Provide the number of fans scheduled, no exceptions.
    c. Fan motors shall be selected to run at no more than 70 Hz at design conditions.
6. Mounting. Blower and motor shall be mounted on a unitary isolation base.
    a. Structural steel fan/motor base shall be designed by the manufacturer to properly support the fan/motor assembly to mitigate vibration.

b. 1” deflection housed seismic rated spring isolators shall be provided.
c. Fan inlets shall be connected to a double wall foam injected plenum wall.
d. Fans shall be connected to the plenum wall with canvas flex connectors with edge caps.

7. Variable Frequency Drives: Provide variable speed drive for all plenum fans. VFDs shall be factory provided and factory installed. See Electrical section of this unit specification for more VFD requirements.
8. Refer to Specification Section – ELECTRIC MOTORS, ETC. for more requirements. Fan sections controlled by variable frequency drives and shall be factory installed. Refer to Specification Section - CONTROLS for all VFD specification requirements.

T. Integral Reversible Water-Source Heat Pump System
1. Air/Refrigerant Coil. Provide fully interlaced coil rated in accordance with AHRI 410-2001 with 0.016" thick seamless copper tubes, stainless steel casing, and 0.006" thick aluminum fins. Maximum face velocity is 500 FPM. Each coil shall be water immersion tested to 450 PSI prior to shipment.
   a. Air/Refrigerant Coil Coatings: Electrofin E-Coat.
2. Cooling Coil Drain Pan. All cooling coils shall be provided with Stainless Steel IAQ drain pans that begin at the entering air side of the coil face and extend a minimum of 12” past the leaving air side of the coil face. Entire underside of the drain pan, including the piping run to the casing exterior, shall be coated with no less than 2” of spray foam insulation to ensure no sweating occurs below. Walk-on stainless steel supports spaced a maximum of 6" apart shall be provided to allow full access to the manifold without damage to the drain pan. Drain pans without this feature shall not be accepted. The drain pan shall be sloped in a minimum of 2 directions to ensure proper drainage.
3. Hot Gas Reheat Coil. Provide coil rated in accordance with AHRI 410-2001 with 0.016" thick copper tubes, stainless steel casing, and rippled aluminum plate fin secondary surface with a thickness of 0.008". Provide factory modulating control valve for temperature control. Each coil shall be water immersion tested to 450 PSI prior to shipment.
   a. Hot Gas Reheat Coil Coatings: Electrofin E-Coat.
4. Integral water source heat pump section: Provide integral water source heat pump system factory piped, wired, charged, and tested. Entire heat pump section shall be assembled by the unit manufacturer. Mounting a different manufacturer's heat pump in the casing is not acceptable.
   a. Refer to the schedule for the minimum EER requirements, minimum number of circuits, and minimum number of compressors. Equipment not meeting these requirements will be rejected.
   b. Integral water source heat pump consisting of: scroll compressors, mounted on RIS vibration isolators, air-refrigerant coil, water-refrigerant coil, 4-way reversing valve, suction accumulator, reversible flow filter-drier and sump heaters. Water flow valves, valve actuators, and interlocks shall be provided but shall be installed by others.
   c. Heat pump section shall be fully designed, listed, and labeled for use with R-32 or R-454B refrigerant and shall include all factory-furnished A2L refrigerant safety provisions, labels, charge compliance measures, and control interlocks required by the manufacturer and applicable codes
   d. Heat pump section shall be factory piped, wired, tested, and charged with the manufacturer’s standard refrigerant, which shall be R-32 or R-454B.

e. Provide coaxial water to refrigerant heat exchangers. Brazed plate heat exchangers are not acceptable and will be rejected.
f. The compressors shall provide modulating control from 100% down to 10% of the full refrigeration system capacity. Staged control is not acceptable and will be rejected. Hot gas bypass is not an acceptable method of capacity control and will be rejected. Provide factory modulating head pressure control valve (3-way) shall be provided to keep system operational and optimize efficiency of the compressors.

5. Water Piping Requirements: The heat pump manufacturer is responsible for the following water piping:
a. A strainer factory mounted at each water/refrigerant heat exchanger inlet.
b. P/T ports factory mounted on both sides of the water/refrigerant heat exchanger.
c. A flow switch factory mounted on the leaving water side of the water/refrigerant heat exchanger.
d. The manufacturer shall provide a modulating head pressure control valve for each heat pump circuit. The valve(s) will be shipped loose for field installation and wiring.

U. Outside Air Dampers shall be manufactured by Greenheck, Ruskin, or T.A. Morrison or approved equal. Dampers shall meet or exceed the following construction and ratings.
1. Frame Material:0.125" thick aluminum with thermal break, 5" x 1" hat channel; Blade Material: 0.063" thick extruded aluminum; Blade Type: Polyurethane insulated airfoil with thermal break; Linkage: Plated steel concealed in the jamb (out of airstream). Plastic and/or gear driven linkages shall not be allowed; Axle Material: Minimum 1/2" plated steel; Axle Bearings: Dual bearing with Acetal (synthetic) inner sleeve, flanged outer bearing; Blade Seals: Silicone; Jamb seals: Silicone
2. Ratings. AMCA Class 1A rated at 1” w.c. and Class 1 up to 4-10” w.c. with AMCA certified performance for pressure drop and leakage per AMCA 500-1D, Test Figures 5.2, 5.3, and 5.5. Dampers shall be IECC compliant. Velocity Limit: Suitable for use to 4000 feet per minute; Leakage: 3 cfm/sq. ft (AMCA Class 1A); Temperature Range: -70 deg F to 200 deg F; Pressure Limit: Suitable for use to 8" w.c.; Thermal Efficiency Ratio: 94.1%
3. Shall be equipped with 2-position actuator

V. Exhaust Air Dampers shall be manufactured by Greenheck, Ruskin, or T.A. Morrison or approved equal. Dampers shall meet or exceed the following construction and ratings.
1. Frame Material:0.125" thick aluminum with thermal break, 5" x 1" hat channel; Blade Material: 0.063" thick extruded aluminum; Blade Type: Polyurethane insulated airfoil with thermal break; Linkage: Plated steel concealed in the jamb (out of airstream). Plastic and/or gear driven linkages shall not be allowed; Axle Material: Minimum 1/2" plated steel; Axle Bearings: Dual bearing with Acetal (synthetic) inner sleeve, flanged outer bearing; Blade Seals: Silicone; Jamb seals: Silicone
2. Ratings. AMCA Class 1A rated at 1” w.c. and Class 1 up to 4-10” w.c. with AMCA certified performance for pressure drop and leakage per AMCA 500-1D, Test Figures 5.2, 5.3, and 5.5. Dampers shall be IECC compliant. Velocity Limit: Suitable for use to 4000 feet per minute; Leakage: 3 cfm/sq. ft (AMCA Class 1A); Temperature Range: -70 deg F to 200 deg F; Pressure Limit: Suitable for use to 8" w.c.; Thermal Efficiency Ratio: 94.1%
3. Shall be equipped with 2-position actuator

W. Outside Air Pleated Filter. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for Temporary Use of Equipment Requirements and filter quantities. Provide a flat bank or V-bank filter section as shown on the unit drawing and as follows:
   1. Depth and Rating: 2" MERV-8
   2. Location: Mount filters immediately downstream of the outside air inlet.
   3. Rack: Mount in shared rack with cartridge filters
   4. Face Velocity: Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.
   5. Filters shall be rated per U.L. standard 900.
   6. Filter Pressure Monitoring. Magnahelic pressure gauges shall be provided across all filter racks. A rain/sun shield shall be provided.

X. High Efficiency Cartridge Filter. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for Temporary Use of Equipment Requirements and filter quantities. Provide a flat bank or V-bank filter section as shown on the unit drawing and as follows:
   1. Depth and Rating. Provide 4" MERV-14 cartridge filters
   2. Location: Mount in a shared rack with the pre-filter, immediately downstream of the OA inlet, or in the supply airstream if shown on the unit drawing.
   3. Rack: Provide a galvanized steel front access rack. Front access racks shall include filter clips and be gasketed.
   4. Face Velocity: Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.
   5. Filters shall be rated per U.L. standard 900.
   6. Filter Pressure Monitoring. Magnahelic pressure gauges shall be provided across all filter racks. A rain/sun shield shall be provided.

Y. Return Air Pleated Filter. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for Temporary Use of Equipment Requirements and filter quantities. Provide a flat bank or V-bank filter section as shown on the unit drawing and as follows:
   1. Depth and Rating: 2" MERV-13
   2. Location: Mount filters immediately downstream of the return air inlet.
   3. Rack: Provide a galvanized steel front access rack. Front access racks shall include filter clips and be gasketed.
   4. Face Velocity: Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.
   5. Filters shall be rated per U.L. standard 900.
   6. Filter Pressure Monitoring. Magnahelic pressure gauges shall be provided across all filter racks. A rain/sun shield shall be provided.

Z. Modulating Outdoor/Exhaust Control Dampers
   1. Modulating Control Dampers: Outside air and exhaust air dampers intended for proportional control and installed in exposed outdoor ductwork shall be heavy-duty, low-leakage, insulated airfoil type, specifically rated for outdoor service and operation under the full system static pressure and velocity developed by the associated fan. Dampers shall be AMCA certified for air performance, leakage, and pressure drop and shall be suitable for continuous outdoor exposure, including rain, snow, wind, temperature extremes, and UV exposure. Damper assembly shall be designed for operation at not less than 12 inches w.c. differential static pressure and velocities up to 4000 fpm, unless scheduled otherwise. Damper frames shall be thermally broken extruded aluminum, minimum 0.125-inch thick, with stainless steel jamb hardware and corrosion-resistant

fasteners. Blades shall be insulated airfoil aluminum construction with mechanically retained seals. Provide silicone or EPDM blade edge seals and jamb seals suitable for outdoor service and low leakage performance. Linkage shall be concealed in the jamb and out of the airstream. Bearings shall be corrosion-resistant and suitable for high-cycle modulating service. Damper shall have a maximum leakage rate of 4 cfm/sf at 1 in. w.c. and shall be tested in accordance with AMCA 500-D. Damper shall be suitable for mounting in exposed outdoor ductwork and for modulation under full fan shutoff pressure.

2. Actuators: Modulating dampers shall be furnished with factory-mounted or field-mounted electronic direct-coupled actuators as indicated by the controls documents. Actuators shall be specifically listed or rated for exposed outdoor installation and shall be provided with a NEMA 1 or NEMA 4X enclosure, weatherproof housing, or manufacturer's approved outdoor protective enclosure as required for the installation. Actuator shall be selected based on the damper manufacturer's published torque requirements at the scheduled maximum differential pressure, with not less than 25 percent additional torque margin. Actuator shall be suitable for high-pressure, low-leakage damper service and capable of tight shutoff against the maximum specified differential pressure. Provide spring return where required by sequence or fail-safe position. Actuators shall include adjustable end stops, manual override, and visible position indication. All external hardware, mounting brackets, and linkage components shall be corrosion-resistant and suitable for outdoor rooftop exposure.
3. Airflow Measuring Device: Provide an airflow measuring device in the outdoor/exhaust airstream where indicated, suitable for the maximum system velocity and pressure, factory calibrated, and furnished for full integration with the BAS to allow monitoring and control of airflow.
4. Controls Compatibility: Modulating damper actuators shall be fully compatible with the Temperature Controls Contractor's BAS. Coordinate actuator voltage, control signal, fail position, spring return requirements, auxiliary switches, and control wiring requirements with the controls drawings and sequence of operation. Refer to section 250000.

AA. Combination Fire/Smoke Dampers
1. Dampers shall be low-leakage, dynamic-rated combination fire/smoke dampers, listed and labeled in accordance with UL 555 and UL 555S, and installed in accordance with NFPA 90A and the manufacturer's listing. Dampers shall be suitable for the maximum system velocity and pressure differential at the installed location. Provide actuators, sleeves, retaining angles, breakaway connections, access doors, and accessories required for a complete installation.
2. Actuators for combination fire/smoke dampers shall be listed for fire/smoke damper service, shall be suitable for the installed pressure conditions, and shall be provided with end switches and auxiliary contacts for monitoring and interlock functions.
3. Coordinate damper operation with the fire alarm system, smoke control sequence, duct smoke detectors, and BAS/ATC system as indicated in the Contract Documents.

BB. Prior to Owner use and final acceptance, start-up service shall be performed by the manufacturer's factory-authorized representative. Utilize startup sheets included in the Specification Section GENERAL PROVISIONS - MECHANICAL. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for additional requirements.

CC. Provide eight hours of onsite training for this system. Training shall occur after the system is fully operational and prior to turnover. Owner's operating staff shall be instructed in startup, shutdown, seasonal operation, alarms, routine maintenance, and troubleshooting.

DD. Provide manufacturer's standard warranty for the complete unit and all components for not less than one year from Substantial Completion unless longer warranty periods are specified elsewhere in the Contract Documents. Warranty shall include repair or replacement of components failing due to defects in materials or workmanship. Routine maintenance items such as filters and belts are excluded.

EE. Compressor Warranty: Provide a five-year non-prorated parts warranty for compressors commencing at Substantial Completion unless otherwise required by the Contract Documents.

2.3 VARIABLE AIR VOLUME TERMINAL BOXES (SUPPLY AND EXHAUST):

A. Acceptable Manufacturers: Titus, Price, Nailor Industries, Trane, Carrier, Johnson Controls/York, ETI.

B. Terminals shall be certified by AHRI and bear the AHRI 880 seal.

C. Provide single-duct pressure-independent supply VAV terminal units for ventilation air service only. Units shall deliver ventilation air either directly to the space or to the return of the associated heat pump, as indicated on the Drawings. Supply VAV terminal units shall be controlled through the BAS demand control ventilation sequence in response to associated CO2 sensors and shall modulate between the minimum and maximum airflow values indicated on the Drawings and in the controls schedules. Reheat coils are not permitted unless specifically indicated otherwise.

D. Provide pressure-independent exhaust air VAV (EVAV) terminal units for maintenance of minimum required exhaust airflow from toilet rooms, janitor closets, and similar exhaust spaces. Exhaust VAV terminal units shall maintain the airflow values indicated on the Drawings and shall be suitable for pressure-independent operation over the full range of expected system pressures.

E. Terminals shall be constructed of not less than 22 gauge galvanized steel, able to withstand a 125 hour salt spray test per ASTM B-117. The terminal casing shall be mechanically assembled (spot-welded casings are not acceptable). Terminal shall include control enclosure and hanger brackets. The terminal shall be provided with a removable bottom access panel. Unit shall have right or left hand access to controls(refer to drawings). Maintain clearance as required by code and indicated on the drawings.

F. Casing shall be insulated with minimum 1-inch fiberglass insulation complying with ASTM C1071, ASTM C665, UL 181 erosion requirements, and maximum flame spread/smoke-developed rating of 25/50 per ASTM E84, UL 723, and NFPA 90A. Insulation shall be foil faced and protected so that no raw insulation edges are exposed to the airstream. Raw insulation edges at discharge openings shall be covered with metal liner or nosing; sealant-only treatment is not acceptable. Insulation shall comply with ASTM C1136 for resistance to mold, mildew, and humidity. At an inlet velocity of 2000 fpm, pressure drop across the basic terminal shall not exceed 0.08 inch w.g.

G. Terminal units shall be double-wall construction with insulation fully encapsulated behind a minimum 26-gauge galvanized steel inner liner. No insulation shall be exposed to the airstream. All wire penetrations through the casing shall be protected with grommets.

H. The primary air valve shall consist of a minimum 22 gauge cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material, and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot in self lubricating bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.

I. The differential pressure airflow sensor shall traverse the duct along two perpendicular diameters. Cylindrically shaped inlets shall utilize the equal cross sectional area or log-linear traverse method. Single axis sensor shall not be acceptable. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" W.G. at an air velocity of 450 FPM or less. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements. Terminal shall have access door for inspection and cleaning.

J. Terminal units shall be furnished for integration with the building automation system. Supply VAV terminals shall modulate in accordance with the demand control ventilation sequence in response to associated space CO2 sensors, occupancy inputs, and minimum/maximum airflow setpoints indicated on the Drawings and in the Sequence of Operations. Exhaust VAV terminals shall maintain the scheduled exhaust airflows indicated on the Drawings

K. Provide terminal units with factory-mounted damper actuator and airflow sensor. Provide units suitable for integration with the specified temperature controls system, with controller furnished factory-mounted or by the Temperature Controls Contractor as required by the Controls Section.

L. Terminal units shall be capable of stable operation at the full range of scheduled airflow setpoints, including minimum ventilation and maximum design airflow. Submit certified performance data, sound data, and pressure drop data for each scheduled terminal.Submit radiated and discharge sound power levels in accordance with AHRI 880 for each scheduled terminal.

M. Provide two hours of onsite training for this system after the system is fully operational and prior to turnover. Training shall include terminal operation, BAS interface, airflow setpoint adjustment, maintenance access, and troubleshooting.

2.4 KITCHEN RANGE HOOD EXHAUST SYSTEMS:

A. Type I Exhaust Hood – GREASE LADEN VAPORS: Refer to the Food Service Plans and Specifications.

B. Type II Exhaust Hood – NON-GREASE LADEN VAPORS: Refer to the Food Service Plans and Specifications.

2.5 KITCHEN HOOD EXHAUST FAN

A. Acceptable Manufacturers: Twin City, Greenheck, Cook.

B. Fans shall be direct-drive upblast centrifugal roof exhaust type as scheduled.

C. Type 1 grease hood exhaust fan shall be listed for restaurant exhaust service and shall be UL 762 listed for grease removal and suitable for use with the specified hoods.

D. Provide Type 1 hood exhaust fan with motor enclosure, grease containment/grease box, and all accessories required for listed restaurant exhaust service.

E. Type 2 Hood Exhaust Fans serving Type 2 hood shall be suitable for heat, steam, and non-grease exhaust service and shall be matched to the hood and duct system indicated.

F. Type 1 requirements apply only to fans serving grease exhaust systems. Type 2 requirements apply only to fans serving non-grease hood exhaust systems.

G. Fans shall have aluminum housing, backward-inclined centrifugal wheel, and motor mounted on vibration isolation.

H. Disconnect Switch: Where scheduled, a NEMA 3R disconnect switch shall be supplied with wiring leading from the motor to the junction box (TEFC motors).

I. Accessories: Refer to the drawings for additional requirements.

J. Coordinate fan operation, shutdown, interlocks, and fire suppression interfaces with the Food Service Drawings and Specifications and with the hood manufacturer.

K. Provide a complete hood control system for each hood system, including exhaust fan(s), makeup air VAV box(es), remote control panel, heat sensor interlocks, starters, relays, fusing, and all power/control wiring between indoor and outdoor equipment for a complete operational system. System shall be arranged for single-point connection to a weatherproof control panel unless specifically indicated otherwise. Provide individual disconnect means for each motor. Outdoor control panels shall be NEMA 3R, rain-tight.

L. A recessed stainless steel rangehood remote control panel shall be furnished in location indicated on the drawings. Switches shall be furnished and labeled as follows:
   1. Switch #1 - On/Off – All Hood Lights
   2. Switch #2 - On/Auto – Grease Hood Exhaust Fan (interlock with makeup air VAV boxes)

3. Fan Status Indicator Light
4. Trouble Indicator Light
5. Fire System Trip Indicator Light

M. With Switch #2 in the "ON" position the grease hood exhaust fan and makeup air VAV boxes shall operate continuously. With Switch #2 in the Auto Mode, automatic heat sensors in the hood exhaust collars (one per collar) shall energize the exhaust fan & makeup air VAV boxes when cooking operations occur; with an adjustable set-point of 70 to 85 degrees F. This adjustable controller shall be installed within the rangehood remote control panel and set to 85 degrees F, but not accessible from the face of the panel.

N. Hood supply and exhaust systems shall have final air balance supervised by the hood manufacturer or manufacturer's factory-authorized personnel to obtain maximum performance. Submit air balance report to the Engineer stating final exhaust and supply fan CFM.

O. Fans shall be AMCA certified for air and sound performance.

P. Prior to utilization of equipment, start-up service shall be performed by factory authorized representative. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for additional requirements.

Q. Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, 100% functional, tested, inspected and approved system. Refer to Specification Section - ELECTRIC MOTORS, ETC. for additional requirements.

2.6 ELECTRIC UNIT HEATERS

A. Wall-Recessed Cabinet Heaters
1. Acceptable Manufacturers: Indeeco, Markel, QMark, Berko, or approved equal.
2. Units shall be wall-reccessed cabinet unit heaters of sizes and capacities as scheduled, factory assembled and factory tested, with steel cabinet, electric resistance heating elements, and discharge air arrangement as scheduled.
3. Provide with electric resistance heating elements, automatic fan delay, automatic reset thermal cutout, and integral high-limit protection.
4. Provide ECM fan motor and filter arrangement as scheduled, minimum MERV 13 where filter is provided.
5. Controls shall consist of a local line-voltage wall thermostat. Unit shall operate as a standalone heater and shall not require BAS interface unless specifically indicated otherwise.
6. Provide disconnecting means where required by code or where scheduled. Coordinate electrical characteristics and power connection requirements with Division 26.
7. Units shall be UL listed and labeled and installed in accordance with manufacturer's written instructions.

B. Ceiling Mounted Heaters
1. Acceptable Manufacturers: Indeeco, Markel, QMark, Berko, or approved equal.

2. Provide factory-assembled, ceiling-mounted electric fan-forced unit heaters of capacities and arrangements scheduled. Units shall be flat, surface-mounted or recessed-mounted as indicated on the Drawings.
3. Units shall include steel cabinet, electric resistance heating elements automatic fan delay, automatic reset thermal cutout, and integral high-limit protection.
4. Provide ECM fan motor and filter arrangement as scheduled, minimum MERV 13 where filter is provided.
5. Controls shall be by local line-voltage wall thermostat. Units shall operate as standalone heaters and shall not require BAS interface unless specifically indicated otherwise.
6. Units shall be UL listed and labeled and installed in accordance with manufacturer's written instructions.

C. Industrial Suspended Heaters
1. Acceptable Manufacturers: QMark MUH Series, Indeeco, Markel, Berko, or approved equal.
2. Provide factory-assembled industrial suspended electric unit heaters of capacities and arrangements scheduled, suitable for horizontal or vertical discharge as indicated on the Drawings.
3. Units shall include steel cabinet, electric resistance heating elements, totally enclosed fan motor, adjustable discharge louvers, integral fan delay, automatic reset thermal protection, and manual reset high-limit protection.
4. Controls shall be by local line-voltage wall thermostat. Units shall operate as standalone heaters and shall not require BAS interface unless specifically indicated otherwise.
5. Provide wall, ceiling, or suspended mounting brackets as required for a complete installation. Provide disconnecting means where required by code or where scheduled.
6. Units shall be UL listed and labeled and installed in accordance with manufacturer's written instructions.

2.7 AIR SEPARATOR

A. Basis of Design: Bell & Gossett Rolairtrol Model R-8F. Acceptable manufacturers shall be Bell & Gossett or approved equal.

B. Provide centrifugal air separator with integral strainer for closed-loop heating and chilled water systems. Separator shall be designed and constructed in accordance with ASME Section VIII, Division 1, with carbon steel body and baffle and 304 stainless steel strainer. Unit shall be rated for minimum 125 psig working pressure and 350 degrees F maximum operating temperature. Separator shall have a minimum Cv of 1020 and be selected for 790 GPM with maximum pressure drop of 1.38 feet. Separator may be provided with flanged, grooved, threaded, or other piping connection type as required for the piping system and installation conditions. Furnish removable strainer, factory-coated exterior, and all trim and accessories required for a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that required utilities, supports, housekeeping pads, curbs, openings, and service clearances are in place and ready for equipment installation.

B. Beginning of installation shall constitute acceptance of existing conditions and substrates as suitable for proper equipment installation.

3.2 INSTALLATION – UNITARY EQUIPMENT

A. Install equipment in accordance with manufacturer's written instructions, approved submittals, and the Contract Documents.

B. Locate equipment as indicated, level and shim equipment as required, and anchor or support from structure in accordance with manufacturer's recommendations and code requirements.

C. Protect equipment from dirt, dust, moisture, and physical damage during the balance of construction.

D. Verify hose kit orientation, valve package accessibility, condensate trap installation, and overflow shutdown operation for each water-source heat pump.

E. Install vibration isolation devices, seismic restraints, and flexible duct/piping/electrical connections as specified and as required for a complete installation.

F. Verify minimum and maximum airflow settings for all VAV and EVAV terminals and coordinate final setpoints with the approved controls sequences and balancing report

G. Verify that all equipment is installed with required service clearances and access for filter replacement, coil cleaning, valve service, drain pan cleaning, motor service, and controls access.

H. Coordinate point-to-point verification, actuator checkout, sensor calibration, and sequence testing with the Temperature Controls Contractor.

I. For hydronic or water-connected equipment, provide shutoff valves, balancing devices, vents, drains, unions, and accessories as required by the Drawings and related piping Sections. Where vents are concealed and not readily accessible, extend vent connections to an accessible location.

J. Provide condensate drain piping for all equipment requiring drainage. Install traps, cleanouts, auxiliary drains, and overflow safeties in accordance with manufacturer's written instructions and the Drawings. Route condensate to the nearest approved drain location.

K. Submit manufacturer startup reports, field checkout reports, and deficiency/correction logs prior to Substantial Completion.

3.3 INSTALLATION

A. The Mechanical Contractor shall coordinate all installation requirements including unloading, rigging, hoisting, supports, field wiring, piping, ductwork, controls, field assembly, and all other work required for a complete installation.

B. Manufacturer shall furnish all gasketing, sealants, hardware, splice materials, and accessories required for field assembly of multi-section equipment.

C. The Mechanical Contractor shall verify that the following items have been completed prior to scheduling the DOAS manufacturer's final inspection and start up:
   1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
   2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
   3. All hydronic piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
   4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
   5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
   6. All automatic temperature controls, safeties, actuators, sensors, and interlocks have been installed and verified complete.
   7. All dampers are fully operational.
   8. All shipping materials have been removed.
   9. All (clean) filter media has been installed in the units.
   10. Condensate drains, traps, and overflow safeties have been installed and verified operational.
   11. Duct connections to large air-handling equipment shall be flared/transitioned as indicated on the Drawings and coordinated with the equipment manufacturer.

D. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer’s instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

E. Coordinate point-to-point verification, actuator checkout, sensor calibration, and sequence testing with the Temperature Controls Contractor.

F. Verify that all equipment is installed with required service clearances and access for filter replacement, coil cleaning, valve service, drain pan cleaning, motor service, and controls access.

G. After the Mechanical Contractor has provided all water and steam piping connections, ductwork connections, and field control wiring, and Electrical Contractor has provided all the field power wiring, the Mechanical Contractor shall inspect the installation. The Mechanical Contractor shall then perform startup of the equipment.

H. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall present at the job site at the time of the equipment start up.

I. The Mechanical Contractor, shall perform the following tests and services and submit a report outlining the results:
   1. Record date, time, and person(s) performing service.
   2. Lubricate all moving parts.
   3. Check all motor and starter power lugs and tighten as required.
   4. Verify all electrical power connections.
   5. Conduct a start up inspection per the AHU manufacturer's recommendations.
   6. Record fan motor voltage and amperage readings.
   7. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.
   8. Check fan for excessive vibration.
   9. Check coupling for proper alignment.
   10. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.
   11. Disengage all shipping fasteners on vibration isolation equipment.
   12. Check safety guards to ensure they are properly secured.
   13. Secure all access doors to the fan, the unit and the ductwork.
   14. Switch electrical supply "on" and allow fan to reach full speed.
   15. Physically check each fan at start up and shut down to ensure no abnormal or problem conditions exist.
   16. Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record entering and leaving chilled water temperatures and flow, steam pressures and flow, and outside air temperature.
   17. Verify proper condensate drainage and overflow shutdown operation.
   18. Verify all safeties, alarms, status points, and BAS integration points.
   19. Verify VAV and EVAV airflow modulation and control response.
   20. Verify hood exhaust and makeup air interlocks and automatic heat-sensor operation.
   21. Verify water-source heat pump enable/disable, safeties, and control interlocks.

J. Flush piping systems and clean strainers.

K. Submit manufacturer startup reports, field checkout reports, and deficiency/correction logs prior to Substantial Completion.

3.4 GREASE DUCT LEAKAGE TESTING:

A. Prior to the use or concealment of any portion of the duct system, a duct leakage test shall be performed in the presence of the Code Official. Ducts shall be considered concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides. The Contractor shall be responsible to provide the necessary equipment and perform the duct leakage test. A light test or an approved equivalent test method shall be performed to determine that all welded and brazed joints are liquid tight. A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of the ductwork to be tested. The lamp shall be open so as to emit light equally in all directions perpendicular to the duct walls. A test shall be performed for the entire duct system, including the hood-to-duct connection. The Contractor, Owner, Architect, Engineer, Test and Balance Contractor and the Equipment Manufacturer shall all be present during the Code Official Inspection(s).

B. Prior to the Code Official Inspection(s), the Contractor and the Equipment Manufacturer shall perform a pre-test on all duct systems to include a flashlight test of the ductwork. Any deficiencies shall be corrected and re-tested prior to the formal inspection(s) by the Code Official.

3.5 HOOD PERFORMANCE TESTING

A. Performance test(s) shall be conducted by the Contractor and witnessed by the Code Official upon completion and before final approval of the installation of the ventilation system serving the commercial kitchen appliances. The test(s) shall verify the rate of exhaust airflow and makeup airflow as required as well as the proper operation of the system. The Contractor shall be responsible to provide the necessary equipment and perform the test including 45 second white smoke candles. The test(s) shall emulate actual cooking conditions with all appliances in operation. The test(s) shall also include validation of the automatic controls systems. The Contractor, Owner, Architect, Engineer, Test and Balance Contractor and the Equipment Manufacturer shall all be present during the Code Official Inspection(s).

B. Prior to the Code Official Inspection(s), the Contractor and the Equipment Manufacturer shall perform pre-test(s) on all hood systems to include smoke bomb testing with 45 second white smoke candles. The pre-test(s) shall emulate actual cooking conditions with all appliances in operation. The test(s) shall also include validation of the automatic controls systems. Any deficiencies shall be corrected and re-tested prior to the formal inspection(s) by the Code Official.

C. Provide four hours of onsite training for the kitchen hood exhaust and control system after building completion and prior to turnover. System shall be fully functional and Owner’s operating staff shall be instructed in normal operation, automatic mode, emergency operation, fire system interfaces, and troubleshooting.

3.6 CLEANING

A. After construction is complete, including painting, clean exposed equipment surfaces. Vacuum clean coils, fan sections, drain pans, and accessible cabinet interiors.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials available from manufacturer.

C. Install new final filters after substantial completion activities are complete and prior to Owner occupancy or certificate of occupancy, whichever occurs first.

END OF SECTION

SECTION 233723 - HVAC PUMPS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Electric motors shall be furnished with the pumps and shall be of the size and type scheduled or otherwise specified. All motors shall be UL labeled and shall comply with applicable NEMA standard. Motors to be high efficiency type. Refer to Specification Section – ELECTRIC MOTORS, ETC.

1.2 GENERAL REQUIREMENTS

A. Shop drawings shall be submitted as required and shall include complete pump specifications, installation and start-up instructions, current and accurate pump performance curves with the selection points clearly indicated, maintenance data and spare parts lists.

B. Pumps shall be factory tested, cleaned and painted prior to shipment. Size, type, capacity and electrical characteristics are listed in the pump schedule.

C. Insofar as possible, all pumps shall be by the same manufacturer.

D. Submit manufacturer’s product data for each pump type specified, including:
   1. Construction materials and dimensions
   2. Motor data (HP, voltage, phase, enclosure)
   3. Performance ratings and limits
   4. List of standard and optional accessories

E. For condensate pumps, include reservoir capacity, flow rate, head capacity, electrical requirements, and control features.

F. Pumps shall be selected to operate within the Preferred Operating Region (POR) as defined by ANSI/HI 9.6.3.1 and shall not exceed 110% of Best Efficiency Point (BEP) at design conditions.

PART 2 - PUMP TYPES

2.1 PERMANENTLY LUBRICATED INLINE PUMPS

A. Permanently Lubricated Inline Pumps shall be Series PL as manufactured by Bell & Gossett or equal by Taco, Armstrong, Patterson.

B. The pumps shall be of the horizontal permanently lubricated type, specifically designed for quiet operation. Suitable for 225 degrees F operation at 150 PSIG working pressure.

C. Pumps shall be suitable for variable flow operation where scheduled and shall be compatible with variable frequency drives or ECM motors.

D. Coordinate control sequences, safeties, and interlocks with Division 23 controls.

E. The pumps shall have a solid high-strength alloy steel shaft supported by XL11 permanently lubricated sealed precision bearings. Bearings are to be permanently oil lubricated. Pump shaft shall connect to a non-metallic noryl impeller.

F. Pump shall have integral stainless-steel face plate and double-sided stainless-steel neck rings for increased life and seasonal start-up capabilities.

G. Pump volute shall be of cast bronze. The connection style on bronze pumps shall be flanged with isolation valves.

H. The motor shall be isolated from circulating fluid through use of a carbon/silicone seal attached on a stainless-steel shaft sleeve.

I. Motors shall be of an Open Drip-Proof design and shall be non-overloading at any point on the pump curve. Motors shall be UL listed.

J. Pump shall be of a maintenance free design and be capable of operating in variable speed (varying voltage) applications.

2.2 CLOSED COUPLED INLINE PUMPS

A. Closed Coupled Inline Pump shall be Series e90 as manufactured by Bell & Gossett or equal by Taco, Armstrong, Patterson.

B. The pumps shall be of a vertical or horizontal installation type specifically designed for quiet operation. Suitable for 225° F operation at 175 PSIG working pressure. The pump shall be single stage, vertical split case design, all bronze construction. The pump internals shall be capable of being serviced without disturbing piping connections.

C. Pumps shall be suitable for variable flow operation where scheduled and shall be compatible with variable frequency drives or ECM motors.

D. Coordinate control sequences, safeties, and interlocks with Division 23 controls.

E. The pumps shall have a solid SAE1045 steel shaft that is integral to the motor. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.

F. The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.

G. Pump shall be equipped with a mechanical seal assembly. Seal assembly shall have a brass housing, BUNA bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.

H. Pump shaft shall connect to a brass impeller. Impeller shall be hydraulically and dynamically balanced, keyed to the shaft and secured by a locking caps crew or nut.

I. Pump should be designed to allow for true back pull-out access to the pump's working components for ease of maintenance.

J. Pump volute shall be of cast iron design for heating systems or cast brass for domestic water systems. The connection style on cast iron and bronze pumps shall be flanged. Volute shall include gauge ports at nozzles.

K. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Motors shall have heavy-duty grease lubricated ball bearings to offset the additional bearing loads associated with the closed coupled pump design. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications.

L. Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.

M. Each pump shall be factory tested and name-plated before shipment.

N. Pumps shall conform to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR).

O. Where pumps are variable flow, provide ECM motors for fractional horsepower applications where available.

2.3 CONDENSATE PUMPS

A. Condensate pumps shall be factory-assembled, automatic, electrically operated units suitable for removal of condensate from cooling coils, fan coil units, heat pumps, and similar equipment.

B. Pumps shall consist of a corrosion-resistant reservoir, pump, motor, float switch, check valve, and discharge connection, all contained within a compact housing.

C. Reservoir shall be constructed of high-impact, corrosion-resistant plastic with a removable cover for inspection and cleaning.

D. Pump shall be centrifugal type with thermally protected motor, suitable for continuous duty. Motor shall be 115V, single phase unless otherwise indicated.

E. Unit shall include an integral float switch to automatically start and stop pump operation based on liquid level. Provide integral high-level safety switch for alarm and/or equipment shutdown interlock.

F. Provide factory-installed check valve on discharge piping connection.

G. Maximum sound level shall not exceed 45 dBA at 3 feet.

H. Acceptable Manufacturers:
1. Little Giant (VCMA Series or approved equal)
2. DiversiTech (CP Series)
3. Hartell

I. Coordinate pump capacity and head with system requirements. Minimum capacity shall be 65 GPH at 1 ft head unless noted otherwise.

J. Provide flexible discharge tubing and route to nearest approved drain location. Coordinate with Division 22.

2.4 END SUCTION BASE MOUNTED PUMPS

A. End Suction Base Mounted Pumps shall be Series e1510 as manufactured by Bell & Gossett or equal by Taco, Armstrong, Patterson.

B. Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow servicing of the impeller and bearing assembly without disturbing piping connection. Pump volute shall be Class 30 cast iron with integrally cast pedestal support feet. The impeller shall be cast bronze enclosed type, dynamically balanced, keyed to the shaft and secured by a locking caps crew.

C. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.

D. Baseplate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully open. A flexible type, center dropout design coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor. Coupler shall be shielded by a coupler guard securely fastened to the base. Coupler shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections.

E. Provide all pumps with neoprene couplers. EPDM shall not be acceptable.

F. Pumps shall be suitable for variable flow operation where scheduled and shall be compatible with variable frequency drives.

G. Coordinate control sequences, safeties, and interlocks with Division 23 controls.

H. Pump Accessories -
   1. Isolation valves at suction and discharge.
   2. Check valve and balancing valve at discharge.
   3. Y-strainer with blowdown at suction.
   4. Flexible pipe connectors at pump connections.
   5. Pressure/temperature gauge ports at suction and discharge.
   6. Air vent at high point of pump casing where applicable.

I. High efficiency motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation. Each pump shall be factory tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

J. Provide shaft guard with slotted window. Guard to be removable. Guard to meet ANSI B15.1, Section 8 and OSHA 1910.219 requirements.

K. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.

L. Comply with pump and coupling manufacturers' written instructions.

M. A qualified representative of the pump supplier shall perform the pump alignment prior to start-up of any base mounted separately coupled pump. Adjust alignment of pump and motor shafts for angular and parallel alignment by 1 of 2 methods specified in the H.I.'s Standards for Centrifugal, Rotary & Reciprocating Pumps, "Instructions for Installation, Operation and Maintenance."

N. After alignment is correct, tighten foundation bolts evenly but not too firmly. Fill base plate completely with non-shrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.

O. Alignment Tolerances: According to manufacturer's recommendations, but no more than + .005” in the parallel and angular planes. Provide written report to Engineer and Owner from pump supplier indicating alignment procedure and readings from each pump installation

PART 3 – EXECUTION

A. START UP AND COMMISSIONING
   1. Provide manufacturer’s authorized startup for all base-mounted pumps.
   2. Verify rotation, laser alignment, and performance.
   3. Submit startup report to Engineer.
   4. Include manufacturer’s installation instructions, maintenance procedures, and spare parts lists.

END OF SECTION

SECTION 233725 – DIFFUSERS, REGISTERS, GRILLES, & LOUVERS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, COMMON WORK RESULTS FOR HVAC and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Coordinate with Section 23200 SHEET METAL, Section 230995 – TESTING, ADJUSTING, AND BALANCING FOR HVAC, and Section 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.

1.2 SUBMITTALS

A. A. Submit product data for all registers, grilles, diffusers, and louvers including dimensions, materials, finishes, mounting details, and performance data.

B. Submit a complete room-by-room air distribution schedule indicating:
1. Device tag matching drawings.
2. Airflow (CFM).
3. Throw, spread, and drop.
4. Pressure loss.
5. Noise criteria (NC).
6. Mounting height and ceiling type.

C. Performance data shall be based on published manufacturer test data in accordance with ASHRAE 70.

D. Submit color samples for Architect selection.

1.3 QUALITY ASSURANCE

A. Performance ratings shall be based on tests conducted in accordance with ASHRAE Standard 70.

B. Sound ratings shall be based on AHRI 885.

C. Devices shall be selected to meet scheduled airflow, throw, and noise criteria without excessive balancing damper throttling.

PART 2 - PRODUCTS

2.1 REGISTERS, GRILLES AND DIFFUSERS

A. Acceptable R, G & D manufacturers are Titus, Metal Aire, Nailor Industries, Price Industries or Tuttle & Bailey, or approved equal. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect. If Architect elects not to select color, all colors shall be white. Factory color samples shall be submitted with shop drawings.

B. General Requirements
   1. Provide factory-fabricated devices of steel or aluminum construction.
   2. Devices shall be suitable for the intended application (supply, return, or exhaust).
   3. Provide opposed blade dampers on all supply, return, and exhaust sidewall grilles unless otherwise indicated.
   4. Dampers shall be accessible from face of device unless otherwise approved.
   5. Provide air extractors or equalizing grids where required for performance.

C. Construction
   1. Supply diffusers: Multi-cone, plaque, slot, or linear type as scheduled.
   2. Return/exhaust grilles: Fixed blade, eggcrate, or perforated face as scheduled.
   3. Frames shall be compatible with ceiling systems (lay-in, surface mount, or hard ceiling).
   4. Provide gasketed edges where installed in critical spaces.

D. Finish
   1. Finish shall be factory-applied baked enamel.
   2. Color as selected by Architect. If no selection is made, provide white.

E. Accessories
   1. Plenum boxes for diffusers where required.
   2. Insulated plenums for supply air devices.
   3. Volume control dampers.
   4. Border types compatible with ceiling system.
   5. Blade Scoops as scheduled

2.2 LOUVERS

A. Acceptable louver manufacturers are Ruskin, Greenheck, United Enertech, Arrow or approved equal. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein.

B. General Requirements
   1. Louvers shall be extruded aluminum construction unless otherwise indicated.
   2. Provide stationary drainable blade type for exterior applications.
   3. Provide bird screens on all exterior louvers.
   4. Provide insect screens where indicated.

C. Performance
   1. Maximum face velocity: 400 fpm for intake louvers unless otherwise indicated.
   2. Maximum pressure drop: 0.10 in. w.g. unless otherwise noted.
   3. Minimum free area: 45%.
   4. Louvers shall be tested in accordance with AMCA 500-L.

D. Accessories
   1. Extended sills.
   2. Blank-off panels where required.
   3. Flanges and mounting frames.
   4. Drain pans.

E. Finish:
   1. Factory-applied fluoropolymer or baked enamel finish.
   2. Color as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices level, aligned, and securely fastened in accordance with manufacturer's instructions.

B. Coordinate installation with ceiling systems and architectural finishes.

C. Install opposed blade dampers and ensure accessibility for balancing.

D. Seal duct connections airtight.

3.2 ADUJSTING

A. Adjust devices during TAB to achieve scheduled airflow and performance.

B. Replace any devices that cannot meet performance requirements.

3.3 PROTECTION

A. Protect devices from damage and contamination during construction.

B. Clean all devices prior to acceptance.

END OF SECTION

SECTION 250000 – AUTOMATIC TEMPERATURE CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The Contractor's attention is directed to the General and Special Conditions, 230100 COMMON WORK RESULTS FOR HVAC, and 019113 GENERAL COMMISSIONING REQUIREMENTS and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Refer to Division 22, 23, and 26 along with Division 1 specifications.

1.2 BUILDING AUTOMATION SYSTEM SCOPE AND REQUIREMENTS

A. Sequences of Operation, Control Diagrams and Points Lists are located on the drawings.

B. The controls system for this project shall be a web-based digital controls system. All controllers, control interface hardware, services, installation, warranty, training, etc., shall be included as hereinafter specified. The system shall utilize a network controller and “unitary" controllers. Including such minor details not specifically mentioned or shown, as may be necessary for the complete operation of the system.

C. The Temperature Control Contractor (TCC) shall furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing Web Based Direct Digital Controls. All labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned shall be included for the complete, fully functional and commissioned temperature controls system.

D. The TCC shall provide all items, articles, materials, devices, operations or methods listed, mentioned or scheduled on the drawings including all labor, materials, equipment and incidentals necessary and required for their completion to provide a complete and operating temperature control system. This will include connecting to any mechanical equipment furnished with a control interface device and contacting the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished.

E. These apparatuses shall consist of, but not limited to, all necessary thermostats, sensing devices, valves, automatic dampers, damper motors, actuators, (coordinate with automatic dampers, valves, and damper motors furnished with HVAC equipment), and with the necessary accessories for the complete control of all equipment hereinafter specified.

F. Control sequences are specified in this section and on the drawings. Provide all points, sensors, and control equipment required to perform sequences described. Coordinate all dampers with the sheet metal contractor and equipment provider. It is the responsibility of the control contractor to ensure all required dampers in the sequence of operations are provided.

G. Include all required DDC panels with power wiring and cabling for the operation of the controls system. Refer to Electrical Division Specifications for additional requirements.

H. Include complete dashboard, programming, graphics, and display as indicated herein and included on drawings.

I. Accepted Manufacturer's: Trane, Automated Logic. Alerton, Zenergy
   1. Basis of design manufacturer shall be ABS (Alerton)
   2. School Facility Operator shall be able to upload, download, monitor, trend, control and program every input and output in DDC system using existing Alerton control system software and operator workstations. A link to the operator workstation will not be accepted.
   3. DDC system shall interface with the existing Alerton control system to adhere to The School District graphic and programming standards already in-place.
   4. Provide a building automation system to allow all objects as defined by ASHRAE Standard SPC-135A/95 to be sent to the existing School Wide Alerton control system.

J. Controls Contractor shall also include infrastructure as follows
   1. Include all infrastructure necessary to implement the web-based controls system as described in the specifications, including all hardware, servers, required proprietary or non-proprietary software.

K. Web interface software shall support 16 users simultaneously.
   1. PDF control drawings, sequences of operation and control devices shall be loaded on the web server.
   2. All controllers shall be BACnet. Proprietary controllers shall not be used for controlling of any equipment.
   3. Provide programming tools for setting up and modifying web server.

L. The TCC shall have an established working relationship with the control manufacturer of not less than five years and shall have prior approval from the Owner and are the only allowed supplier and/or installing contractor. The TCC shall have a local office within 100 miles of the project site and provide service and/or replacement parts within a 24-hour notification of a control failure.

M. A mandatory pre-installation meeting shall occur prior to the TCC beginning any work on site. This meeting shall be attended minimally by the Construction Manager, mechanical contractor superintendent, TCC superintendent, Owner, Design Team, and Commissioning Agent. The purpose of the meeting is to have the controls installer communicate their understanding of the system design and how the system is intended operate to the Engineer and get the Engineer's input and agreement. The agreement between the TCC and the mechanical engineer is to be thoroughly documented by the TCC for later reference.

N. The installation shall comply with the Local Authorities and State Fire Marshal code requirements, including normal operating and smoke mode functions (where applicable). The

installation shall comply with the requirements of the NEC, NFPA, UL and the Building Codes, including referenced mechanical, electrical, energy codes, etc.

O. The TCC shall list the following cost breakdowns, material and labor, on the official project schedule of values:
   1. Controls Shop Drawings
   2. Controls Materials & Labor
   3. Controls Power Sub-Metering, Startup, Testing, Documentation, etc.
   4. Controls Graphics
   5. Controls Startup, Testing, Documentation, etc.
   6. Controls Training and Acceptance

PART 2 - SYSTEM REQUIREMENTS

2.1 GENERAL

A. All labeling for this system shall utilize actual final room names and numbers. The room names and numbers on the Contract Documents may not be the Owner's exact requirements. Coordinate with the Owner to ensure compliance.

B. Include in the bid for the Controls Contractor to perform additional 40 on-site hours of on-site programming, adjustments, modifications, etc. as requested by the Engineer during the warranty period after the date of substantial completion for the project.

C. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the control's manufacturer for use as a building operation terminal. The primary point of interface on these PCs will be a standard Web Browser.

D. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system integrated utilizing ANSI/ASHRAE Standard 135-2001 BACnet, LON Works technology, OBIX TCP/IP, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system

E. The TCC shall connect to any mechanical and electrical (power monitoring) equipment furnished with a control interface device. The TCC shall contact the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished. All points not provided with the equipment control interface are the responsibility of the TCC.

F. The operating system shall be based on a distributed control system in accordance with specifications. All building controllers, application controllers and all input/output devices shall communicate via BACnet MS/TP communication protocol. Network controller shall communicate via BACnet over Ethernet (IP).

G. The TCC contractor shall provide access to the system from a location determined by the Owner and from the Consulting Engineer's office (CMTA, Inc.). This shall include remote access requirements, set-up, passwords and any software necessary to access the BAS system.

H. The TCC shall all have access to various types of WEB browsers (i.e. Netscape, IE, etc.), which shall be included for access to the Direct Digital Control (DDC) system via the Owner's Wide Area Network (WAN) and/or Local Area Network (LAN).

I. The TCC shall be responsible for coordination with the Owner's IT staff to ensure that their system will perform in the Owner's environment without disruption to any of the other activities taking place on that WAN/LAN.

J. The Facility Management Control system (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified herein.

K. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

PART 3 - SPECIAL PROJECTS

3.1 REQUIREMENTS

A. The controls system shall consist of a new Network Controller (UNC) with a standalone network backbone. All new unitary controllers will be connected to the new UNC. Provide a dual data drop at the new UNC located within the main mechanical room and at other locations as indicated on the plans. Prior to the bid, coordinate this scope with the appropriate sub-contractor(s)/vendor(s) to insure a complete, working system.

B. It will be the responsibility of the TCC to implement this project onto the school district/town master B.M.S. with no damage to the existing projects. Any computer connected to the WAN, utilizing a web browser and having the proper password shall be able to communicate with the Owner's DDC system.

C. System shall include Network and Unitary controllers.

D. The control system shall include a facility management system described as follows:

1. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC) and/or BACnet (IBC) controllers and other open and legacy protocol systems/devices provided under Mechanical Division or Electrical Division.
2. The Facility Management and Control System (FMCS) as provided in the Division shall be based on the Niagara Framework (or "Niagara"), a Java based framework developed by Tridium. Niagara provides an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over the internet using a

standard Web browser. Systems not developed on the Niagara-Framework platform are unacceptable.

PART 4 - SUBMITTALS

4.1 REQUIREMENTS

A. The TCC shall not start the project installation until the shop drawing submittals have been reviewed by the Engineer. Submittals shall include custom graphics template and floor plans to be used for this project.

B. Submittals shall include hardware, end devices, ancillary control components, a written operating sequence, unitary control wiring, building floor plans showing communication cabling and labels as well as logic flow diagrams. All submittals shall be provided on paper and electronically in PDF format.

C. Submittals shall contain one control drawing per specified system and equipment. Drawing shall include point descriptors (DI, DO, AI, AO), addressing, and point names. Each point names shall be unique (within a system and between systems). For example, the point named for the mixed air temperature for AHU #1, AHU #2, and AHU #3 shall not be MAT but should be named AHU#1MAT, AHU#2MAT, and AHU#3MAT. The point names should be logical and consistent between systems and AHU's. The abbreviation or short hand notation (e.g., MAT) shall be clearly defined in writing by the TCC.

D. Control diagrams shall identify: System being controlled (attach abbreviated control logic text, all digital points, analog points, virtual points, all functions (logic, math, and control) within control loop, legend for graphical icons or symbols, definition of variables or point names and detailed electric connections to all control devices and sensors.

E. Points list shall include all physical input/output. Points list shall be provided in both hard copy and in electronic format and shall include: Name, address, engineering units, high and low alarm values and alarm differentials for return to normal condition, default value to be used when the normal controlling value is not reporting, message and alarm reporting as specified, identification of all adjustable points and description of all points.

F. Submittals shall contain floor plans depicting DDC control devices (control units, network devices, LAN interface devices, and power transformers as well as static pressure sensor in duct and temperature sensors in rooms) in relation to mechanical rooms, HVAC equipment, and building footprint.

G. Submittals shall contain DDC system architecture diagram indicating schematic location of all control units, workstations, LAN Interface devices, gateways, etc. Indicate address and type for each control unit, Indicate protocol, baud rate, and type of LAN per control unit.

H. Electrical wiring diagrams shall include motor start, control, and safety circuits and detailed digital interface panel control point termination diagrams with all wire numbers and terminal block numbers identified. Indicate all required electrical wiring. Provide panel termination

drawings on separate drawings. Clearly differentiate between portions of wiring that are existing, factory-installed and portions to be field-installed.

I. Show all electric connections of the controls system to equipment furnished by others complete to terminal points identified with manufacturer's terminal recommendations.

J. TCC shall provide one complete drawing that shows the control-wiring interface with equipment provided by others.

K. Submittals shall include project specific graphic screens for each system including a picture of the screen with a list of the variables to be placed on the screen.

L. Submittals shall include complete dashboard graphics and equipment.

M. Submittals shall include TCC's hardware checkout sheets and test reports.

N. Submittals shall include the agenda for approval by the engineer and owner of the specified training periods. See training section for requirements.

O. Provide complete panel drawings that are:
   1. Clearly labeled and schematic or drawn to scale.
   2. Show the internal and external component arrangement so that the operators can identify the components by their position if the labels come off.
   3. Wiring access routes shall also be identified so that Class 1 wiring is separated from Class 2 and 3 and so high voltage wiring is segregated from low voltage wiring.
   4. Complete identification of all control devices (manufacturer's type, number, and function).
   5. Provide details for labeling all wiring, control devices, and controllers.
   6. Material and equipment descriptive material such as catalog cuts, diagrams, performance curves, and other data to demonstrate conformance with specifications shall be provided.

P. Include room schedule including a separate line for each terminal unit, heat pump, etc. indicating location and address.

Q. Include control valve schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: code number, configuration, fail position, pipe size, valve size, body configuration, close-off pressure, capacity, valve Cv, design pressure, and actuator type.

R. Include control damper schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: code number, fail position, damper type, damper operator, duct size, damper size, mounting, and actuator type.

PART 5 - O&M MANUALS AND CLOSEOUT DOCUMENTS:

5.1 RELATED SECTIONS

A. Refer to Mechanical Specification Section 230300– SHOP DRAWINGS, MAINTENANCE MANUALS, AND PARTS LIST for additional requirements.

5.2 REQUIREMENTS

A. Operating instructions, maintenance procedures, parts and repair manuals shall be supplied. Repair manuals shall include detailed instructions in the setup, calibration, repair and maintenance of all equipment furnished. Also supplied with these manuals will be a complete parts listing of all devices supplied which is to include part numbers and model numbers of all parts and component parts along with exploded views of devices.

B. All as built drawings (wiring diagrams, flowcharts, floor plans, etc.) shall also be supplied to the owner electronically in PDF format.

C. System specific wiring, control diagrams, sequence of operation and points lists shall be as installed in each control panel. This means as-built drawings, not design (submittal) drawings.

D. Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving.

E. Supply one copy of the software programming manual (hard copy and PDF format). The manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.

F. Provide a Bill of Materials with each schematic drawing. List all devices/equipment and match to schematic and actual field labeling. Provide quantity, manufacturer, actual product ordering number, description, size, accuracy, operating ranges (voltage, temperature, pressure, etc.), input/output parameters, etc.

G. Maintenance manual shall include copies of signed-off acceptance test forms, commissioning reports, start-up reports, etc.

H. The TCC shall turn over to owner two (2) sets of computerized back-ups of the complete temperature control system.

PART 6 - WARRANTY & SOFTWARE LICENSES

6.1 REQUIREMENTS

A. Labor and materials for the control system specified shall be warranted free from defects for a period of 24 months after substantial completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner.

B. The TCC shall respond to the Owner's request for warranty service within 24 hours during normal business hours. The TCC shall respond to the Owner's request for Emergency service (defined as life-threatening or creating the potential to cause property damage) during the warranty period within 4 hours.

C. The TCC shall provide technical phone support to the owner during the warranty period for warranty related issues and for two years after the warranty period. If the technical support location of the TCC is outside of the toll-free calling area for the customer, the TCC shall have a toll-free number or accept collect calls for the purpose of providing technical support.

D. During the warranty period, standard parts for the DDC system shall arrive at the facility within 48 hours of placing an order. Non-standard parts (requiring re-manufacturing or ordering from another supplier) shall be shipped within 96 hours.

E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the TCC shall be provided and correctly installed at no charge during the warranty period.

F. Provide licensed electronic copies of all software for each workstation, laptop, server. This includes, but is not limited to: project graphic images (editing/modifying/creating), project database, trouble-shooting and debugging programs, project-specific programming code and all other software required to operate and modify the programming code (including software at system level, primary control units, secondary control units, and all communication software). Any hardware devices (cables, protection devices) required to operate the software/hardware shall also be provided.

G. All additional licensing needed for this project shall be supplied by TCC. Software license shall not expire or utilize any sort of protection hardware device for its use. In any case owner shall be free to direct the modification of any software license, regardless of supplier to allow open access to all controllers. Owner shall hold the software and firmware licensing. Software license shall not expire or utilize any sort of protection hardware device for its use.

H. System software shall be the latest version available with upgrades provided at the end of the warranty period, and shall be fully licensed to the Owner for the entire system. Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving.

I. Facility Management Software:
   1. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
   2. It is the owner's express goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices.
   3. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier, by Tridium Inc.

PART 7 - TRAINING

7.1 REQUIREMENTS

A. A formal on-site "Hands On" training session shall be conducted for the owner's maintenance personnel. This shall be a minimum of five (5) sessions at six (6) hour each to train the staff on setup, operation, and maintenance of all system(s) and/or devices. This will be at a time and location selected by the Owner at any time within the project construction or warranty period. All training materials and books shall be provided. All sessions shall be given by the manufacturer's "factory" technical representative. (This is defined as someone other than the installing contractor's representative.) All expenses are to be provided by the TCC. All training sessions shall be scheduled at Owner's request.

B. TCC shall conduct training courses for designated personnel in operation and maintenance of system. Training shall be oriented to specific system being installed under his contract and shall be digitally recorded and submitted on flash drive by the TCC.

C. Training shall be a mix of, test exercises, and actual keyboard entry and screen viewing at the operator's terminal. A curriculum shall be discussed and implemented based on the level of expertise of the employees. Hands-on experience and problem solving shall be emphasized.

D. If during any training session, the trainer/owner finds more than three (3) items that need repair, the training session will be immediately terminated. The session will be rescheduled for another date. The re-scheduled training session will be carried out at no additional cost to the Owner.

E. The training shall be oriented to making the owner self-sufficient in the day-to-day use and operation of the DDC system.

F. Additionally, the training shall include:
1. System start-up, shutdowns, power outage and restart routines, alarms, security levels, changing setpoints, changing schedules and other parameters, overrides, freeze protection, manual operation, return to automatic operation, and resetting equipment.
2. All screens shall be discussed, allowing time for questions.
3. Information specifically focused on showing the owner methods of troubleshooting the mechanical systems using the DDC.
4. Use of laptop and hand-held operator interface device, if applicable.
5. Creating, modifying, viewing, downloading, and reloading, trend logs.
6. Remote access to the system.
7. The other training sessions shall be oriented toward answering specific questions from Owner's staff.
8. The trainer must be well grounded in both DDC system operation and in mechanical systems service and shall be the programmer.

PART 8 - COMMISSIONING & VERIFICATION, FUNCTIONAL PERFORMANCE TESTING & CHECKLISTS

8.1 REQUIREMENTS

A. 100% compliance with the requirements of this section is a condition of the Owner's acceptance and start of the warranty period.

B. The TCC shall be responsible for completion of (1) their hardware checkout sheets and test reports, (2) Point-by-point confirmations of ALL points – this includes visual inspection of installed components, and (3) sequence of operation confirmation.

C. This documentation and process shall be complete, approved and accepted by Engineer and Owner prior to acceptance. This information shall be documented as completed. A copy shall be delivered to the Engineer and Owner and included in the O&M manuals. Each subcontractor shall be responsible for completion of their own System Verification Checklists/Manufacturer's Checklists. Sample checklists shall be submitted to the Engineer and Testing Agent for approval.

D. Air and water balancing shall be completed (and discrepancies resolved) before the TCC's final system check and before the acceptance test to be conducted in the presence of the Engineer.

E. Refer to Mechanical Specification Section – COMMON WORK RESULTS FOR HVAC for additional information and requirements.

PART 9 - WIRE MANAGEMENT, ELECTRICAL POWER, ETC

9.1 RELATED SECTIONS

A. Refer to 260010 – GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS and 260500 – COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS section of this specification for additional requirements.

9.2 REQUIREMENTS

A. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.

B. All wiring and cabling in tunnels, crawlspaces, mechanical and electrical rooms shall be in conduit or MC cable. No wiring or conduit can be exposed to view in any other area. Conceal all wiring and cabling in conduit (or MC Cable) in wall from thermostats or other controls devices to above ceiling. Install conduit in wall from wall thermostats to above ceiling for cabling. Route wiring directly to cable tray from control points above the ceiling. Rough-in for control devices shall be in compliance with the requirements of the ELECTRICAL SPECIFICATIONS.

C. Any power for controls shall be fed from dedicated circuits in emergency electrical panels, when provided for a project, and shall not be obtained from receptacles, lighting, or equipment circuits. Unitary control power may be obtained from the equipment served. If power is obtained from the equipment served, the power may not be interrupted to the electronics if the equipment is off for any reason.

D. The TCC shall be responsible for the power source to any control panels, unitary controllers, etc. on any controlled equipment and all other control power requirements. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.

E. Prior to installation, ensure coordination with all trades, that appropriate clearances (36” minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, heat pumps, etc.

F. The TCC shall provide all CAT6 cabling network cabling for a complete system. This shall include cabling to the Owner’s data drop. The main system data drop will be provided by others.

G. All control circuits within the electrical panels shall be marked to indicate equipment served.

H. The TCC shall perform all temperature control interlock wiring. This shall include control valves, dampers, thermostats, indoor/outdoor HVAC systems, etc. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid

and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.

I. The TCC shall be responsible for any power required for the unitary controls or control panels. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.

J. Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic control components. This receptacle may be served from the control panel 120 VAC power source.

K. All wiring shall be continuous runs. Any junctions must be made in metal enclosure.

L. Grounding terminals shall be color coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip. Terminals shall be Entrelec M 4/5.3A. PI or equivalent by Weidmuller, Phoenix, or Allen Bradley.

M. Contractor shall insure control panels have an identification label stating the "Certification Agency" such as UL, CE, etc. or a label of certification for each control panel by a Professional Engineer (P.E.) stating that the design of the control panel was under their direct supervisory control. Include with shop drawings.

N. An electrical contractor licensed by the State of Connecticut with a licensed Master Electrician and a licensed on-site electrician can install the electrical wiring for lighting controls systems or Building Automation Systems (BAS).

PART 10 - CABLING

10.1 RELATED SECTIONS

A. Refer to 260010 – GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS and 260500 – COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS section of this specification for additional requirements.

10.2 REQUIREMENTS

A. All control wiring shall be installed in a wire management system to include cable trays, bridle rings, & conduits. No exceptions! Coordinate with electrical contractor to insure a complete wire management system.

B. Acceptable cable manufacturers are Belden, West Penn or Alpha.

C. A complete cabling system shall be furnished and installed, which shall adhere to the highest workmanlike standard of quality and appearance. Cabling shall be installed square with building lines and contained within a wire management system.

D. All sizing of cabling shall be according to manufacturer's recommendations, but shall be a minimum of 18 AWG.

E. Furnish a floor plan of the building indicating communication cable labeling and routing as well as addresses and branch wiring from the unitary devices. All cabling shall be labeled on both ends. The type, size and label of all cabling shall be indicated on submittal floor plan drawings.

F. Wall space temperature sensor cabling (from the sensor to the unitary controller) shall be a minimum of two conductor communicating type.

G. All cabling shall be stranded. "NO" solid conductors will be accepted. All cabling shall be 100% shielded with appropriate drain wire and insulation.

H. All cable connections shall be continuous run (including shield). Any junctions must be made in a metal enclosure, connections must be soldered, taped and the metal enclosure must be mechanically attached to the nearest ground. No wire nuts or crimped connections will be accepted. Note location of junction boxes on the as built floor plans. All cabling networking unitary controllers, and other networked equipment, shall be in soldered.

I. All shields must be terminated as per manufacturer's recommendation. Shield termination requirements by the manufacturer must be provided with submittals.

J. Wireless controllers are not approved unless specifically mentioned in the sequence of operations or noted on plans.

PART 11 - SYSTEM SOFTWARE

11.1 RELATED SECTIONS

A. System software will be the latest version available with upgrades provided for full warranty period, and shall be fully licensed to the owner for all network controllers and servers. Refer to WARRANTY section of this specification for additional requirements.

11.2 REQUIREMENTS

A. The BAS shall include trend logging screens accessible from tabs on the home page for building utilities usage.

B. System software shall, at a minimum, provide:
   1. Monitor and supervise all control points.
   2. Add new points and edit system database.
   3. Change control setpoints, timing parameters and loop tuning of PID coefficients in all control loops in all control units.

4. Enter programmed start/stop schedules.
5. View alarm and messages.
6. Modify existing control logic (or sequence of operation) in all control units.
7. Upload/Download programs, databases, control parameters, etc.
8. Modify graphic screens.

C. Sequence of operation programming methodology - The application software shall be user programmable. Application programming shall be (1) Line type programming that uses text programming in a language similar to BASIC or FORTRAN, or (2) graphical block programming - The method of programming shall be by manipulation of graphic icon "blocks." Each block represents a subroutine containing the programming necessary to execute the function of the device that the block represents.

D. Unitary Control Unit Database Archiving - The host software shall provide capability to upload sequence of operation, database, and other control parameters from each controller. Uploaded programs shall be retained on hard disk for system backup. Programs may be modified using Editor functions, and downloaded to individual controllers as desired. Downloading of databases shall not interrupt other multi-tasked functions that are ongoing.

E. Third Party Software Packages - The host software shall provide the capacity to run third party software packages for word processing, spreadsheets, or database management programs. Use of third-party software shall not suspend operation of background tasks of multi-tasking operating system, such as alarm logging, and report generation.

PART 12 - OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

12.1 GENERAL INFORMATION

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, Lon Works technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

12.2 REQUIREMENTS

A. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each Lon Works device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device’s compliance level. Minimum compliance shall support the ability to support data read and write functionality and those features as specified. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

B. All components and controllers supplied under this Division shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.

C. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

D. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.
   1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
   2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

PART 13 - NETWORKS

13.1 REQUIREMENTS

A. The Local Area Network (LAN) shall be a minimum 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:
   1. Ethernet; IEEE standard 802.3
   2. Cable; 100 Base-T, UTP-8 wire, category 6
   3. Minimum throughput; 100 Mbps.

PART 14 - NETWORK ACCESS

14.1 REQUIREMENTS

A. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer’s Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

B. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control

devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of Lon Works controller data, BACnet controller data, and any device connected through an optional software driver installed in the NAC
7. Network Management functions for all Lon Works based devices

PART 15 - GRAPHICAL USER INTERFACE SOFTWARE

15.1 REQUIREMENTS

A. Provide PC based work station, Intel multiple core, 3 GHz minimum utilizing solid-state hard drive and 8 GB ram; Include 24" minimum monitor.

B. The GUI shall operate on Microsoft Windows XP Professional.

C. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

D. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL’s, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
    a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

E. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
1. Create, delete or modify control strategies.
2. Add/delete objects to the system.
3. Tune control loops through the adjustment of control loop parameters.
4. Enable or disable control strategies.
5. Generate hard copy records or control strategies on a printer.
6. Select points to be alarmable and define the alarm state.
7. Select points to be trended over a period of time and initiate the recording of values automatically.

F. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

G. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

H. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

I. Alarm Console
1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

PART 16 - WEB BROWSER CLIENTS

16.1 FEATURES AND USER EXPERIENCE

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:
   1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
   2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
   3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
   4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
   5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
   6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
      a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
      b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
      c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
      d. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
      e. View logs and charts
      f. View and acknowledge alarms
      g. Setup and execute SQL queries on log and archive information

7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

PART 17 - NETWORK CONTROLLER (UNC):

17.1 ESSENTIALS AND USER ACCESS OVERVIEW

A. All controllers shall be properly labeled. Controller shall meet the requirements of UL512 and be arc flash compliant.

B. The Network Controller shall be web-based and communicate BACnet IP. It shall issue all time schedules, summer/winter commands, customized trending, holiday scheduling, alarm handling, clock or other shared commands to all unitary controllers within the building network. If for any reason communications between the unitary(s) and the Network Controller is lost, the unitary(s) shall operate in a stand-alone manner (in day operation) until communications is restored. It shall also operate in the "summer" or "winter" mode as last commanded.

C. The Network Controller shall be integrated and interoperable with the facility infrastructure and include user access to all system data locally over the Local Area Network (LAN) / Wide Area Network (WAN) within the building and remotely by a standard Web Browser over the Internet. Any computer connected to the network, utilizing a web browser and having the proper password.

D. The Network Controller shall be a fully user-programmable, supervisory controller. It shall monitor the network of distributed unitary controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers.

E. The Network Controller shall have battery back-up to allow a minimum of seven days of operation. The Network Controller shall be composed of one or more independent, stand-alone, microprocessor to manage the network strategies described in Application software section. The network controller shall have ample memory to support its operating system, database and programming requirements. The operating system of the Network Controller shall manage the input and output communications signals to allow distributed unitary controllers to share real and virtual point information and allow central monitoring and alarms. The database and custom programming routines of the Network Controller shall be editable from a single operator station.

F. The Network Controller shall be remotely monitored via the internet. Additionally, it shall include automatic emailing and texting out alarms, gathering alarms, reports and logs, programming and downloading database.

G. The Network Controller shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:

1. Assume a predetermined failure mode.
2. Emit an alarm.
3. Display card failure identification.

H. Under no circumstance shall more than 75% of the total number of sensor and control points be connected through a single Network Controller. Each DDC system component shall provide for the future addition of at least 20% of each type of the number of sensor and control points connected to that component including a minimum of one universal input and one universal output.

PART 18 - UNITARY CONTROLLER

18.1 INSTALLATION, CONFIGURATION, AND REQUIREMENTS

A. Unless otherwise specified, each piece of equipment shall have its own Unitary Controller (i.e., heat pump, DOAS, etc.). The Unitary Controller for each piece of equipment shall be mounted on the wall near the side of the unit unless shown otherwise. The Unitary Controller for all other equipment shall be mounted in a panel and properly labeled.

B. The Outside Air Unit shall have its own Unitary Controller mounted where shown on the drawings. If an installation location is not clear, the Contractor shall notify the Engineer for clarification prior to installation.

C. Unitary Controllers used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F. All Unitary Controllers shall have an RJ-11 or similar type connection for monitoring or programming access by room or local equipment level with access to any unitary within the network without modification.

D. Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet the requirements of UL512 and be arc flash compliant panels.

E. Unitary Controllers utilized in the network shall have full stand-alone capability including time of day and holiday scheduling as well as all energy management functions such as optimal start/stop, duty cycling, etc. The terminal unit Unitary Controllers may be pre-programmed with the project specific sequence of operation as specified for the application. Any re-programming of the electronics shall be performed on location using a portable personal computer with appropriate software or through the Network Controller. The entire unitary data base shall have the capability of being backed up and or downloaded locally.

F. All points to have a unique digital input to the BAS system. The use of digital point count expanders is not an acceptable replacement to digital inputs to the unitary controller. The conversion of a single universal input channel to accept up to multiple voltage free contacts such as relay contacts, auxiliary starter contacts, differential pressure switches, etc. is not acceptable.

G. Unitary Controllers shall communicate via BACnet MSTP or LonMark/LonTalk communication protocol. A BACnet Protocol Implementation Conformance Statement (PICS)

shall be provided for each Unitary Controller that will communicate on the BACnet MS/TP Bus.

H. All Unitary Controllers shall be fully application programmable. All control sequences within or programmed into the unitary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery shall be retained.

I. Unitary Controllers shall have a 20% spare point capacity to be provided for all applications.

J. The Unitary Controller for equipment shall be mounted in a panel and properly labeled. Prior to installation, insure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for equipment, etc.

K. After a power failure, the Unitary Controller shall operate the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

PART 19 - SENSORS AND MISCELLANEOUS DEVICES

19.1 SENSOR RESOLUTION

A. All temperature sensors shall have a minimum resolution - ±0.36 °F over range of 32 to 116 °F (0 to 47 °C); ± 0.19 °F at 72 °F (22 °C). Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. Outside air, water and duct sensors shall be tested and accurate to within 0.5 degrees F.

19.2 SPACE SENSORS AND THERMOSTATS:

1. Refer to the drawings for proper type and location.
2. All thermostat and sensors shall be provided with temperature indication, unless otherwise noted.
3. Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point for supervised areas.
4. Unsupervised areas shall have non-adjustable set-point.
5. Generally, thermostats/sensors shall be installed 54" above the finished floor if accessible by side wheel chair access.
6. Where thermostats/sensors are to be mounted next to a light switch, install at the same height as the light switch.
7. Sensors in hallways, vestibules, stairways, restrooms and locker rooms shall utilize a stainless-steel surface mount temperature sensor installed on an interior wall or partition (2"x4" stainless steel blank plate). Care must be taken in the installation of these sensors to ensure proper insulation from the wall temperatures in order to properly sense space temperature.
8. If there is a question consult engineer prior to rough-in.

19.3 WATER SENSORS

A. Temperature sensors for water lines are to be the well type. Wells are to be threaded brass (same manufacturer as the temperature sensor) with the sensor coated with a heat transfer compound. Strap on sensors will not be acceptable.

19.4 OUTDOOR AIR SENSOR

A. The outdoor air sensor will be installed on the north wall in the shade as not to be affected by sunlight, building ventilation or weather. This location shall be indicated on the control drawings. Installation in outside air ductwork or louvers is not acceptable. If not installed to provide "accurate" temperature readings, it shall be relocated (at the TCC's expense) until a suitable location is found.

19.5 MIXED AIR SENSORS

A. These sensors shall be bendable averaging, type made of copper or aluminum elements. In unit ventilators, these sensors shall be at least five (5) feet in length and installed in the discharge air of the unit. For Air Handling Units, Outside Air Units, etc. the sensors shall be at least 20 feet in length.

19.6 DISCHARGE AIR AND DUCT ROOM RETURN AIR SENSORS

A. Shall be rigid insertion type. In all applications, care shall be taken to ensure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.

19.7 FREEZE/LOW-LIMIT THERMOSTAT

A. Provide a freeze/low-limit thermostat in each Air Handling Unit, Outside Air Unit, etc. with a water coil for freeze protection. These devices shall be the manual reset type. This device shall be wired by using a normally closed contact in series with the motor starting circuit and a normally open set of contacts as an input to the unitary controller. The element shall be constructed of copper and be at least 20 feet in length. It shall be installed serpentine across the air leaving the coil. Each application should be closely evaluated before installation. The device shall sense the lowest temperature by any one-foot section of its element.

19.8 HUMIDITY SENSORS

A. These devices shall be 100% solid state, linear and temperature compensated with a 0-100% RH range. The response time shall be a minimum of 30 seconds for a 60% change. They shall have a 1% accuracy between 0% - 90% RH - Do not submit products that do not meet this range. The output of the device shall utilize a 0-10 VDC signal. The device shall use a power supply of 24 VAC or VDC. Duct mounted sensors shall have at least 4" insertion probe with a 16-gauge steel enclosure. NIST traceable certification shall be provided to the Engineer as part of

the shop drawings. For wall mounted sensors the enclosure shall be polystyrene plastic mounted next to and at the same height as the temperature sensor in that area. Both shall have the same appearance. Annual calibration shall be required for 5 years after substantial completion by the TCC.

19.9 COMBINATION TEMPERATURE/HUMIDITY SENSORS

A. All temperature sensors shall have a minimum resolution of - ±0.36 °F over range of 32 to 116 °F (0 to 47 °C); ± 0.19 °F at 72 °F (22 °C). Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. The humidity sensing device shall be 100% solid state, linear and temperature compensated with a 0-100% RH range. The response time shall be a minimum of 30 seconds for a 60% change. They shall have a minimum of 3% accuracy minimum accuracy of ± 3% at 10 to 90% RH. RH non-condensing and maximum hysteresis +/_1.5% RH.– Do not submit products that do not meet this range. The output of the device must utilize a 0-10 VDC or 4-20mA signal as required. The device must use a power supply of 24 VAC or VDC. Duct mounted sensors shall have at least 4" insertion probe with a 16 gauge steel enclosure. NIST traceable certification shall be provided to the Engineer as part of the shop drawings. For wall mounted sensors the enclosure shall be polystyrene plastic mounted next to and at the same height as the temperature sensor in that area. Both shall have the same appearance. Provide protective cages in fitness and common areas.

19.10 LOW PRESSURE TRANSDUCERS

A. These devises shall be 100% solid state, linear and temperature compensated. Accuracy shall be no less than plus or minus 1% of its full range. Linearity, repeatability and hysteresis shall be no less that plus or minus 0.1%. All pressure sensors shall utilize output averaging/output clipping to adjust and stabilize any fluctuations in the output. The output of the device shall utilize a 0 - 10 VDC signal. The device shall use a power supply of 24 VAC or VDC. The enclosure 16-gauge steel. For sensing internal static pressure of air handling ducts utilize sensors with a rage of 0 to 5 inches water column. For sensing building static pressures (building compared to atmospheric) utilize a sensor with a range of -0.25 to +0.25 inches water column.

B. Provide down duct static pressure sensors at locations shown drawing. Final sensor location shall be subject to adjustment during startup and TAB based on actual field conditions and system operation. Contractor shall include all labor, materials, wiring, conduit modifications, and controls work required to relocate the sensor as necessary for proper system control at no additional cost.

19.11 RELAYS

A. Relays for starting and stopping fractional horsepower motors shall be rated as follows:
   1. 1/4 horsepower motors or less use 15 ampere rated relays,
   2. 1/3 horsepower motors use 20 ampere rated relays,
   3. 1/2 horsepower motors use 30 ampere rated relays,
   4. Relays used for pilot duty service shall be rated at a minimum of 10 amperes.

5. Provide auxiliary pilot duty relays on motor starters as required for control function.
6. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

19.12 FLOW SWITCHES

A. Flow switches utilizing differential pressure type switches, UL listed, Vent 1 type enclosure.

19.13 OA HANDLERS

A. The Outside Air Unit shall be provided with a D.A.P. (differential air pressure) switch across each the supply fan to provide fan status for each air handler.

19.14 SMOKE SHUTDOWN

A. All OA units, Heat Pump Units, etc. with fans of greater than 2,000 CFM serving more than one space are required to have smoke shutdown safeties as required by the Building Code. These smoke detectors shall have a set of auxiliary contracts wired to a dedicated input of the Unitary to provide status of the smoke detector. All units must be provided with a current sensor to provide fan status for each air handler. For projects with Outside Air (OA) units, any system fire alarm activation shall shutdown all OA units. Coordinate with the Fire Alarm Contractor to insure a complete, code compliant installation.

19.15 CURRENT SENSING DEVICES

A. Veris Industries model Hx08 Series and H701 or equal. All current sensors shall be capable of alarming to the BAS for belt losses, pump coupling shear or other mechanical failure on loads.

19.16 SINGLE DIRECTION WATER FLOW METER

A. Onicon Model F-1200 series dual turbine insertion flow meter. 50:1 turn down with 2% accuracy with 0.4 to 20 fps range. Install flow meter with sufficient pipe diameters as recommended by manufacturer. Provide factory authorized start-up verification of operation and calibration. Provide with remote display where indicated.

19.17 BI-DIRECTIONAL WATER FLOW METER

A. Onicon Model FB-1200 series dual turbine insertion flow meter. 50:1 turn down with 2% accuracy with 0.4 to 20 fps range. Install flow meter with sufficient pipe diameters as recommended by manufacturer. Provide factory authorized start-up verification of operation and calibration. Provide with remote display where indicated.

19.18 POTABLE WATER FLOW METER

A. Neptune domestic water meter suitable for potable water service, with integral register mounted on meter body and pulse output for remote monitoring. Provide factory calibrated meter/register assembly with dry contact pulse transmitter and all accessories required for a complete installation. Install meter with sufficient straight pipe diameters as recommended by manufacturer. Provide remote register/display where indicated.

19.19 BTU METER

A. Provide and install ONICON System -10 MTU Meter system, including F-3200 in line electromagnetic flow meter, supply and return temperature sensors and wells and control panel. The entire system shall be factory calibrated and programmed for particular system where installed (geothermal system and 2-pipe system) and shall be re-programmable at the control panel keypad. Furnish a certificate of calibration for each BTU meter. Interface the control panel into the DDC controls system to obtain energy totals, flow rates, temperatures (supply and return) for trending. Install flow meter with sufficient pipe diameters as recommended by manufacturer. Provide factory authorized start-up verification of operation and calibration. Provide with remote display where indicated.

19.20 TRANSFORMERS/POWER SUPPLIES

A. Shall be UL listed, Class 2, current-limiting type (or over-current protection). Unit output shall match connected requirements included current output at a 50% safety factor. Units shall operate between 0 degrees C to 50 degrees; UL recognized.

19.21 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Provide Rosemount (ITT Bell & Gossett ST-102R) or Johnson Controls Setra DPT 2302-050-V field mounted differential pressure sensor transmitters as indicated on the plans. Range shall be 0-25 psig. Accuracy shall be .025% full span.

B. Locate differential pressure sensors in locations shown on drawing for pump speed control. Final location shall be subject to adjustment during startup and TAB to ensure the sensor reads a stable and representative differential pressure at the hydraulically critical point. Contractor shall include all required labor and materials to relocate the sensor at no additional cost.

19.22 CARBON DIOXIDE SENSORS/ TRANSMITTERS

A. This sensor shall be electronic non-dispersive infrared (NDIR) type, diffusion sampling with LED or LCD display.
   1. Measurement Range 0-2000/5000 ppm (programmable)
   2. Accuracy ±30 ppm ±2% of measured value*
   3. Repeatability ±20 ppm ±1% of measured value
   4. Response Time <60 seconds for 90% step change
   5. Input Power 20 to 30VDC/24VAC; 100mA max.

6. Analog Output 4-20mA, (clipped & capped)/0-5VDC/0-10VDC (selectable)
7. Operating Temperature Range 0° to 50°C (32° to 122°F)
8. 5-year calibration interval (recommended)
9. Low ambient sensitivity

19.23 WEATHER STATION HOUSING

A. Provide Kele Model A21 Outdoor Aspirated Humidity/Temperature housing. NEMA 3R enclosure is painted white to reduce the effect of radiation, and the enclosure has a lockable latch for security. The outdoor air sensor will be installed on the north wall in the shade as not to be affected by sunlight, building ventilation or weather. This location shall be indicated on the control drawings. Installation in outside air ductwork or louvers is not acceptable. If not installed to provide "accurate" temperature readings, it shall be relocated (at the TCC's expense) until a suitable location is found.

PART 20 - DAMPERS AND ACTUATORS

20.1 TECHNICAL REQUIREMENTS AND INSTALLATION GUIDELINES

A. Unless otherwise specified, valves shall be furnished and sized by the TCC. The valves are to provide the required capacity and the close off rating shall be in excess of the system pressures encountered (minimum 40 psi differential). Proportioning-type valve bodies shall be packed type with throttling type inner valve (quick close plug shall not be acceptable). Proportional type valves to be rated at 125 psi static pressure. Modulating control valves shall be selected within a 3-5 psig pressure drop range. Two position control valves (open/close) shall be line size.

B. Dampers for various units requiring field mounting shall be tight closing, "ultra-low leakage", opposed blade with side and edge seals. They shall be sized and furnished under this section. Installation of dampers shall be by the sheet metal contractor, coordinated by the TCC. Frames shall be no less than 16-gauge galvanized steel and furnished with mounting holes for duct mounting. Damper blades shall be no less than 14-gauge galvanized steel with maximum blade width of 8 inches. Blades shall be secured to 1/2-inch zinc plated axles and hardware with nylon bearings. Provide thrust bearings at the end of each blade. All dampers shall have end switches to positively prove damper position.

C. All damper and valve actuators shall be fail-safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They shall return to the normally open position upon a loss of power. Exceptions to the spring return applications are (1) face and bypass actuators, (2) boiler 3-way loop mixing valves, (2) boiler room seasonal changeover valves. Actuators for fan coil units, terminal units, etc. shall fail in the last position.

D. "ALL" Actuators shall be of the same manufacturer and have internal feedback circuitry to provide a positive action to insure proper positioning of the damper or valve through the entire sequence. Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application.

E. Actuators may be factory installed. If not, factory installed, they shall be installed as per instructions by the terminal equipment manufacturer.

F. Locations mounted above ceiling shall be marked on ceiling grid.

G. Install damper motors on the outside of the duct in warm areas where possible, not in air stream or locations exposed to outdoor conditions.

H. For outdoor actuator installation, provide electric actuators with NEMA 4 or 4X enclosure, externally mounted and sized for the required torque under maximum operating conditions. Coordinate actuator control, end switches, and fail position with the BMS and DOAS-1 control sequence.

PART 21 - VARIABLE FREQUENCY DRIVES (VFDs)

21.1 TECHNICAL SPECIFICATIONS AND REQUIREMENTS

A. The work includes all labor, materials, and related items to completely furnish and install, start up and test, and place into service the Variable Frequency Drives (VFDs) indicated and scheduled on the Drawings and described in the Specifications.

B. VFDs shall be as manufactured by ABB, Graham/Danfoss, or Square D. All VFDs for the project shall be by the same manufacturer (no exceptions). Coordinate VFD with equipment requiring variable speed drives. Refer to drawings for schedule.

C. VFDs shall be consist of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

D. The VFD shall be capable of operation form AC voltage in two rages 208–240 VAC ± 10%, or 380–480 VAC ± 10%. 50/60 HZ operation, ± 2 hertz.

E. The VFD enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated, suitable operating conditions: $0 – 40^0$ C continuous. Drives that have thermal cut out circuits, or that cannot operate continuously at 40^0 C shall not be acceptable. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing.

F. The VFD shall produce an adjustable AC voltage/frequency output for step less motor speed control utilizing sine wave coded Pulse Width Modulation (PWM) The Drive shall provide automatic power factor correction and a .98 displacement power factor by incorporating a full wave diode bridge rectifier. The VFD shall have an overload rating of 110% of nominal rated current for 1 minute out of every 10 minutes of operation, which is an acceptable overload for centrifugal loads.

G. The VFD shall include a built-in first environment RFI/EMI filter and be CE and UL labeled. It shall also meet the CE requirement of EN61800-3 which provides an actual test procedure that shows that the VFD is immune from RFI/EMI interference and at the same time does not emit RFI/EMI noise that would interfere with other sensitive equipment near the VFD.

H. The VFD shall include as a minimum a 5% dual DC link or AC line reactor for a clean harmonic signature, which aides in complying with IEEE-519-1992 recommended levels. The VFD manufacturer and representative shall assist in ensuring that the VFD's applied meet IEEE-519-1992 by completing a computer aided Harmonic Analysis of the complete system.

I. The VFD shall include as a standard a built-in digital keypad/display panel. This panel shall provide "Hand" off "Auto" selection, and a manual speed adjustment via up and down arrows. All faults and warnings shall be provided in "Plain English" for operation without a manual. The drive shall have a complete manual stored in memory that can be accessed with a single keystroke. This display shall be password protected and allow all setup parameters to be adjusted only by authorized personnel.

J. The VFD shall include built in Startup, Diagnostic, and Maintenance assistants, which allow for step-by-step startup procedures, troubleshooting, and the ability to indicate when the VFD and the system it is applied to needs preventive maintenance performed.

K. The VFD shall include a real time clock with a day/date stamp for troubleshooting purposes. In addition, with the use of this clock the drive shall be capable of stand-alone operation and act as a unitary controller.

L. The VFD shall include (2) Analog inputs either 4–20 madc or 0-10 vdc, (6) programmable Digital Inputs, (2) Programmable analog Outputs, (3) Form C Relay output rated 2 amps continuous minimum, and (2) PID Process controllers.

M. The VFD keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.

N. BYPASS – The drive shall be provided with an integral Bypass circuit which includes a pair of 115V electrically interlocked contactors for drive and bypass operation. The drive shall include a main input circuit breaker, drive input service/isolation switch, and motor overload protection adjustable for either Class 10, 20 or 30 operation. The bypass shall include a built-in status display which shows via colored LED's the system operational status including safeties and run permissive for ease of operation. The Bypass shall have its own interactive, programmable keypad. The Bypass shall provide single-phase protection for the motor while operating in bypass. Bypass that does not protect the motor from single-phase operation shall not be acceptable.

O. The drive and bypass system shall have embedded serial communication capabilities that allow direct connection to Modbus, Johnson Controls, Siemens and BACnet automation systems as part of the drives software suite without the need for extra hardware cards or gateways. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). In addition, the drive shall be capable of interfacing with Lonworks with the addition of a communication module.

P. All VFDs shall be provided and installed in strict accordance with the manufacturer's recommendations.

Q. Factory-authorized startup for each drive is mandatory. Provide a written record of the startup of each unit. Start up and programming by a factory-authorized technician. At startup, lockout any speed with the VFD that does not meet the vibration allowanced of the equipment manufacturers.

R. A parts and labor warranty of 3 years from startup and 2 years from the date of substantial completion shall be included. Warranty shall include travel time and expenses.

PART 22 - SERVER FUNCTIONS AND HARDWARE

22.1 GENERAL REQUIREMENTS AND CAPABILITIES

A. A central server shall be provided. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

D. The server shall provide the following functions, at a minimum:
   1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
   2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
   3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
   4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
   5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
   6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
   7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
   8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
   9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
      a. Routing of alarms to display, printer, email and pagers
      b. View and acknowledge alarms

c. Query alarm logs based on user-defined parameters

10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
    a. Viewing and printing log data
    b. Exporting log data to other software applications
    c. Query log data based on user-defined parameters

22.2 SERVER HARDWARE REQUIREMENTS

A. The server hardware platform shall have the following requirements:
    1. The computer shall be an Intel Pentium M based computer (minimum processing speed of 2.4 GHz with 1 GB RAM and a 100-gigabyte minimum hard drive). It shall include a DVD-ROM/CD-RW Combination Drive, 2-parallel ports, 2-asynchronous serial ports and 2-USB ports. A minimum 17" flat panel color monitor, 1280 x 1024 optimal preset resolution, 25 ms response time shall also be included.
    2. The server operating system shall be Microsoft Windows XP Professional. Include Microsoft Internet Explorer 6.0 or later.
    3. Connection to the FMCS network shall be via an Ethernet network interface card, 100 Mbps.
    4. A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 12-PPM print speed minimum.
    5. For dedicated alarm printing, provide a dot matrix printer, either 80 or 132 column width. The printer shall have a parallel port interface.

PART 23 - SYSTEM PROGRAMMING

23.1 GRAPHICAL USER INTERFACE (GUI) SOFTWARE REQUIREMENTS

A. Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a

link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

D. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

E. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

F. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

G. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

PART 24 - GRAPHICS SCREENS AND TRENDS

24.1 REQUIREMENTS

A. All dashboard graphics and control graphics screens shall be submitted for review by Owner, Engineer and Commissioning Agency. Refer to drawings for additional information. Provide the following animated, color graphics screens minimally:

B. Entire floor plan home screen with OAT, Time and Date displays.
   1. Floor plan showing major zones per zoning drawings.
   2. Click major zone displays enlarged floor plan of the zone showing individual heat pump zones & numbers. Include link to respective mechanical rooms, closets, crawlspaces.
   3. Click individual zone shows heat pump graphic. Display all data points from points list, occ/unocc schedule and setpoints, OAT, Time and Date.

C. Color Graphic Screens shall be designed for all mechanical systems and shall include the following:
   1. A graphic shall be the starting page with the building graphically indicated. Break up the floor plan into zones to match Contract Documents. The building shall be the point of reference to enter into the respective building control system.
   2. Geothermal plant
   3. All geothermal units including pumps, filters, etc.
   4. DOAS unit
   5. Outside Air Terminal Boxes
   6. Exhaust Air Terminal Boxes
   7. Exhaust Fans

8. Domestic Hot Water Heating
9. Cooling only heat pumps IT/MDF/IDF/Electrical Rooms
10. All floor plans indicating all actual room numbers, thermostats and mechanical equipment. Operator shall be capable of clicking on any equipment and pull up the respective graphic screen.

D. Graphics to include floor plans with room numbers (as-built room numbers) and thermostat locations, links to flow diagrams for heat pumps, geothermal loop systems, outside air systems, and lighting controls.

E. All new graphics shall be similar (or match) the previously provided system graphics for Trumbull School systems.

F. The graphical programming software shall allow for interactive mouse-driven placement of block icons on the graphic screen and connection of block inputs to block outputs by means of drawing lines to form a graphic logic diagram. The user shall not have to manually input text to assign block input/output interconnections. Blocks shall allow entry of adjustable settings and parameters via pop-up windows.

G. The clarity of sequence shall be such that the user has the ability to verify that the system programming meets the specs without having to learn or interpret a manufacturer's unique programming language. Provide a means for testing and/or debugging the control programs off-line (not communicating with control units) using operator entered values for physical inputs and time. Provide a means for testing and/or debugging the control programs on-line (communicating with control units), showing actual physical inputs land all block outputs in real time.

H. Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs. Logic diagrams shall be viewable either off-line, or on-line with real-time output values.

I. All graphic software shall be in the html web browser format and support multiple simultaneous screens to be opened and resizable in a "Windows" type environment. All functions, except text entry, shall be executable with a mouse. Graphic software shall provide for multitasking such that third-party programs can be used while the Operator Workstation Software is on-line. Provide the ability to alarm graphically even when operator is in another software package. The software shall allow for Owner to create user defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics.

J. The contractor shall provide libraries of pre-engineered screens and symbols for all equipment utilized depicting standard air handling unit components (e.g. fans, coils, filters, dampers, etc.), mechanical system components (e.g., pumps, heat pumps, etc.), complete mechanical systems and electrical symbols.

K. The graphic development package shall use a mouse or similar pointing device to allow the user to perform the following:
1. Define symbols
2. Position items on graphic screens
3. Attach physical or virtual points to a graphic
4. Define background screens

5. Define connecting lines and curves
6. Locate, orient and size descriptive text
7. Define and display colors for all elements
8. Establish correlation between symbols or text and associated system points or other displays.
9. Create hot spots or link triggers to other graphic displays or other functions in the software

L. The TCC shall including programming of a minimum of 30-point trends as directed by the Owner and Engineer. These can be requested at any time during the project including the warranty period. Trend "change of state" for digital inputs. Trend analog points in 30-minute increments. Maintain trend history for one year minimum. Include the following:
1. Outside air temperature
2. VFD speeds (OA, EA, pumps)
3. OA & EA air volume summations
4. Geothermal wellfield main supply and return temperatures
5. Geothermal wellfield main flow rate
6. DOAS main supply and return temperatures
7. DOAS unit and exhaust leaving air temperatures.
8. Makeup water flow rate
9. Geothermal flow rate and BTUs
10. Electrical power kW and kWh including sub-meters
11. Zone Temperatures and Humidity
12. Zone CO2 content

PART 25 - TIME SCHEDULES (ALL TIMES SHALL BE USER ADJUSTABLE)

25.1 REQUIREMENTS

A. During construction, the time schedule (for all equipment except OA unit) will be Occupied at 6:00 AM, Unoccupied setpoint at 6:00 PM five (5) days a week.

B. When the system is fully tested and operational and after the Owner's staff have been fully instructed as to the operation of the system the schedule shall be as follows unless otherwise instructed.

C. Classroom areas
1. Monday through Friday Occupied mode at 8:00 AM, Unoccupied mode at 4:30 PM (adj.). Unoccupied for Saturday and Sunday.

D. Morning Warmup Staging: Gym, Dining, Kitchen, and Media Center heat pumps units shall initiate first, then Heat Pumps in exterior classrooms shall be initiated, and then stage interior units shall be initiated.

E. Building outside air handling unit shall operate Monday thru Friday, 8:00 AM to 4:00 PM (adj.).

F. Each piece of equipment shall have its own adjustable time schedule.

G. All schedules shall be coordinated and confirmed with the Owner prior to final implementation.

END OF SECTION

SECTION 260010 - GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer Specification Section 019113 General Commissioning Requirements.

C. Refer to the Owner's OPR for additional items related to as-builts and O&Ms.

1.2 CODES & STANDARDS (INCLUDING BUT NOT LITED TO THE FOLLOWING):

A. 2021 Connecticut State Building Code (CSBC) (IBC 2021 w/ amendments)

B. 2022 Connecticut State Fire Safety Code (CSFSC) (2021 NFPA-1 w/ amendments)

C. 2022 Connecticut State Electrical Code (CSEC) (NFPA 70 2020 w/ amendments)

D. 2022 Connecticut State Energy Conservation Code (IECC 2021 w/ amendments)

E. 2022 Connecticut State Elevator Code)ASME A17.1-2019 and A17.3-2017 w/ amendments)

F. 2022 Connecticut State Building Performance Standard (High Performance Schools)

G. 2022 Connecticut State Fire Safety Code (CSFSC) (NFPA 101 2021 w/ amendments)

1.3 SUMMARY

A. Section Includes general requirements applicable to work specified in Divisions 26, 27, and 28.

B. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.

C. Any materials, labor, equipment, or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required

items in their bid, and that they will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

D. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

E. This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

F. Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an provide to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor holding the prime contract, unless otherwise provided herein.

G. In each of the specifications and drawings referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

H. Intent and Interpretation
   1. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete, tested and ready for operation."
   2. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.
   3. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc. as necessary for trouble free operation, tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.
   4. All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer’s installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer’s installation requirements whether specifically detailed or not within the Plans and Specifications.
   5. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer/ Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.

6. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

I. Drawings and Specifications

1. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for approval before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
2. The drawings and specifications are intended to supplement each other. No Contractor, bidder, proposer, or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.
3. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
4. This Contractor shall make all their own measurements in the field and shall be responsible for correct fitting. They shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
5. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where they consider such adjustments desirable in the interest of concealing work or presenting a better appearance.
6. Each Contractor shall evaluate ceiling heights called for on Architectural Plans and ensure that these heights may be maintained after all mechanical and electrical equipment is installed. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
7. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such an event, neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
8. The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small- and large-scale drawings, the larger scale drawings shall take precedence.

9. The Electrical Contractor and their Sub-Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.
10. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

1.4 GENERAL SCOPE OF WORK

A. New electrical systems will be installed (Extent of demolition and new scope differs at each CIP school).

B. New utility pad mounted service transformer and primary electric service duct bank to new utility service poles at the street and on the school property. This applies to Trumbull Hillcrest Middle Schooland Kickemuit Middle School.

C. Secondary electric service lateral from utility transformer to new main switchboard in the Main Electric Room. This applies to Trumbull Hillcrest Middle School.

D. All low-voltage distribution equipment, switchboards, panelboards, disconnect switches, fuses, transformers, contactors, starters, etc.

E. Electrical Studies including Fault Current, Arc Flash, and Coordination Studies. All studies to be performed by manufacturer of electrical distribution equipment prior to release of equipment.

F. All raceways, conduits, cable management systems, cable trays, J-hooks, conductors, outlet boxes, fittings, pull boxes, manholes, etc.

G. All lighting systems (indoor and outdoor, normal, night, emergency, and exit) including all fixtures, lamps, mounting accessories, switches, controls, outlets, wiring, raceways, and all other components and fittings required for a complete lighting system.

H. Lighting control and dimming system.

I. All wiring devices and device plates.

J. Coordination between electrical and other trades.

K. Electrical connection to all electrically operated equipment furnished and/or installed by others, including powered casework, gym/athletic equipment, elevator, mechanical equipment, kitchen equipment, etc.

L. New Diesel Generator and generator docking stations.

M. Grounding and bonding of all electrical systems and equipment.

N. Identification of electrical systems and equipment labeling.

O. Power wiring to HVAC, plumbing and fire protection equipment.

P. Emergency responder radio coverage system.

Q. Testing of all electrical systems.

R. Low-voltage raceway system.

S. Voice Evacuation fire alarm system

T. All required staging and scaffolding of any height.

U. Lightning protection.

V. All Trade Contractors to provide 1-year Project Warranty and 1st year services for all equipment and materials installed.

W. Include all scope/costs related to any necessary Firewatch per local fire department, inspection/permits for all work provided per AHJ requirements.

X. Provide all necessary permits and inspections by AHJ and provide all required fire watches.

Y. Comply with all OSHA requirements, building safety regulations and construction standards.

Z. Any required asbestos abatement will be performed by Owner prior to commencement of construction.

AA. Provide labeling of all new systems and equipment including signage for notification of equipment operating remote.

BB. Provide all required building penetrations for all raceways and conduit as required.

CC. Provide patching/sealing of existing penetrations not used with new work.

DD. Rigging:
1. Include all rigging costs for all new equipment and materials.
2. Provide any traffic barriers/safety caution tape to cordon off crane and staging area.
3. Provide all required hoisting, scaffolding, chain falls for all rigging activities.

EE. Outlet and switch plates
1. Color as selected by Architect from manufacturer's full range.

1.5 REFERENCES

A. Abbreviations and Acronyms
1. A, AMP: Ampere
2. ADA: Americans with Disabilities Act.
3. AFF: Above Finished Floor
4. AFG: Above Finished Grade
5. AHJ: Authority Having Jurisdiction
6. AHU: Air Handling Unit
7. AIC: Amps Interrupting Capacity
8. ANSI: American National Standards Institute.
9. ASA: American Standards Association.
10. ASTM: American Society for Testing Materials.
11. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
12. ATS: Automatic Transfer Switch
13. A/V: Audio/Visual
14. AWG: American Wire Gauge
15. BAS: Building Automation System
16. BFG: Below Finished Grade
17. BICSI: Building Industry Consulting Services International
18. C: Conduit
19. CB: Circuit Breaker
20. CFCI: Contractor Furnished, Contractor Installed
21. CFOI: Contractor Furnished, Owner Installed
22. CKT: Circuit
23. CLG: Ceiling
24. CT: Current Transformer
25. CM: Construction Manager
26. DDC: Direct Digital Building Controls
27. DOAS: Dedicated Outdoor Air System
28. DWG: Drawing
29. EC: Electrical Contractor
30. ELEV: Elevator
31. EM: Emergency
32. EPO: Emergency Power Off
33. FA: Fire Alarm
34. FAA: Fire Alarm Annunciator
35. FACP: Fire Alarm Control Panel
36. FCC: United States Federal Communications Commission
37. FFE: Finished Floor Elevation
38. FLA: Full Load Amps
39. G, GND: Ground
40. GFCI: Ground Fault Circuit Interrupter
41. HOA: Hands Off Auto
42. HP: Horsepower
43. IDF: Intermediate Distribution Frame
44. IECC: International Energy Conservation Code
45. ISO: International Standards Organization.
46. IT: Information Technology
47. KVA: Kilovolt-Amperes

48. KW: Kilowatt
49. KWH: Kilowatts Hours
50. LRA: Locked Rotor Amps
51. LTG: Lighting
52. MC: Mechanical Contractor
53. MCA: Minimum Circuit Ampacity
54. MCB: Main Circuit Breaker
55. MDF: Main Distribution Frame
56. MDP: Main Distribution Panel
57. MLO: Main Lugs Only
58. MOCP: Maximum Overcurrent Protection
59. MSB: Main Switchboard
60. N/A: Not Applicable
61. NEC: National Electrical Code
62. NECA: Standards for Installation.
63. NEMA: National Electrical Manufacturers Association.
64. NESC: National Electrical Safety Code.
65. NFPA: National Fire Protection Association.
66. NIC: Not in Contract
67. NRTL: Nationally Recognized Testing Laboratory
68. NTS: Not to Scale
69. N/A: Not Applicable
70. OFCI: Owner Furnished, Contractor Installed
71. OFOI: Owner Furnished, Owner Installed
72. OSHA: Office of Safety and Health Administration.
73. P: Pole, Poles
74. PC: Plumbing Contractor
75. PIR: Passive Infrared
76. RFI: Request for Information
77. RIO: Rough-in Only
78. RM: Room
79. SPD: Surge Protection Device
80. SS: Stainless Steel
81. SWBD: Switchboard
82. TIA: Telecommunications Industry Association
83. TYP: Typical
84. UL: Underwriters Laboratories, Inc.
85. UON or UNO: Unless otherwise noted.
86. UG: Underground
87. V: Volt, Volts
88. VFD: Variable Frequency Drive
89. W: Watts
90. WG: Wire Guard
91. WP: Weather Proof
92. XFMR: Transformer

B. Definitions
   1. Architect: The Architect of Record for the project, if applicable.

2. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet intent.
3. Bidder/Proposer: Any person, agency or entity submitting a proposal to any person, agency, or entity for any part of the work required under this contract.
4. Contract Documents: All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Manager's Assignments, Architect's Supplemental Instructions, Construction Contract with Owner, etc.
5. Contractor: Any Contractor whether bidding, proposing, or working independently or under the supervision of a Prime Contractor or Construction Manager and who installs any type of Electrical Work as specified in the Contract Documents.
6. Electrical Contractor: Any Contractor whether bidding or working independently or under the supervision of the entity holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.
7. Electrical Sub-Contractor: Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.
8. Engineer: The Consulting Mechanical-Electrical Engineer consulting to the Owner, Architect, or Other, etc.
9. Indicated: Listed in the Specifications, shown on the Plans or Addenda thereto.
10. Install: Install equipment furnished by others in complete working order.
11. Installer: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
12. Furnish: Deliver to the site in good condition and turn over to the Contractor who is to install.
13. Prime Contractor: The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.
14. Project: All of the work required under this Contract.
15. Provide: Furnish and install complete, tested, and ready for operation.
16. Start-Up: The activities where systems or equipment are initially tested and operated. Start-up is completed prior to functional testing.
17. Typical: Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
18. Vendor: Supplier of equipment.

C. Reference Standards: Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. Contractor shall adhere to the most recent revisions or version adopted by the Authorities Having Jurisdiction, including all relevant changes or addenda at the time of installation.
   1. IEEE – Institute of Electrical and Electronics Engineers.
      a. IEEE C2, National Electrical Safety Code
   2. NECA – National Electrical Contractors Association.
      a. NECA 1, Standard for Good Workmanship in Electrical Construction
   3. NFPA - National Fire Protection Association.
      a. NFPA 70, National Electrical Code (NEC)

4. OSHA - The Occupational Safety and Health Act

1.6 COORDINATION

A. Utility Company Requirements
   1. Contact the utility company for specifics on construction of pads, conduit, grounding, etc., prior to bidding the work and determine all their requirements. All work shall be in accordance with their standards.
   2. Each contractor, prior to bidding the work, is to contact the utility companies (electric and telecommunications) and determine the exact points of extension of all underground services in the field with a representative of each utility company. Also, obtain construction details on manholes, pull boxes, transformer pads, pedestal stub-ups, etc., from each utility company as applicable. Extension points indicated on the plans are approximate and are given for the bidder's information only.
   3. The Contractor shall provide the local utility company with a drawing produced by a licensed Land Surveyor or a licensed Engineer and acceptable to the utility that locates the centerline of the service and connection point. Coordinate further requirements with utility company.
   4. The Contractor is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone, and cable TV companies. This includes any cost associated with the underground electrical service extension.

B. Coordination with Existing Utilities and Structures
   1. The locations of all piping, conduits, cables, utilities, and manholes existing, or otherwise, that are present within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utility grants permission for temporary interruption.
   2. Known utilities and structures as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.
   3. If utilities or structures are installed within the construction project boundary, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.
   4. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
   5. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
   6. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.
   7. Protect all new or existing lines from damage by traffic, etc. during construction.
   8. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

C. Interruption of Existing Services: In general, and to the extent possible, perform all work without interruption of the existing facilities' operations. Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions:
   1. Notify the Owner, Architect, and Engineer no fewer than seven days in advance of proposed interruption of service.
   2. Provide the exact time the interruption will occur and the length of the interruption.
   3. Do not proceed with interruption of service without written permission from Owner, Architect, and Engineer.
   4. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.
   5. Contractor will not be entitled to additional compensation due to work stoppage mandated by unscheduled interruption.
   6. Coordinate interruptions with systems impacted by outages including but not limited to the following:
      a. Generators
      b. Emergency Lighting
      c. Elevators
      d. Fire Alarm Systems
   7. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore the service. The Contractor shall provide tools, materials, skilled journeymen of their own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

D. Coordination Between Trades
   1. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to their work, including Architectural, Mechanical, Structural, and other pertinent Drawings, to the end that complete coordination between trades will be affected.
   2. The Contractor is responsible for the correct location of all rough-in and connections at every piece of equipment. Work not correctly located shall be relocated at the Contractor's expense.
   3. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
   4. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼ inch = 1 Foot, clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. The Contractor shall make the necessary changes in his work to correct the condition without extra charge.
   5. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

E. Temporary Services
   1. The Contractor shall arrange for temporary electrical and other services required to accomplish the work. In the absence of other provisions in the contract, the Contractor

shall provide for temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in their bid.

2. All temporary services shall be removed by Contractor prior to acceptance of work.

F. Temporary Use of Equipment

1. The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without additional cost to the Owner, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.
2. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result from its use.

G. Preinstallation Conference

1. Conduct a preinstallation conference at project site before each construction activity when required by other Sections and when required for coordination with other construction.
2. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of scheduled meeting dates.
3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including any possible conflicts, requirements, limitations, and coordination with other work.
4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
5. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date

1.7 MAINTENANCE MATERIAL

A. Spare Parts and Extra Stock Material

1. Parts and Materials shall be properly marked and packaged for long term storage.

B. Special Tools and Keys:

1. Provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances.
2. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc.
3. Provide at least two of any such special wrench, keys, etc. to the Owner prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Architect and Engineer.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years unless otherwise approved.
   1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
   2. Equipment shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Installer Qualifications
   1. All Electrical Contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supersede this requirement.
   2. All subcontractors bidding the electrical work must have completed one project of 70 percent this subcontract cost size and two projects of 50 percent this subcontract cost size.
   3. All electrical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any worker and unqualified or incompetent workers shall refrain from work in areas not satisfactory to them. Requests for relief of a worker shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.
   4. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician.
   5. Special electrical systems, such as Fire Alarm Systems, Telecommunications or Data Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workers normally engaged or employed in these respective trades. Refer to Divisions 27 and 28 for additional requirements.

C. Licensed Professional Engineer Qualifications: Professional Engineer possessing active qualifications in accordance with Division 01 and licensed by the State of Connecticut

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver or install indoor equipment until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above equipment is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 FIELD CONDITIONS

A. Ambient Conditions:
   1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.
b. Altitude: Not exceeding 6600 feet.

1.11 WARRANTIES

A. Contractor Warranty: Contractor shall unconditionally guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to be the best of its respective kind and shall replace all parts at their own expense, which fail or are proven defective within one year from Substantial Completion of the work by the Engineer. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Architect, Engineer, and Owner's Statement of Substantial Completion.

B. Manufacturer Warranty: Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer shall have warranties and guarantees completed in order and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

C. The Warranties specified herein, and other Sections shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

1.12 INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

1.13 HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, ensure their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling, or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents, or consultants. Also, the Contractor further agrees to defend, indemnify, and hold CMTA, its principals, employees, agents, and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency suitable to the AHJ, and marked for intended location and application.

B. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.

C. Standard Products
1. Except where specifically noted otherwise, all equipment supplied by the Contractor shall be the standard products of a single manufacturer of known reputation and experience in the industry.
2. Only equipment, components, and accessories in current production for at least five years beyond the completion date of this system shall be used and installed. Any equipment found to be obsolete or not in future production will be removed and replaced at Contractor’s expense. This includes all equipment, materials, and labor.
3. Products manufactured more than 2 years prior to date of delivery to site shall not be used, unless specified otherwise.

D. Product numbers are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Engineer in writing prior to ordering the material and performing installation work.

2.2 PRODUCT SUBSTITUTIONS

A. Conform to the substitutions requirements and procedures outlined in Division 01.

B. One substitution for each product specified will be considered and substitutions must be submitted to Engineer a minimum of 10 days prior to bid using the standard CSI substitution request form.

C. If prevailing laws of cities, towns, states, or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

D. Where products are noted as "or equal", a product of equivalent design, manufacture, and performance will be considered. Submit product data (product information, catalog cut sheets, test data, etc.) to substantiate that the product is in fact equivalent to that specified. The burden of proof that the substituted product is equivalent to the specified product rests with the Contractor. Whenever material, process or equipment is specified in accordance with an industry specification (ANSI, TIA, etc.), UL rating, or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance.

E. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the contract documents are used to establish standards of quality, utility and appearance and shall not be construed as limiting competition. Materials, processes, or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when “or equal” follows the manufacturers' names or model number(s).

F. When the Engineer accepts a substitution in writing, it is with the understanding that the Contractor guarantees the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction according to contract documents. Do not provide substituted material, processes, or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution, prior to acceptance by the Engineer, are at the sole risk of the Contractor.

G. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from provisions of the specifications.

H. Contractor shall pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on their work or other Contractor's work.

I. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any Drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.

J. Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Supervision of Work: Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act in matters related to the project.

B. Conduct of Workmen: The Contractor shall be responsible for the conduct of all workmen under their supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden. Possession of a firearm is prohibited and may result in prosecution. Foul or bad language, graffiti is strictly prohibited. Display of nude tattoos is prohibited.

C. No tobacco use, including smokeless tobacco, is allowed on property.

3.2 EXAMINATION

A. Each Contractor shall inform themself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of their work.

B. Each Contractor shall fully acquaint themself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in their work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site and shall report in writing to the Engineer ten days prior to bid, any apparent omissions, or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

3.3 PREPARATION

A. Surveys, Measurements, and Grades
   1. The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations, and measurements. They must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from their failure to do so.
   2. Base all measurements, both horizontal and vertical from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

3. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, they shall notify the Engineer through normal channels of job communication and shall not proceed with his work until they have received instructions from the Engineer.

3.4 INSTALLATION

A. At no time shall the contractor work on energized electrical equipment. Contractor shall comply with NFPA 70E requirements at all times throughout construction.

B. Permits and Fees
1. The Contractor shall give all necessary notices, obtain, and pay for all permits, government sales taxes, fees, and other costs in connection with their work. As necessary, the Contractor shall file all required plans, utility easement requests and drawings, survey information online locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for their work and deliver same to the Engineer before request for final acceptance and final payment for the work.
2. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

C. Codes and Regulations
1. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus, or drawings required in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.
2. All materials furnished and all work installed shall comply with the adopted edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
3. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the AHJ, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
4. The Contractor shall insure their work is accomplished in accord with OSHA Standards and any other applicable government requirements.
5. Where conflict arises between any code and the contract documents, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

D. Materials and Workmanship
   1. All electrical equipment, materials and articles incorporated in the work shall be new and of equal quality to the specified basis of design. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades.
   2. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
   3. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.
   4. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.
   5. Comply with National Electrical Contractors Association (NECA) performance standards that are published as National Electrical Installation Standards (NEIS).
   6. All applicable equipment and devices provided shall meet all FCC requirements and restrictions.

E. Weatherproofing
   1. Where any work penetrates waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
   2. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

F. Equipment Access
   1. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of their work. Cooperate with the Prime Contractor and all other Contractors whose work is in the same space and advise each Contractor of equipment requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
   2. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
   3. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work. In the absence of such specifications, at a minimum such work shall comply with the specifications below. All locations for access panels which are not specifically indicated on the drawings shall be submitted to and approved by the architect prior to ordering.

4. Access Doors; in Ceilings or Walls:
   a. In mechanical, electrical, and service spaces: 14-gauge aluminum brushed satin finish, 1" border.
   b. In finished areas: 14-gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.
   c. In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

G. Connections
1. Provide rough-in and final connections to all electrically operated equipment furnished under the Work of the contract documents. Carefully coordinate with equipment suppliers, manufacturer's representatives, vendors, and other trades to provide complete electrical and dimensional interface to all equipment.
2. Provide all power wiring complete from power source to motor or equipment junction box, including power wiring through starters or contactors. Install all starters not factory mounted on equipment.
3. Provide all control, interlock, sensor, thermocouple, and other connections required for equipment operation. Coordinate ampacity and voltage characteristics for all motors and equipment.
4. Prior to bidding the work, coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other trades, to ensure all needed wiring is provided. Failure to provide such coordination shall not be justification for claims of extra compensation of a time extension to the Contract.
5. At no times shall the contractor work on energized electrical equipment. Comply with NFPA 70E requirements at all times during construction.

H. Scaffolding, Rigging, and Hoisting: The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

3.5 RESTORATION

A. The Contractor shall replace to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable. Patchwork on new construction will not be accepted.

3.6 INDETIFICATION AND OPERATING INSTRUCTIONS

A. Provide all equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

B. Provide operating instructions for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
   1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
   2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
   3. Safety precautions.
   4. The procedure in the event of equipment failure.
   5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

C. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

3.7 SYSTEM TESTING, VERIFICATION, AND START-UP

A. The Contractor (and Sub-Contractors) shall be responsible for starting-up, testing, checking, examining, inspecting, and verifying their systems.

B. The Electrical Contractor shall designate an individual under their employment to lead the start-up, testing, and verification process. This person should not be the project manager or job site superintendent, but a person dedicated to making this critical task successful and completed in a timely manner.

C. A pre-start-up conference shall be held with the Architect, Owner, Contractors, and the Manufacturer providing startup services. The purpose of this meeting will be to discuss the goals, procedures, etc. for start-up.

D. The Contractor shall include in the bid to provide systems startup and verification for all electrical systems specified for this project. Specific startup, testing, and verification requirements are included throughout the Electrical specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians (unless noted otherwise) and shall complete and submit start-up reports/checklists. Submit start-up reports to the Engineer. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner.

E. Where manufacturer start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up in strict accordance with manufacturer's instructions.

F. The Contractor shall be responsible for completion of a System Verification Checklist (SVC) / Manufacturer's Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.

G. The completed reports shall be organized and bound together in a tabbed binder and submitted for review and approval.

3.8 FIELD QUALITY CONTROL

A. Inspections
   1. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect the installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.
   2. Owner's and Engineer's inspections: Two inspections will be held to generate and then review punchlist items. All site inspections and visits thereafter shall be billed to the Contractor at the Engineer's standard hourly rates.
   3. The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.

   4. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when they anticipate commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Costs associated with any rework, cutting, and patching will be at the expense of the responsible Contractor.
   5. Inspections shall be scheduled for rough-in as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to correct deficiencies. Report of each such inspection visit shall be submitted to the Architect, Engineer, and the Contractor within three days of the inspection.
   6. Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
   7. Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

B. Punch Lists
   1. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least three stages of the project.
      a. For review of in-wall work that will be concealed by drywall or other materials well before substantial completion.
      b. For review of the above-ceiling work that will be concealed by tile or other materials well before substantial completion.
      c. For review of all other work as the project nears substantial completion.
   2. When all work from the Contractor’s punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing two weeks prior to the proposed date.

3. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.
4. At the engineer's option, the contractor shall supply digital photographs via email or file-share of any installed work.
5. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due 10 days from date of each additional visit) at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.
6. All panelboard fronts shall be removed prior to final punch list inspection and re-installed after completion. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

3.9 CLEANING

A. The Contractor shall, at all times, keep the area of work presentable to the public and clean of rubbish caused by their operations; and at the completion of the work, shall remove all rubbish, all tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not address such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of rubbish or debris.

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment, and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

3.10 TRAINING

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating all systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or their representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

B. Training shall be accompanied by complete as-built documentation and the technical systems operation manual.

C. The training shall be accomplished by a factory trained representative. Include a minimum of Four hours for each system described here-in unless noted otherwise. Each equipment representative shall be represented wherever their equipment is used.

D. Demonstration and Training DVDs: These training sessions shall be videotaped by the Installer. Submit two copies within seven days of end of each training module. On each copy, provide an applied label with the following information:
   1. Name of Project.
   2. Name and address of photographer.
   3. Name of Architect and Construction Manager.
   4. Name of Contractor.
   5. Date video was recorded.

E. Brochures: Furnish Owner a complete set of operating instructions and diagrams.

F. Instruction Program: Submit outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

G. At completion of training, submit two complete training manual(s) for Owner's use.

H. Qualification Data: For facilitator, instructor, and photographer.

I. Attendance Record: For each training module, submit list of participants and length of instruction time.

3.11 PROTECTION

A. The Contractor shall be entirely responsible for all material and equipment furnished for their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor. Electrical equipment exposed to the weather shall be replaced by the Contractor at their own expense.

3.12 COMMISSIONING - CONTRACTOR RESPONSIBILITIES

A. The contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to the following:
   1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
   2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
   3. Attend commissioning team meetings.
   4. Integrate and coordinate commissioning process activities with construction schedule.
   5. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.
   6. Review and accept commissioning process test procedures provided by the Commissioning Authority.
   7. Complete commissioning process test procedures.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer Specification Section 019113 General Commissioning Requirements.

C. Refer to the Owner's OPR for additional items related to as-builts and O&Ms.

1.2 SUMMARY

A. Section Includes:
1. Slotted Support Systems.
2. Conduit and Cable Supports.
3. Mounting, Anchoring, and Attachment Components.
4. Fabricated Metal Supports.
5. Concrete Bases.
6. Vibration Isolation pads.
7. Sleeves for penetration of non-fire-rated construction walls and floors.
8. Sleeve-seal systems.
9. Firestopping.
10. Cutting and Patching
11. Painting

1.3 REFERENCES

A. Abbreviations and Acronyms
1. EMT: Electrical Metallic Tubing.
2. FMC: Flexible Metal Conduit.
3. GRC/GRS: Galvanized Rigid Steel Conduit.
4. LFMC: Liquid-tight flexible metal conduit.
5. RMC: Rigid Metal Conduit

B. Definitions
1. Channel: A continuous slotted channel (strut) with inturned lips suitable for assembly into multiple configurations

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
1. Metal Framing Manufacturers Association (MFMA)
a. MFMA-4: Metal Framing Standards Publication

b. MFMA-103: Guidelines for the use of Metal Framing

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations with Division 07 Section "Roof Accessories."

1.5 SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of components, profiles, and finishes.
2. Include rated capacities.

B. Shop Drawings: For fabrication and installation details and include calculations for the following:
1. Slotted channel systems.
2. Equipment supports.
3. Concrete Bases for Equipment.
4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: Signed and sealed by a qualified professional engineer. For field assembled or fabricated hangers and supports for electrical systems.
1. Include design calculations and details of trapeze hangers.

D. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to the authority having jurisdiction and marked for intended location and application.

B. Delegated Design: Design support systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 SLOTTED SUPPORT SYSTEMS

A. Description: Preformed, continuous slot, bolted channels with associated fittings and hardware.
   1. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following or an approved equal:
      a. Eaton B-Line.
      b. Kindorf.
      c. nVent Caddy.
      d. Power-Strut.
      e. SuperStrut.
      f. Unistrut.
   2. Comply with MFMA-4 for factory fabricated components suitable for field assembly.
   3. Material and Finish for channel, fittings, and accessories:
      a. Steel: Minimum 16 gauge, Hot dip galvanized after fabrication and applied according to ASTM A123 or A153 suitable for indoor or outdoor wet locations.
      b. Stainless Steel (type 316) per ASTM A276 suitable for corrosive environments.
   4. Channel Dimensions: Minimum 1-5/8 inches wide with varying heights and welded combinations selected to meet applicable load criteria.

2.3 CONDUIT AND CABLE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following or an approved equal:
   1. Eaton B-Line
   2. nVent Caddy
   3. Thomas & Betts

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Provide plugs with number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported.

D. Device Box Mounting Brackets: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.

E. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.

F. Roof-mounted Raceway Support Blocking: Non-penetrating, factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.

G. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.

2.4 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Eaton B-Line
   2. Empire Industries.
   3. Hilti.
   4. ITW.
   5. MKT Fastening.

B. Description: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, or steel with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   3. Concrete Inserts: Steel, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Solid, threaded steel.

2.5 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.6 VIBRATION ISOLATION PADS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Korfund Maxi-Flex Pads or a comparable product by one of the following:
   1. Ace Mountings Co.
   2. California Dynamics Corporation.
   3. Eaton B-Line.
   4. Kinetics Noise Control.

5. Mason Industries.
6. Vibration Eliminator Co.
7. VMC Group

B. Description: Molded, oil resistant, non-skid elastomeric pads arranged in 2-inch square segments.

C. Load Rating from 120 lbs. up to 360 lbs. per 2-inch segment.

D. Provide for all transformers located within the building.

2.7 SLEEVES

A. Wall and Floor Sleeves:
1. Galvanized Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2.8 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable. Link Seal system or approved equal.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Glass reinforced nylon polymer.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.9 FIRESTOPPING FOR ELECTRICAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following or approved equal:
1. Hilti
2. Specified Technologies Inc (STI)
3. Wiremold

B. Source Limitations: Obtain firestopping systems through one source from a single manufacturer.

C. General Requirements:
1. Firestopping systems shall bear UL classification marking corresponding to its Fire Resistance Directory.
2. Comply with testing requirements set forth in ASTM E814 or UL 1479.
3. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
4. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

D. Fire rated cable pathways: Re-penetrable, maintenance-free cable management devices for use with cable bundles penetrating through fire rated walls or floors.
   1. Shall contain a built-in fire sealing system sufficient to maintain the hourly rating of the fire rated wall or floor being penetrated.
   2. The system shall adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials.
   3. Shall be engineered to allow two or more devices to be ganged together with wall plates for larger cable capacities.

E. Fire-rated cable grommets: Molded, two-piece grommet with sealing membrane for use with single cables or small bundles at through or membrane wall penetrations.
   1. System shall be installed around cables and shall lock tightly into the wall assembly.

F. Outlet Box Putty Pads: Non-hardening, moldable, intumescent material shaped into preformed pads for use with metallic outlet boxes.

G. Refer to Division 07 for requirements related to other firestopping systems and materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with manufacturer's installation requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CUTTING AND PATCHING

A. Unless otherwise indicated, provide cutting and patching necessary to install the work specified. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accordance with the Architect's standards for such work.

B. Do not cut structural elements without reinforcing the structure to maintain the designed weight bearing and stiffness. Coordinate approved reinforcement method with Architect and Structural Engineer.

3.3 SUPPORT SYSTEM APPLICATION

A. Comply with NFPA 70, NECA 1, NECA 101, and MFMA-103 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.

B. Do not support conduit, raceways, or equipment from existing plaster ceilings and/or supports. Each piece of equipment, apparatus or conduit mounted above the floor level shall be provided with suitable structural support, platform, or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment, conduit, and raceways. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components multiplied by a safety factor of four with a minimum of 200 lbs.

C. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for raceways as required by NFPA 70.

D. Minimum Hanger Rod Size for Raceway Supports: 3/8-inch diameter unless noted otherwise.

E. Single Raceways:
   1. For Raceways 1-1/4-inch and smaller: Install adjustable steel band hanger suspended on threaded rod.
   2. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/4-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Multiple Raceways and single raceways larger than 1-1/4-inch:
   1. Install trapeze-type supports fabricated with slotted support system suspended on threaded rods for horizontal applications and fastened to building structure for vertical applications.
   2. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   3. Secure raceways and cables to these supports with two-bolt steel conduit clamps or single-bolt steel conduit clamps using spring friction action for retention in support channel.

3.4 SUPPORT SYSTEM INSTALLATION

A. Comply with NFPA 70, NECA 1, NECA 101, and MFMA-103 for installation requirements except where requirements of this Article are more stringent.

B. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
      a. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured. Fit each hanger rod with a nut at its upper

end and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Self-drilling concrete anchors or expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.

C. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars or existing raceways embedded in slab. Verify reinforcing locations with Structural Engineer and X-Ray existing concrete structures as required.

D. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.

E. Slotted Support Systems
1. Install slotted channel systems level and plumb.
2. Remove burrs from all exposed cut edges prior to installation.

F. Wall Stud and Ceiling Supports
1. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.
2. Install Device Box Mounting Brackets supported between two studs. Attach all device boxes to two studs, device box stabilizers are prohibited.
3. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings. Install at least one independent support rod from box hanger to structure.
4. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.

G. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.

1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work to maintain warranty of roof system.

H. Threaded Rod Hardware
   1. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.
   2. Trim rod excess to within 1-inch of locknut, de-burr, and provide protective endcap.

I. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.

J. Locate raceways and supports so as not to hinder function or code required clearance to any system or equipment.

K. Provide independent supports and hang all electrical raceways and devices from the building structure with UL listed and approved materials. Utilizing the support systems of other trade's work is prohibited, except with written approval from the Engineer.

L. Provide riser support clamps for vertical conduit runs and install at each floor level penetration and at additional locations required to support weight of system.

M. Tighten all bolted connections to proper torque values in accordance with manufacturer's written instructions.

N. Provide supports to maintain 1/4-inch air space between raceway and mounting surface where raceways are mounted exposed in wet or corrosive locations and where directly attached to concrete or masonry.

O. The use of tie wire or perforated metal tape for support or fastening of any raceway system is prohibited.

P. Where galvanized wire is used for cable supports above suspended ceilings, provide minimum #12 support wire independent of ceiling system secured at both ends. Paint or provide tag to distinguish supports from ceiling system.

Q. Welding directly on raceways, fittings, or outlet boxes is prohibited.

3.5 INSTALLATION OF VIBRATION ISOLATION PADS

A. Select vibration device load ratings to match equipment loading and deflection criteria.

B. Arrange pads in single or multiple layers of sufficient stiffness for uniform loading.

C. Install pre-cut segments in accordance with manufacturer recommendations to match shape of equipment base.

3.6 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.7 CONCRETE EQUIPMENT BASES

A. Housekeeping Pads: Construct concrete housekeeping pads a minimum of 4-inches thick and 6-inches larger in both directions than supported unit.

B. Exterior Equipment Pads: Construct exterior equipment pads a minimum of 8-inches thick and 6-inches larger in both directions than supported unit unless noted otherwise.

C. Use 3000-psi, 28-day compressive-strength concrete unless otherwise noted. Comply with Division 03 Section "Cast-in-Place Concrete" and ACI standards for subbase requirements, concrete materials, reinforcement, placement, and cover requirements.
   1. Reinforce pads with a minimum #4 rebar on 12-inch centers each way or equivalent welded wire fabric. Support reinforcement and tie together to prevent displacement during construction.
   2. For interior pads, provide #4 dowels at 24-inch centers each way (minimum of 4) to anchor to structural slab below. Embed dowels into slab a minimum of 3-inches.
   3. Provide rubbed finish for all surfaces.
   4. Provide ¾-inch chamfer at all exposed edges.
   5. Provide Engineer approved repairs if pad surface is rough or shows signs of honeycomb.
   6. Provide crown for exterior pads with a slope of 1/8-inch per foot.
   7. Do not set heavy equipment on pad for at least 7 days after pour unless approved by Engineer.

D. Anchor equipment to concrete base.
   1. Locate anchors to be a minimum of 10 bolt diameters from edge of the base.
   2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   3. Install anchor bolts to elevations required for proper attachment to supported equipment.
   4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.8 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Coordinate all required openings and provide sleeves and inserts prior to construction of wall and floor systems. Where openings are missed or incorrectly located, provide core-drilling and patching at no additional expense to owner.

C. Install sleeves without compromising structural integrity of wall or floor.

D. Sleeves for Conduits or Cable Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Unless sleeve seal systems are used, size pipe sleeves to provide a minimum 1/4-inch annular clear space between sleeve and raceway. Where conduit motion due to expansion and contraction will occur, provide sleeves a minimum of two conduit sizes larger than the nominal conduit diameter.
   3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls.
      a. For conduit penetrations, cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
      b. For cable penetrations, extend sleeve a minimum of 2-inches beyond surface of wall and provide plastic insulated bushing.
   4. Install sleeves for floor penetrations. Extend sleeves installed in floors a minimum of 6-inches above finished floor level unless noted otherwise. Install sleeves during erection of floors.
   5. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

E. Sleeves for Cables Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound or acoustical sealant for gypsum board assemblies.

F. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units and counter flashing applied in coordination with roofing work. Coordinate all work with roofing system to maintain roof warranty.

G. Exterior-Wall and Floor Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal system. Size sleeves to allow for manufacturer recommended annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Where sleeves are installed in core drilled openings, grout sleeve into the opening.

H. Where sleeves are installed exposed in finished spaces, provide metal escutcheon plates of size to match the sleeve.

I. Sleeve-Seal-System:
   1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

2. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.9 ELECTRICAL SYSTEM FIRESTOPPING INSTALLATION

A. Install firestopping at all penetrations of fire-rated assemblies. Comply with requirements in Division 07 and as outlined below.

B. Coordinate location and proper selection of firestop devices with fire rated assembly. Ensure cast-in place devices are installed before placement of concrete.

C. Install firestop materials in accordance with UL Fire Resistance Directory and manufacturer's instructions.

D. Affix permanent label to each side of penetration immediately adjacent to firestopping to communicate to futures installers and code authorities the following:
1. Fire-stop product/system used
2. Installation Company
3. Penetration Hour Rating
4. Installation Date

E. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities.

3.10 PAINTING

A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Building wire and cable rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V or less.
   3. Control Voltage Conductors and Cables

B. Related Requirements:

C. Refer to Division 27 for additional cabling requirements.

1.3 REFERENCES

A. Abbreviations
   1. RoHS: Restriction of Hazardous Substances.

B. Definitions
   1. Low Voltage: Circuits and equipment operating at more than 50VAC but less than 1000VAC for building electrical distribution systems.
   2. Control Voltage: Circuits and equipment operating at less than 50VAC for remote-control and signaling power-limited circuits.
   3. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
   4. Homerun: The run of raceway(s) and cable(s) between the panelboard or switchboard and the junction box in the area served where branch circuit cables originate.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA)
      a. NECA 104, “Installing Aluminum Building Wire and Cable”
      b. NECA/NACMA 120, “Standard for Installing Armored Cable (Type AC) and Type Metal-Clad (MC) Cable”.

PART 2 - – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

2.2 BUILDING WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alpha Wire Company.
2. Cerro Wire LLC.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Okonite Compony.
6. Southwire Company.

B. Building Wire Description: Flexible, insulated, and uninsulated, drawn current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Cable Description: A factory assembly of one or more current-carrying insulated conductors in an overall protective sheath.

D. General Requirements:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

E. Copper Conductors: 98% conductive annealed copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Conductor Insulation:

G. 600V, 90°C

H. Comply with ANSI/NEMA WC 70/ICEA S-95-658.

I. THHN/THWN-2: Comply with UL 83.

J. XHHW-2: Comply with UL 44.

K. Metal Clad Cable, Type MC

1. Comply with UL1569.
2. Circuits: Single circuit with color coded current carrying conductors and insulated ground conductor.
3. Conductor Insulation: THHN/THWN-2.
4. Armor Jacket: Galvanized Steel Interlocking Armor. Aluminum Armor is not acceptable.
5. Connectors shall be provided with lock nut connection to the termination point enclosure.
6. Connectors shall be steel, die cast is not acceptable.
7. Listed for use in penetration firestop systems.

L. Mineral Insulated Cable, Type MI
1. Solid copper conductors encased in compressed metal oxide with an outer metallic sheath
2. UL 2196 for fire resistance.
3. Insulation: Compressed magnesium oxide
4. Sheath: Copper

2.3 SPLICING DEVICES & CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. 3M; Electrical Products Division.
2. AFC Cable Systems, Inc.
3. Burndy
4. Gardner Bender.
5. Hubbell Power Systems, Inc.
6. Ideal Industries, Inc.
7. ILSCO.
8. NSi Industries LLC.
9. O-Z/Gedney;
10. Thomas & Betts.
11. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Twist-On Wire Connectors: spring pressure type, 600V, 105°C insulation, suitable for connecting two or more wires in a pigtail application.

D. Material: Tin plated copper

E. Crimp Sleeve Splices: butt or parallel crimp type, copper sleeve with nylon cover and skirted insulators, capable of permanent connection of two or more wires up to #10 AWG.

F. Compression Splices: standard or long barrel type, 90°C, with cold shrink tubing, for use with hydraulic crimping tool, capable of permanent connection of wires #6 AWG and larger.

G. Ring or Flanged Fork Tongue Terminals: crimp type, 600V, 105°C insulation, insulated serrated barrel, capable of terminating wires up to #10 AWG.

H. No aluminum splicing devices or connectors are permitted.

2.4 CONTROL VOLTAGE CONDUCTORS AND CABLE

A. Control Cable: NFPA 70, Type CMG or CMP
   1. Single or multi-pair, twisted, minimum No. 18 AWG, stranded tinned copper conductors.
   2. PVC insulation.
   3. Shielded or Unshielded.
   4. Flame Resistance:
      a. CMG: Comply with UL1685
      b. CMP: Comply with NFPA 262

B. Class 1, 2, and 3 Control Circuits: Stranded Copper, Type THHN/THWN-2

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATION

A. Branch Circuits: Copper. THHN/THWN-2. Solid for #10 AWG and smaller; stranded for # 8 AWG and larger.

B. Provide XHHW-2 insulation for the following:
   1. Feeder circuits (60A and more)
   2. Circuits routed exposed on rooftops.
   3. Conductors on the load side of a Variable Frequency Drive.
   4. Circuits run in underground conduits.

C. Conductors for motors or vibrating or oscillating equipment: Extra flexible stranded.

D. Cord Drops and Portable Appliance Connections: Type SOOW, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

E. Conductor sizes indicated on drawings are based upon 75 degree C rating.

F. Minimum branch circuit or feeder size:
   1. Not less than #12 AWG copper wire unless noted otherwise within the building.
   2. Not less than #8 AWG copper wire for circuits run to the exterior.

G. Minimum control circuit conductor sizes:
   1. Class 1 remote-control and signal circuits; No 14 AWG.
   2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG

H. Provide all the wire for the project in new and undamaged condition. Deliver in standard coils or reels. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable.

3.2 EXAMINATION

A. Prior to installing conductors and cables:
   1. Verify that raceway installation is complete according to Section 260533 “Raceways and Boxes for Electrical Systems” and ready for installation of conductors and cables.
   2. Verify that raceways are properly sized in accordance with NEC.
   3. Visually inspect exposed raceways to ensure that raceways are not damaged, and bends are not deformed.
   4. Verify that raceways do not exceed the maximum number of bends between pull-points.
   5. Verify raceways have been cleaned of all dirt and debris.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Pulling Conductors in Raceways
   1. Pull cables in accordance with cable manufacturer and pulling equipment manufacturer recommendations as well as applicable sections of the National Electric Code.
   2. Use installation equipment, tools, and materials as necessary, such as sheaves, pulling eyes, basket grips, winches, cable reels and/or cable reel jacks, duct entrance funnels, and pulling tension gauges, and approved pulling lubricants where required to facilitate cable pulling without damage to cables or raceway.
   3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not use lubricants that harden or become adhesive with age. Apply lubricant where cables enter ducts and conduits and at all intermediate access points on long or difficult pulls.
   4. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Utilize special remote readout equipment to ensure compliance.
   5. Avoid abrasion and other damage to cables during installation. Provide physical protection of cables, such as using appropriately sized flexible cable guides or feed-in tubes, at the entrance of boxes and raceways.
   6. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

B. Bend Radius
   1. Handle conductors and cables carefully. Make bends in cables and conductors such that cables, conductors, sheaths, armor, etc., are not damaged.
   2. Do not bend conductors and cables to less than the NEC and manufacturer recommended minimum bending radius.
   3. Ensure that tools and accessories used to install conductors and cables, such as rollers, sheaves, trolley assemblies, tube guides, and/or raceways, are properly sized and utilized to be greater than the minimum bending radii of conductors and cables.
   4. Minimize bending where conductors and cables enter or exit raceways, cabinets, and boxes. Do not install cables that have been bent or kinked to a radius less than the recommended dimension.
   5. Install conductors only after insulating bushings are in place.

C. If multiple circuits are pulled in a single homerun, provide a dedicated neutral for each phase conductor. In these cases, a maximum of seven conductors (six current carrying and one ground) are permitted in a single conduit except for switch legs and travelers in multi-point switching arrangements. De-rate conductors per NEC.

D. Multi-wire branch circuits with a shared neutral are not permitted unless specifically noted on the drawings. Where indicated, group the phases and neutral together with cable ties in the panelboard and in all pull boxes.

E. Install conductors for isolated power systems in as short a run of conduit as practicable. The use of pulling compound or lubricant is not permitted on conductors in isolated power systems.

F. Voltage Drop:
   1. Adjust conductors and conduit sizes accordingly based on actual field installed conditions.
   2. Size and install all feeders and branch circuits for a maximum 2% voltage drop in feeders and 3% in branch circuits with a maximum total voltage drop of 5%.
   3. Calculate using a load equal to 80% of the supply breaker rating unless the circuit breaker is rated to carry 100% of the load.
   4. When the conductor length from the panel to the first outlet on a circuit exceeds the values below, adjust branch circuit conductors from the panel to the first outlet. Increase the conductor size of remaining branch circuit as needed to meet above voltage drop limitations.
      a. For 277VAC homeruns exceeding 125-feet, #10 AWG minimum.
      b. For 120VAC homeruns exceeding 100-feet, #10 AWG minimum.
      c. For 120VAC homeruns exceeding 175-feet, #8 AWG minimum.

G. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

H. Install cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours.

I. Bundle cables where run in groups using listed supports. Provide independent supports directly from structure, do not route through structure or on work of other trades.

J. Metal Clad Cable, Type MC
   1. MC cable is permitted for the following applications:
      a. Normal power branch circuits between wiring devices and nearest junction box, #10 AWG and smaller, where concealed in walls and ceilings.
      b. Provide no more than three MC cable circuit connections per junction box.
      c. For power circuits, limit length of MC cable to 10ft from the junction box to the first wiring device and transition circuit to conduit if it continues outside the wall.
      d. For lighting circuits, limit length of MC cable to 6ft from the junction box to the first luminaire and extend MC cable to other fixtures in the same room.
   2. MC cable is not permitted for the following:
      a. Emergency or standby power circuits
      b. Feeders
      c. Homeruns to panelboards.
      d. Branch circuits with conductors larger than #10 AWG.
      e. Branch circuits serving HVAC, elevator/escalator, and kitchen equipment loads.
      f. Within mechanical, electrical or telecommunication equipment rooms.
      g. Exposed locations.
      h. Inaccessible ceiling locations.
      i. Within masonry walls.
      j. Exterior or outdoor locations.
      k. Wet or damp locations.
      l. Direct buried locations.

3. Where MC cable is permitted, comply with the following:
   a. Install MC cables and connectors in accordance with NECA/NACMA 120.
   b. Use only for single-circuit applications. For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.
   c. Support MC cables with clamps, clips, or similar product specifically designed for supporting cables in accordance with NEC and route all runs parallel or perpendicular to building lines with right angle turns complying with manufacturer's bend radius requirements.
   d. Cables shall be bundled and run in groups using listed supports to maintain proper spacing. Where spacing can't be maintained, apply adjustment factors for derating conductors.
   e. Do not route through structure or on work of other trades. Provide independent supports directly from structure.

K. Control Circuit Conductors and Cables
1. Use insulated spade lugs for wire and cable connection to screw terminals.
2. Conductors installed within environmental air plenums shall be per NEC. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Provide plenum-rated cable supports where plastic straps or other supports, etc., are installed in plenum areas.
3. Where indicated, systems and control conductors that are installed exposed shall not be routed across ceilings or ductwork. Provide independent supports anchored to building structure or other permanent support members.
4. Install in such a manner as to not interfere with the access to or operation of equipment or removal of ceiling tiles.
5. Nylon tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served.
6. Install grommets where dropping out of trays or into panels or service columns.
7. Install sleeves with bushings where penetrating partitions.
8. Provide firestopping for penetrations of fire rated assemblies with approved materials.

3.4 SPLICES, TAPS, CONNECTIONS, AND TERMINATIONS

A. Prepare cable in accordance with the conductor, cable, splice and termination component manufacturers' recommendations and instructions.

B. Cut conductors and cables using tools and methods which ensure a square cut. Do not nick or damage conductors.

C. Ensure conductor inserts fully into the connector or termination with the insulation fitting closely to the connector or termination.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tools shall be used to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

E. Splices and Taps
1. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
2. Make splices and taps in junction boxes or other enclosure approved for the wiring method.
3. For conductors #10 AWG and smaller conductors, use pressure crimp type connections.
4. For conductors #8 AWG and larger, use a hydraulic compression type connection, with cold shrink tubing and tape to restore full insulation value of the wire being spliced.

F. Connections and Terminations
1. Ensure that conductor temperature and ampacity ratings are compatible with connectors, terminals, and equipment to which they are to be connected.
2. Provide crimp-applied ring or flanged fork type terminals for motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using #10 AWG or smaller conductors.
3. Motor Connections shall use connection lugs with motor stub splice insulators.

G. Wiring at Outlets: Install conductors at each outlet with at least 12 inches of slack.

H. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 10 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to the wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

3.5 PROTECTION

A. Intentional or unintentional painting of exposed low-voltage and/or control-voltage cabling insulation is prohibited. Ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades.

B. Review the project’s painting requirements for all disciplines and provide protection as required.

C. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, provide cabling in enclosed raceways, or provide alternate options for cable colors to engineer for approval.

3.6 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."
1. Identify all conductors by means of labels placed on conductors in all junction boxes and at each terminal point with labels indicating source, circuit number or terminal number.
2. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.
3. Identify each control voltage conductor or cable on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

B. Provide conductors, in all sizes of cable, with continuous solid insulation color(s) from the manufacturer. Taped ends shall not be acceptable.
   1. Conductors shall be color coded as follows:
      a. 120/208 Volt Conductors
      b. Phase A: Black
      c. Phase B: Red
      d. Phase C: Blue
      e. Neutral: White
      f. Ground: Green
      g. Isolated Ground: Green/Yellow
      h. 277/480 Volt Conductors
      i. Phase A: Brown
      j. Phase B: Orange
      k. Phase C: Yellow
      l. Neutral: Gray or White with Brown tracer
      m. Ground: Green
      n. Isolated Ground: Green/Yellow
   2. Control voltage wiring color coding shall be consistent throughout the project and shall match existing equipment and standards where applicable. Color coding for each system shall be unique.
   3. Conductors within enclosures that may be energized when enclosure disconnect is off - yellow or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide limacoid plate warning sign on front of enclosure where this condition occurs.
   4. DC Wiring:
      a. Positive: Light Blue
      b. Negative: Dark Blue

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Visual Inspections:
   1. Compare cable data with drawings and specifications.
   2. Inspect exposed sections of cable for physical damage and correct connections in accordance with drawings.
   3. Inspect bolted electrical connections for high resistance. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.
   4. Inspect compression-applied connectors for correct cable match and indentation.
   5. Inspect for correct identification and arrangements.
   6. Inspect cable jacket insulation and condition.

C. Electrical Tests:
   1. Perform insulation resistance testing for all electrical distribution system feeders unless notes otherwise. Testing may be witnessed by the Engineer and/or Commissioning agent. Schedule all tests with Architect with sufficient notice.
   2. Insulation resistance tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at a DC voltage of 500 volts for 120-300 volt rated equipment. The test duration shall be one minute. The minimum acceptable (temperature corrected) resistance is

25 megaohms for 120-300 volt rated equipment and 100 megaohms for 600 volt rated equipment and wiring.

3. Test instruments shall be calibrated to national standards within the last 12 months.

D. Test and Inspection Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.

F. Submit test results to Architect and Engineer for approval.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Grounding and Bonding for electrical systems cover several different but interrelated systems including Electrical System Grounding, Equipment Grounding System, Grounding Electrode System, and interfaces with telecommunications bonding infrastructure as well as lighting protection systems.

B. Section includes requirements for electrical system and equipment grounding, plus the following special applications:
   1. Underground distribution grounding.
   2. Power system grounding.
   3. Electrical equipment grounding and bonding.
   4. Grounding electrodes.
   5. Ground bonding common with lightning protection system.

C. Related Requirements:
   1. Refer to Section 270526 “Grounding and Bonding for Communications Systems” for requirements associated with the telecommunications bonding infrastructure.

1.3 SYSTEM DESCRIPTION

A. The entire electrical installation (non-current carrying metal parts), including but not limited to, metallic conduits and raceways, cable trays, junction and pull boxes, enclosures, fixtures, service equipment, distribution boards and panels, transformers, switches, motor frames, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically shown or specified.

B. Resistance: Resistance from the main ground bus bar through the ground electrode to earth shall not exceed 5 OHMS unless otherwise noted.

C. Ground each separately derived system neutral as described herein except as otherwise shown or specified.

D. Provide telecommunications system grounding as described herein except as otherwise shown of specified.

E. Ground HVAC ductwork per Division 23 requirements.

1.4 REFERENCES

A. Abbreviations
   1. MGB: Main Grounding Busbar

B. Definitions
   1. Grounding: Establishing a direct or indirect connection to Earth or some conducting body that serves in place of Earth.
   2. Bonding: Method by which all non-energized conductive materials are effectively interconnected to create a low impedance path.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA)
      a. NECA 331 – Standard for Building and Service Entrance Grounding and Bonding.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

B. Comply with NFPA 70 and UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the following:
   1. Burndy Electrical
   2. nVent Erico Inc.
   3. Thomas & Bett, Electrical
   4. VFC Lyncole

2.3 CONDUCTORS

A. Insulated Copper Conductors: Comply with Section 260519 “Low-Voltage Electrical Power Conductors and Cables”.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.

4. Boding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

C. Grounding electrode conductor shall be a minimum of #4/0 AWG unless otherwise indicated, and shall be continuous without joints or splices. Conductor shall be stranded cable.

D. Underground conductors shall be #4/0 AWG, bare, tinned, stranded, unless otherwise indicated.

E. Straps/Jumpers: Copper tape, braided conductors pre-terminated with copper ferrules, cross-sectional area no less than a No. 6 AWG conductor.

2.4 ELECTRICAL SYSTEM BUSBARS

A. Grounding Busbar: Predrilled rectangular bars of annealed copper, minimum 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Size busbar length to accommodate initial conductor installation plus a 50% growth factor. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 1000 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.5 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits consisting of graphite molds, copper oxide and aluminum weld metal, and electronic ignition system. Provide types recommended by kit manufacturer for materials being joined and installation conditions.

C. Irreversible Compression Connectors: Tin-plated copper, for installation using a hydraulic compression tool and die matched to connector type. Provide die code or other visual indicator to ensure proper connector selection and uniform compression for a permanent connection.
1. Taps: C-type, H-type, or Figure 6/8 type.
2. Splices: Long Barrel straight or tee.
3. Terminals: Two-hole lug long barrel type.

D. Mechanical Connectors: Tin-plated high strength copper alloy or high strength cast bronze.
1. Water Service Pipe Clamps: Heavy-Duty, two-piece saddle type with stainless steel bolts.
2. Pipe Clamps: Heavy-Duty, U-bolt type with silicon bronze hardware.
3. Lay-in Lug Connector: Heavy-Duty, open face lug with hex head set screw.

2.6 GROUNDING ELECTRODES

A. Ground Rods: 10 mil pure electrolytic copper coating with molecular bond to high strength steel core; 3/4 inch by 12 feet with chamfered end. Ensure ground rods are die-stamped near the top with the name and trademark of the manufacturer and the length in feet.

B. Enhanced Composite Backfill: Electrically conductive, environmentally safe, maintenance free backfill material with neutral PH properties that creates a stable, non-corrosive, low resistance connection between a grounding electrode and earth. Basis of Design: Erico Ground Enhancement Material (GEM).

C. Test Well: Lightweight polymer concrete, Tier 15 rated, non-slipcover, suitable for non-deliberate incidental traffic. 12-inch by 12-inch minimum, 12-inches deep unless noted otherwise, with "GROUND" legend unless noted otherwise. Provide hand holes for Test Wells.

PART 3 - EXECUTION

3.1 GENERAL

A. Bond grounding bus and all non-current carrying metallic parts of raceways systems and equipment to common ground in accordance with the National Electrical Code, NECA 331, as shown on the Contract Drawings, and in accordance with the requirements of the local authority having jurisdiction.

B. The size of the grounding and bonding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings.

C. Interconnect all grounding systems in or on the structure to provide a common ground potential.

D. Bond all outlet, junction, pull boxes, and enclosures to the equipment grounding conductor with a grounding pigtail.

E. Provide (2) grounding electrodes exterior to the building near the main electrical room not less than (6) feet apart.

3.2 APPLICATIONS

A. Conductors: Install solid conductor for #10 AWG and smaller, and stranded conductors for #8 AWG and larger unless otherwise indicated.
   1. Installing bare conductors where not specifically identified as bare or insulated except where installed in conduit with associated phase conductors. Install insulated conductors in conduit with insulation of the same material as the associated phase conductors with which it is installed.
   2. Provide insulated conductors not exceeding No. 8 AWG in size with green colored insulation. Identify conductors larger than No. 6 AWG with 4-inch green tape at each termination and at all junction and pull boxes.

B. Underground Grounding Electrode Conductors: Install bare copper conductor, sized per NEC or as indicated on drawings, whichever is larger.
   1. Bury at least 36 inches below grade or below the frost line depth, whichever is greater.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Electrical System Grounding Busbar: Install in electrical rooms housing service equipment, and elsewhere as indicated to provide a common connection point for individual grounding electrode conductors and bonding jumpers.
   1. Install bus horizontally, on insulated spacers 4 inches minimum from wall, 18 inches above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
   3. Provide green laminated plastic nameplate with 1/2" high white letters indicating function of ground bus (i.e. “Service Main Ground Busbar”).

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Connections: Mechanical connectors.
   2. Underground and Exposed Exterior Connections: Exothermic welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Mechanical connectors.
   4. Connections to Structural Steel: Exothermic welded connectors.
   5. Connections to Busbars: Irreversible compression connectors.

3.3 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the neutral bus except where service equipment neutral and ground bussing complies with exceptions listed in the NEC. Install a main bonding jumper between the neutral bus and ground bus. Provide external grounding busbar and install grounding electrode conductor to interconnect main grounding busbar and neutral bus.

B. Where ground fault protection is installed, ensure interconnection of neutral bus and ground bus does not interfere with correct operation of fault protection.

3.4 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Transformers: Provide grounding in accordance with the NEC and the following:
   1. System Bonding Jumper (SBJ): Install at the source enclosure between the grounded terminal (neutral) and the equipment grounding terminal.
   2. Supply Side Bonding Jumper (SSBJ): Install wire type SSBJ to bond the source enclosure to the enclosure at the first disconnect or overcurrent protective device.
   3. Grounding Electrode Conductor (GEC): Install at the source enclosure from the SBJ connection point to the building grounding electrode system.
   4. Bonding Jumpers: Where the metal water piping and/or the metal structural steel building frame in the area served by the separately derived system are not used as a grounding electrode, provide bonding jumper to the GEC connection point at the source enclosure.
   5. Equipment Grounding Conductor (EGC): Bond the EGC of the primary feeder to the equipment grounding terminal.

3.5 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements for utility equipment.

B. Exterior Pad-Mounted Equipment: Install a minimum of two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items are associated with equipment by connecting them to underground grounding conductors and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.6 EQUIPMENT GROUNDING AND BONDING

A. Equipment Grounding Conductors: Install insulated equipment grounding conductors with all feeders and branch circuits. Provide conductors of the same wire/cable type as the ungrounded current carrying conductors.

B. Increase equipment grounding conductor sizes in accordance with NEC article 250 where ungrounded current carrying conductor sizes are increased to minimize voltage drop.

C. Provide all circuits with a dedicated equipment grounding conductor unless noted otherwise.

D. Provide an equipment grounding conductor to each outlet on circuits protected by a GFCI circuit breaker.

E. At all metallic outlet, junction and pull boxes, bond the equipment grounding conductor to the enclosure.

F. Metal Poles Supporting Outdoor Lighting Fixtures: Install a ground rod and a separate insulated equipment grounding conductor at each pole in addition to grounding conductor installed with branch-circuit conductors.

3.7 INSTALLATION

A. Grounding Electrode Conductors and Bonding Jumpers: Securely fasten and route along the shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
   1. Route conductors maintain a downward or horizontal direction to ground with a minimum bend radius of 8-inches.
   2. Protection: Install above grade conductors No 6 AWG or larger exposed to physical damage and all conductors smaller than No. 6 AWG in schedule 80 PVC conduit. Where metallic conduit is required, bond each conduit end to the electrode or ground conductor as close to the openings as possible with a full-size conductor and bonding bushing to create an electrically parallel path.
   3. Clearance: Maintain a minimum separation of 12-inches from open telecommunications cable groups.

B. Bonding for Lightning Protection Systems: Where lightning protection systems are installed comply with NFPA70, NFPA 780, and UL 96 for bonding the lightning protection system grounding electrodes with the building grounding electrode system.

1. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor.
2. Do not use conductors and electrodes for grounding the lightning protection system in place of the grounding electrodes required by this specification and section 250.50 of NFPA 70.

C. Ground Rods: Auger 6-inch diameter hole to depth 6 inches shorter than the ground rod length. Drive rods a minimum of 12 inches into the bottom of the hole until tops are 12 inches below final grade. After installing connections, backfill around ground rod with enhanced composite backfill.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Except at test wells, use exothermic welds for all below-grade connections to ground rods.
3. For the grounding electrode system at the service, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole.
1. Install at least one test well for each service unless otherwise indicated. Install it at the ground rod electrically closest to the service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts. Install straps and jumpers such that it does not restrict movement of the structure to which it is connected.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a mechanical connector. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Other Metal Piping: Bond each aboveground portion of metal piping systems, including gas piping, downstream from its equipment shutoff valve in an accessible location.

4. Except for water piping, do not utilize piping systems as a ground path where dielectric fittings are utilized. Do not use bonding jumpers to bridge over such fittings.

5. Do not use underground portions of natural gas, flammable gas, or liquid fuel piping as grounding electrodes.

G. Grounding for Steel Building Structure:
   1. Where the building's steel frame is made discontinuous by masonry breaks or expansion joints, provide an accessible No. 500 kcmil bare copper jumper with exothermic weld connections to bond steel sections together, making the steel frame electrically continuous. The installation of the bonding jumpers shall be reviewed by the Engineer before covering.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Provide and fabricate in accordance with NFPA 70; use a minimum of 20 feet bare copper conductor no smaller than #4 AWG located in building footing that has direct contact with earth.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts using exothermic weld connections. Extend grounding conductor below grade and connect to building's ground ring or to grounding electrode external to concrete.

I. Exothermic Welded Connections: Provide in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
   1. An electronic ignition system shall be used, and weld metal shall be a self-contained, sealed system with a bi-metallic fuse to start the reaction.
   2. Comply with AWS Standards and manufacturer's instructions for procedures, appearance, and quality of welds; and methods used in correcting welding work.
   3. Ensure process joins all strands and does not cause the parts to be damaged or weakened.
   4. A completed connection or joint must be equal or larger in size than the conductors joined and have the same current-carrying capacity as the largest conductor.

J. Mechanical Connections: Install mechanical connections in accessible locations.
   1. Tighten connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values.
   2. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

K. Poles Supporting Outdoor Light Fixtures: Install grounding rod and a separate #4 bare ground electrode conductor bonded to pole in addition to equipment grounding conductor installed with branch circuit conductors.

L. Connections between Dissimilar Metals: Make connections so the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
   1. Clean surfaces and apply antioxidant compound prior to installation of connections.
   2. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   3. Make connections with clean, bare metal at points of contact.
   4. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

5. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.8 FIELD QUALITY CONTROL

A. Buried or concealed grounding electrode systems shall be accepted by Engineer and Owner Representative before backfilling or covering.

B. Tests and Inspections:
1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Bond Resistance Test: Test the bonding connections of the system using a certified micro-ohmmeter, taking two-point resistance measurements across each bond in the grounding electrode system. The maximum acceptable value of each bond is 0.5 milliohms.
3. After completing installation of the grounding electrode system and finished grade, but before permanent electrical circuits have been energized, test for compliance with requirements.
4. Grounding Electrode Resistance Test: Test completed grounding electrode system at service disconnect enclosure grounding terminal and at ground test wells using a manufacturer calibrated and certified 3-point ground resistance tester.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by three-point fall-of-potential method according to IEEE 81.
    c. Disconnect and isolate the grounding electrode conductor from the electrical system at the main ground bus before testing.
    d. Install outer test probe outside the sphere of influence of the grounding electrode system. This value is typically 10 times the size of the grounding electrode system, between 300 and 500 feet from the main ground bus.
    e. Install inner test probe at 10 equally spaced intervals, in a straight line between the grounding electrode system connection and the outer test probe and note the resistance reading at each location.
    f. The resistance measurements taken from the flat part of the curve shall be averaged to determine the grounding electrode system resistance to earth.
    g. If large variations are noted in the resistance measurements, the outer test probe should be relocated further from grounding electrode system (outside its sphere of influence) to achieve some degree of flatness on the resistance curve.
    h. Excessive Ground Resistance: If resistance to ground exceeds 5-ohms, notify Engineer promptly and include recommendations to reduce ground resistance. If deemed necessary by the Engineer, additional electrodes shall be placed, and the measurement process repeated until the desired ground potential is achieved.
5. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and

their depth at each location, and include test probe locations, observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare detailed test and inspection reports and submit them to the Engineer for review.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

C. Each Electrical Contractor's attention is directed to Section 260501 - General Requirements for Electrical Systems, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

A. Section Includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

B. Related Sections include the following:
   1. Division 26 Section "Common Work Results for Electrical Systems 260500" for products and installation requirements necessary for vibration isolation pads and other support systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit

C. LFMC: Liquid-tight flexible metal conduit

D. GRS: Galvanized rigid steel conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Allied Tube & Conduit
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. Thomas & Betts Corporation.
      e. Unistrut; Tyco International, Ltd.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Device Box Mounting Brackets: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper B-Line, Inc.; a division of Cooper Industries.
      b. ERICO International Corporation.

F. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper B-Line, Inc.; a division of Cooper Industries.
      b. ERICO International Corporation.

G. Roof-mounted Raceway Support Blocking: Factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line C-Port series components or a comparable product by one of the following:
      a. Cooper B-Line, Inc.; a division of Cooper Industries.
      b. ERICO International Corporation.

H. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper B-Line, Inc.; a division of Cooper Industries.
      b. ERICO International Corporation.

I. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

J. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, or steel with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b.
      1 Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Solid, threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NFPA 70, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.

B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for EMT and GRS as required by NFPA 70.

C. Minimum Hanger Rod Size for Raceway Supports: Minimum rod size shall be 1/4 inch in diameter.

D. Single Raceways:
   1. For Raceways 1-1/4-inch and smaller: Install adjustable steel band hanger suspended on threaded rod.
   2. For Raceways larger than 1-1/4-inch: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods. Size trapeze members, including the suspension rods, based on the support required for the size, and loaded weight of the conduits.
      a. Secure raceway or cable to support with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

E. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods, where multiple raceways are run vertically or horizontally at the same elevations. Size trapeze members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 EXAMINATION

A. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SUPPORT INSTALLATION

A. Comply with NFPA 70, NECA 1 and NECA 101 for installation requirements except where requirements of this Article are more stringent.

B. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.

C. Install Device Box Mounting Brackets supported between two studs. All device boxes shall attached to two studs, device box stabilizers shall not be acceptable.

D. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.

E. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings.
   1. Install at least one independent support rod from box hanger to structure.

F. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.
   1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work.

G. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.

H. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.

I. Locate raceways so as not to hinder access to mechanical equipment.

J. Do not secure conductors, raceways, or supports to suspended ceiling hanger rods or wires.

K. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

L. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
   6. To Light Steel: Sheet metal screws.
   7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
   8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.

M. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.

N. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars. Verify reinforcing locations with Structural Engineer. X-Ray existing concrete structures as required.

3.4 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 3 inches larger in all directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.6 PAINTING

A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 – General Requirements for Electrical Systems apply to this Section.

1.2 SUMMARY

A. This section is intended to specify the raceways, fittings, boxes, cabinets, specialties and related items necessary to complete the work as shown on the drawings (Power, lighting and low voltage) and specified herein.

B. Section Includes:
1. Metal conduits and fittings
2. Nonmetallic conduits and fittings
3. Surface metal raceway
4. Metal wireways and auxiliary gutters.
5. Boxes, enclosures, and cabinets
6. Wall ducts and trench ducts.

C. Related Requirements:
1. Refer to Division 07 firestopping section and Section 260010 “General Requirements for Electrical Systems” for penetration firestopping requirements related to electrical pathways and boxes.
2. Refer to Section 270528 “Pathways for Communications Systems” for supplemental pathway requirements related to communications systems.

1.3 REFERENCES

A. Abbreviations
1. EMT: Electrical Metallic Tubing
2. ERMC-S: Electrical Rigid Metal Conduit – Steel.
3. FMC: Flexible Metal Conduit
4. GRC: Galvanized Rigid Steel Conduit
5. IMC: Intermediate Metal Conduit
6. LFMC: Liquid-tight Flexible Metal Conduit.
7. RAC: Rigid Aluminum Conduit
8. RMC: Rigid Metal Conduit

B. Definitions
1. Outlet: A point on the wiring system at which current is taken to supply utilization equipment.

2. Raceway: an enclosed channel designed for enclosing and protecting electrical, communications, and signaling wires and cables.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
1. National Electrical Contractors Association (NECA)
   a. NECA 101 - Standard for Installing Steel Conduits (RMC, IMC, EMT)
   b. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)
2. National Electrical Manufacturers Association (NEMA)
   a. NEMA FB 2.10 - Selection and Installation Guidelines for Fittings for Use with Non-Flexible Metallic Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)
   b. NEMA FB 2.20 - Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable
   c. NEMA RV 3 - Application and Installation Guidelines for Flexible and Liquid-tight Flexible Metal Conduits

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

2.2 METAL CONDUIT AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Calconduit
5. Electri-Flex Company.
6. O-Z/Gedney.
7. Southwire Company.
8. Thomas & Betts Corporation.
9. Wheatland Tube Company.

B. Electrical Metallic Tubing (EMT) and Elbows:
1. Comply with ANSI C80.3 and UL 797.
2. Shall be of corrosion-resistant steel construction.

C. Electrical Rigid Metal Conduit (ERMC-S, GRC, RMC) and Elbows:
   1. Comply with ANSI C80.1 and UL 6.
   2. Zinc coating both inside and outside by means of hot-dip galvanizing.
   3. Use only threaded fittings for ERMC-S.

D. PVC Coated Galvanized Rigid Metal Conduit (RMC) and Elbows:
   1. Comply with NEMA RN 1
   2. Minimum 40 mil thick PVC exterior coating with overlapping sleeves protecting threaded joints.
   3. Minimum 2 mil thick urethane interior coating.
   4. Clear urethane coating over hot-dip galvanized threads.

E. Electrical Intermediate Metal Conduit (IMC) and Elbows:
   1. Comply with ANSI C80.6 and UL 1242

F. Flexible Metal Conduit (FMC):
   1. Comply with UL 1.
   2. Continuous interlocked hot-dip zinc galvanized steel with smooth interior and exterior.
   3. Suitable for dry locations.

G. Liquid-tight Flexible Metal Conduit (LFMC):
   1. Comply with UL 360.
   2. Continuous interlocked hot-dip zinc galvanized steel core with smooth interior and exterior.
   3. Suitable for wet and dry locations, direct burial applications, and concrete encasement.
   4. Sunlight resistant, flame-retardant thermoplastic PVC jacket resistant to heat, oil, and chemical breakdown.

H. Metal Fittings
   1. Comply with NEMA FB1 and UL 514B.
   2. Listed and labelled for type of conduit, location, and use.
   3. Fittings for EMT:
      a. Compression type, zinc-plated galvanized steel.
      b. Concrete-tight- or rain-tight, hardened steel locknuts, and nylon insulating throats.
   4. Fittings for ERMC-S and IMC:
      a. Threaded zinc plated steel.
      b. Concrete-tight- or rain-tight, nylon insulating throats.
   5. Conduit Bodies:
      a. Material: gray iron or heavy copper-free cast aluminum
      b. Available in varying configurations with integral bushing and gasketed coverplate.
   6. Expansion/Deflection Fittings: UL 651 listed, manufactured coupling accommodating 3/4-inch linear movement from normal and 30-degree angular movement in all directions
      a. Basis of Design: OZ/Gedney DX
      b. PVC or steel sleeve to match conduit type with neoprene jacket, rated for environmental conditions were installed.
      c. Integral braided copper bonding jumper.
   7. Fittings for FMC and LFMC:
      a. LFMC: Tubular Steel, zinc-plated with gland nut, sealing ring, high tensile grounding ferrule, insulated throat, and body for liquid tight connection.
   8. Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

9. "Kwik-Couple" type fittings are not permitted.
10. Indentation, set-screw, or die-cast fittings are not permitted.

I. Joint Compound for threaded conduit: UL 2419 listed for use in conduit assemblies and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3 NON-METALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Allied Tube & Conduit
2. Cantex
3. Carlon
4. Prime Conduit

B. Rigid Polyvinylchloride (PVC) Conduit:
1. Comply with NEMA TC-2 and UL 651.
2. Sunlight resistant and suitable for use with 90 degree C conductors.
3. Type EPC-40 suitable for normal duty applications.
4. Type EPC-80 suitable for heavy duty applications.

C. Non-Metallic Fittings
1. Comply with NEMA TC 3 and UL514B.
2. Listed and labelled for type of conduit, location, and use.
3. Compatible with conduit type and material.
4. Solvents and Adhesives: as recommended by conduit manufacturer.

2.4 SURFACE MOUNTED METAL RACEWAY

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
1. Hubbell
2. Mono-Systems
3. Legrand Wiremold

B. Source Limitations: Obtain surface metal raceway, components, outlets, and fittings from single manufacturer.

C. Single and Multi-Channel Raceways:
1. Two-piece design with base and snap on cover complying with UL 5, suitable for use with electrical branch circuit wiring, data/voice network cabling, and low voltage wiring.
2. Material: Galvanized Steel
3. Finish: Manufacturer's standard enamel finish in color selected by Architect, suitable for field painting to match adjacent surfaces.
4. Size: Available in varying widths, selected to accommodate number of conductors and services indicated on drawings with a maximum of 40-percent fill.

D. For multi-channel configurations, provide integral divider separating raceway into equal compartments for power and low voltage wiring.

E. Fittings: Include clips, straps, couplings, elbows, tees, connectors, and bushings suitable for interconnecting raceway segments in various configurations. Fittings to overlap raceway and hide uneven cuts. Material and finish to match raceway.

F. Device Boxes: single and multi-gang configurations, suitable for mounting standard devices and faceplates. Material and finish to match raceway.

G. Device Plates: sized to match raceway width with openings suitable for mounting various standard power and communications devices. Material and finish to match raceway.

H. Device Brackets: suitable for mounting standard single or two-gang devices horizontally or vertically within large raceways.

I. Plugmold: steel surface metal raceway with integral Simplex NEMA 5-20R outlets spaced 12-inches on center or as indicated on drawings.

2.5 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton B-Line
2. Hubbell Wiegmann.
3. nVent Hoffman.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise required by environmental application, and sized according to NFPA 70. Minimum of 14-gauge steel before finishes are applied.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
1. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.
2. Provide dividers to separate conductors of different insulation levels or where required by equipment vendor installation instructions.

D. Wireway Covers: Furnish with continuous hinged covers on all runs and removable covers on all fittings unless otherwise noted, to allow a continuous unobstructed path for conductor installation.

E. Finish: Manufacturer's standard enamel finish resistant to corrosion, moisture, and oil.

F. Size: available in nominal sizes 2-1/2-inch by 2-1/2-inch, 4-inch by 4-inch, 6-inch by 6-inch or 12-inch by 12-inch.

G. Install supports to allow unobstructed access to wireway interior. Use minimum 1/4-inch rod hangers for up to 4-inch by 4-inch wireway, 3/8-inch rod up to 8-inch by 8-inch wireway, and 1/2-inch rod for 12-inch by 12-inch wireway.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Eaton Crouse-Hinds.
   2. Emerson/Appleton Electric.
   3. FSR Inc.
   4. Garvin Industries
   5. Hoffman.
   6. Hubbell Killark.
   7. Mono-Systems, Inc.
   8. O-Z/Gedney.
   9. RACO / Hubbell.
   10. Thomas & Betts.
   11. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed for intended use.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Non-adjustable, designed for attachment of luminaires, listed and marked for the maximum allowable weight with at least a 2.0 safety factor for the anticipated fixture weight.

F. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1, constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. For box extensions and mud rings used to accommodate building finishes, provide with same material as recessed box.

J. Minimum Device Box Dimensions unless noted otherwise:
   1. Single gang: 4-inches square by 2-1/8-inches deep with single gang extension ring.
   2. Two gang: 4-inches square by 2-1/8-inches deep with two-gang extension ring.
   3. Three gang: 8-5/8-inches by 4-1/2-inches by 2-1/2-inches deep with three gang extension ring.

4. Four gang: 10-7/16-inches by 4-1/2-inches by 2-1/2-inches deep with four gang extension ring.

K. Gangable boxes are prohibited.

L. Boxes assembled with sheet metal screws are prohibited.

M. Hinged Cover Enclosures: Comply with UL 50 and NEMA 250, suitable for installed environment with continuous-hinge cover and flush latch unless noted otherwise.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass
3. Interior Panels: Steel, all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Apply raceway products as specified below unless otherwise indicated:
1. Refer to Section 260543, "Underground Ducts and Raceways for Electrical Systems" for additional requirements related to raceways installed underground outside of the building footprint.
2. Exterior and Exposed: ERMC-S/GRC
3. Concealed Underslab: ERMC-S/GRC or PVC Type EPC-40 where approved.
4. Concealed Underslab with conductors above 600V: Concrete encased ERMC-S or concrete encased PVC Type EPC-40 where approved.
5. Interior, Concealed in Ceilings, Walls, and Partitions: EMT, IMC, or ERMC-S
6. Interior, Concealed in Below Grade Concrete or Grouted Masonry Walls and Partitions: IMC or ERMC-S/GRC
7. Interior, Damp or Wet Locations: ERMC-S.
8. Interior, Where exposed and Not Subject to Physical Damage: EMT, ERMC-S, or IMC. Raceway locations include the following:
   a. Electrical Rooms
   b. Mechanical Rooms (Above 8'-0")
9. Interior, Where Exposed and Subject to Severe Physical Damage: ERMC-S. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms (below 8'-0").
   d. Gymnasiums
10. Interior, where Exposed in washdown area and Subject to Severe Physical Damage: PVC Coated GRC. Raceway locations include the following:
11. Exposed stub-ups in Commercial/Institutional Kitchen or Cafeteria.
12. Conductors operating above 600V: ERMC-S.

13. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
14. Connection to ceiling mounted recessed and semi-recessed luminaires and electrical devices: FMC.
15. Boxes and Enclosures: NEMA 250, Type 1 except as follows:
    a. Damp or Wet locations: NEMA 250, Type 3R
    b. Kitchens and Cafeterias: NEMA 250, Type 3R
    c. Corrosive environments: NEMA 250, Type 4X
16. Exposed Boxes subject to physical damage: Die cast metal boxes with threaded hubs.
17. EMT is not permitted underslab, embedded in concrete slabs, or where exposed to physical damage.
18. Non-metallic conduit is not permitted for the following applications unless approved by the Engineer:
    a. Interior Locations including environmental air plenums.
    b. Applications where a redundant ground fault path is required by code.
19. Flexible non-metallic conduit is not permitted.

C. Minimum Raceway Size: 3/4-inch trade size unless noted otherwise on the drawings.

D. Raceway Fittings: Compatible with raceways and suitable for use and location
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4.
5. Flexible Conduit: Use only steel fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth or where prolonged contact with construction materials will degrade the aluminum.

F. Install raceways and fittings in a manner to avoid use of dissimilar metals that would result in galvanic action corrosion.

G. Install surface conduits or raceways only where indicated on Drawings.

H. Do not install surface conduits or raceways on exterior facades unless approved by Engineer.

I. Do not install nonmetallic conduit where ambient temperature or operating temperature of the conductors exceeds the rating of the raceway.

J. Conduit installed embedded in concrete slabs is not permitted.

3.2 RACEWAY INSTALLATION

A. Comply with requirements in Section 260500 "Common Work Results for Electrical Systems" for hangers and supports.

B. Comply with NECA 1, NECA 101, NECA 111 and manufacturer's written instruction for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Complete raceway installation before starting conductor installation.

D. Comply with utility company requirements for raceways and boxes containing utility company conductors.

E. Size raceways to conform with Annex C, of the National Electrical Code, unless otherwise shown in the Contract Drawings.

F. Level and square raceway runs and installs at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.

G. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated.

H. Install conduits with runs parallel or perpendicular to building lines, walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. Randomly routed conduits are not acceptable.

I. Make bends in raceway using large-radius preformed elbows. Provide concentric bends for parallel runs of conduit. Conform with NFPA 70 minimum radii requirements for field bending. Use only equipment specifically designed for material and size involved.

J. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12-inches of changes in direction.

K. Provide junction boxes or pull boxes so that conduit runs do not exceed 100 feet, or as shown on the Contract Drawings. Size junction boxes per NEC, Article 370.

L. Provide conduit supports spaced not more than 8-feet apart.

M. Support conduit within 12-inches of enclosures to which attached.

N. Do not drill into bar joists to support raceways or cables.

O. Install conduits at least 12-inches away from flues, steam or hot water pipes.

P. Conduit installed under concrete slabs is permitted for feeders and for branch circuits serving floor outlets. Underslab conduit is prohibited for other locations unless noted on the drawings or with permission of the engineer. Where approved, comply with the following:
   1. Locate raceway a minimum of 12-inches below the bottom of slab.

2. Provide minimum 2-inch spacing between conduits to ensure proper compaction of structural fill.
3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
4. Transition underslab RNC to ERMC-S for all bends larger than 20-degrees and for all stub-ups through a slab on grade. Arrange stub-ups so curved portions of bends are not visible above finished slab. Extend ERMC-S stub-ups a minimum of 6" above the concrete slab. Schedule 80 PVC stub-ups are allowed where approved by engineer.
5. Seal around conduits when penetrating vapor barriers.

Q. Where raceways are subject to environmental changes, locate seals immediately at the boundary so no fittings or boxes are between the seal and the change of environments that would allow migration of condensation within the raceway system. Seal the interior of all raceways at the following points:
1. Where conduits pass from cold to warm locations, such as boundaries of refrigerated spaces and at building wall and roof penetrations.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

R. Install conduits in a manner so as to ensure against collection of trapped condensation. Arrange all runs of conduit so as to be devoid of traps. Provide trapped conduit runs with explosion proof drains at low points.

S. At hazardous locations, install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed non-shrink sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

T. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.

U. Complete installation of electrical raceways before starting installation of cables or wires within raceways.

V. Take precautions to prevent the lodgment of dirt, plaster, or trash in all conduit or tubing, fittings, and boxes during construction. Use mandrel to clean all conduit for floor boxes or conduit below grade and ensure its swabbed free of debris or moisture before wiring is installed.

W. Unless using ERMC-S, do not locate conduits, cables, raceways, and enclosures within 2 inches of bottom of metal-corrugated sheet roof decking, measured from the lowest surface of the roof decking to the top of the conduit, cable, raceway, or box.

X. Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal-corrugated sheet decking type roofing.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72-inches of flexible conduit for ceiling mounted recessed and semi-recessed luminaires, and 36-inches for all other equipment subject to vibration, noise transmission, or movement, and for transformers and motors.
   1. Install as a single piece with clamp-on insulated throat connectors designed for the purpose.
   2. Provide strain relief fittings where subject to vibration.
   3. Provide an equipment grounding conductor and bonding jumper at all locations.
   4. For LFMC, provide a minimum of 18-inches and loop to avoid restraining vibrating equipment.

Z. Stub-ups to Accessible Ceilings:
   1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or into an enclosure.
   2. Where conduits terminate at a cable tray pathway, provide listed fitting to secure conduit to cable tray.

AA. Mechanically fasten conduit terminations at a wireway, provide metal insulated bushings, and bond to the wireway with bonding jumper.

BB. Furnish conduit bodies in proper configurations, avoiding excessive openings. Any openings that are left shall be properly plugged. Wiring splices within conduit bodies are not permitted.

CC. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

DD. Provide a completely separate raceway system, including junction boxes and pull-boxes, for each emergency power, optional stand-by, and normal power system for complete separation in accordance with NEC.

EE. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of secured slack at each end of pull wire. Secure pull string at each end and cap raceways.

FF. Coordinate with vendors and provide extra pull-strings as required to ensure sufficient number of pull strings.

GG. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

HH. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
   1. Install raceways square to enclosures and terminate with appropriate fitting:
   2. For enclosures without hubs, terminate with appropriate fitting, insulated throat liner, and case-hardened locknuts on both sides of enclosure wall.
   3. Terminate rigid conduits with threaded hubs or with locknuts on inside and outside of enclosure and insulated throat metal bushing.
   4. Install locknuts hand tight, plus one-quarter turn more.

5. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
6. All threaded fittings shall engage a minimum of seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.
7. Split sleeve insulators are not permitted.

II. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

JJ. Expansion-Joint Fittings:
1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit support to allow for expansion movement.

KK. Where raceways penetrate rooms or walls with acoustical requirements, seal raceway openings on both sides of penetration with acoustically rated putty or sealant.

3.3 BOX AND ENCLOSURE INSTALLATION

A. Provide electrical outlets and enclosures as required for splices, taps, wire pulling, and equipment connections.

B. Provide pull boxes as required to maintain conduit run and bend limitations specified herein.

C. Size all outlets, pull boxes, junction boxes, cabinets, etc., per adopted edition of the National Electrical Code.

D. Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

E. Install interior and exterior outlet boxes recessed in building construction with face or cover flush with finished surfaces unless noted otherwise. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or in walls covered by wood wainscot or paneling, provide deep box to ensure the outlet boxes are installed straight and secure in walls.

F. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements and architectural elevations. Install boxes with height measured to center of box unless otherwise indicated.

G. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box. Do not split the mortar joint.

H. Provided 3/4-inch rigid conduit pendants where lighting fixtures, appliances, or wiring devices are to be suspended from ceiling outlet boxes. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and #14-gauge steel locking ring. Provide safety chain between building structure and housing for all fixtures, appliances, or devices greater than

10 lbs weight. Install fixtures plumb and level. Cover pendants shall be finished to match fixtures.

I. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

J. Locate boxes so that cover or plate does not span different building finishes.

K. Provide spanner bars to support all boxes from more than one side by spanning two framing members.

L. Fasten boxes up to 4-11/16 square size to their mounting surface or support with two fasteners of proper size. Fasten larger sizes with four fasteners, minimum.

M. Support boxes recessed in ceilings independent of ceiling tiles and ceiling grid.

N. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits or ceiling support wires.

O. Provide all cabinets and boxes for NEMA 1 applications with knockouts, as necessary, or field cut with approved cutting tools which will provide a clean, symmetrically cut opening to maintain UL listing of enclosure.

P. Replace any unused knockouts or openings with a listed knockout closure.

Q. Coordinate with equipment vendors to provide special sized outlet boxes to support installed equipment.

R. Where boxes and enclosures are located in areas or on walls with acoustical requirements, seal openings and knockouts in back and sides of boxes with acoustically rated putty or sealant and provide gasket for wall plates and covers.

3.4 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 “Grounding and Bonding for Electrical Systems”.

B. Where conductors are spliced or terminated within a box, or supported by a box, bond metal box with pigtail to the equipment grounding conductor.

C. Provide insulated throat grounding bushings with appropriately sized bonding jumpers for the following locations to maintain electrical continuity between the raceway and enclosure:
   1. Metal raceways and enclosures that contain service conductors.
   2. Metal raceways and enclosures that contain grounding electrode conductors.
   3. Where metal raceways containing circuits over 250V terminate in a concentric or eccentric knockout at cabinets, enclosures, or sheet metal pull boxes listed in accordance with UL 50.
   4. Where the integrity of a concentric or eccentric knockout has been compromised.
   5. Metal raceways and enclosures that contain feeders.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

B. Protect threads on conduits and fittings with plastic protectors or other means to prevent damage prior to installation.

C. Provide protection for all conduit stubbed through floor during construction with plastic caps approved for this purpose.

D. Provide backboxes for all low-voltage floor-mounted and wall-mounted outlets, including all necessary accessories required to extend the low-voltage cabling to the ceiling.

3.6 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Identify all junction, outlet and pull boxes in data/mechanical/electrical rooms and above ceilings with panel and circuit designation on outside of covers. Identify all exposed junction, outlet and pull boxes in finished areas with panel and circuit designation on the inside of covers.

C. Provide black finish for exposed raceways and junction boxes on theater stage.

3.7 PAINTING

A. Raceways installed in exterior locations shall receive one coat of primer, two coats finish paint after preparation of galvanizing, color selected by Architect.

B. Exposed raceways in painted interior areas shall be painted to match adjacent finishes.

END OF SECTION

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Direct-buried and concrete-encased conduits, ducts, and duct accessories.
   2. Handholes and boxes.
   3. Utility Structure accessories.

B. Related Requirements:
   1. Refer to Section 260533 “Raceways and Boxes for Electrical Systems” for pathway requirements installed under building slabs.

1.3 REFERENCES

A. Abbreviations
   1. GRC: Galvanized rigid conduit.
   2. IMC: Intermediate metal conduit.
   3. RNC: Rigid nonmetallic conduit.

B. Definitions
   1. Backfill: Earth or other controlled material placed in trenches for filling and grading back to a finished state.
   2. Initial Backfill (encasement): Backfill placed beside and over conduit arrangements in a trench, including haunches to support sides of conduits.
   3. Final Backfill: Backfill placed over initial backfill to fill a trench.
   4. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying conduit.
   5. Duct: A single or multiple underground conduits encased in concrete or direct buried.
   6. Duct Bank: An arrangement of two or more ducts installed together.
   7. Encasement: Material placed around a duct or duct bank to provide additional protection.
   8. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA TCB-2 “Guidelines for the Selection and Installation of Underground Nonmetallic Raceways”.

1.4 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

2.2 CONDUITS AND FITTINGS

A. Comply with 260533 “Raceways and Boxes for Electrical Systems”.

2.3 DUCT ACCESSORIES

A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during encasement or backfilling.

B. Fabric Innerduct: Continuous, nylon resin polyester, multi -pocket fabric innerduct, with internal pull tape. Maxcell or equal.

C. Pull Line: Flat, woven, polyester or polyaramid tape, low stretch, pre-lubricated for reduced friction. Strength suitable for required pulling tensions with a minimum of 200-lb. Muletape or equal.

D. Underground Detectable Warning Tape: Flexible tape constructed with solid aluminum foil backing and clear film laminate, 6-inches wide, 5-mil overall thickness.
   1. Suitable for the method of installation and locating underground utility lines.
   2. Chemically inert tape material and ink, resistant to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
   3. Comply with APWA Uniform Color Code.
   4. Inscriptions for Red-Colored Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
   5. Inscriptions for Orange-Colored Tapes: “CAUTION BURIED COMMUNICATIONS LINE BELOW”.

E. Duct Sealants: Re-enterable, two-part, closed-cell urethane foam capable of sealing conduits with multiple cable configurations.
   1. Capable of withstanding temperatures from -40 deg F to 200 deg F and holding 22 feet waterhead pressure continuous.
   2. Chemically resistant to gasoline, oils, dilute acids and bases.
   3. Compatible with cable jacket and shall not affect the physical or electrical properties of wire and cable.
   4. Workable at temperatures as low as 40 deg F.
   5. UL94 Class HBF fire retardant rating.

2.4 POLYMER CONCRETE HANDHOLES AND BOXES

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two. Coordinate all boxes for utility cabling with utility requirements.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armorcast
   2. NewBasis
   3. Oldcastle
   4. Hubbell Quazite

C. General Requirements:
   1. Comply with SCTE 77. Minimum Tier 15.
   2. Color: Gray.
   3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
   4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   6. Cover Legend: Molded lettering, as indicated for each service.

2.5 PRECAST CONCRETE HANDHOLES

A. Description: Factory fabricated, one-piece units and units with interlocking mating sections, complete with accessories, hardware, and features. Frame and cover shall have load rating consistent with that of structure.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Christy Concrete Products
   2. Oldcastle
   3. Utility Concrete Products
   4. Utility Vault Co

C. Comply with ASTM C 858.

D. Precast reinforced-concrete, H-20 structural load rating according to AASHTO HB 17.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   1. Locate windows no less than 6 inches from interior surfaces of walls, floors, or roofs of structure, but close enough to corners to facilitate racking of cables on walls.
   2. Provide window opening with cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
   3. Provide window opening frame with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
   4. Provide windows 1-1/2 to 2 inches thick.

F. Duct Entrances in Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   1. Type and size shall match fittings to duct or conduit to be terminated.
   2. Fittings shall align with elevations of approaching ducts and be located near interior corners of structures to facilitate racking of cable.

G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

H. Provide ventilation openings where indicated on drawings.

I. Frames, Covers, and Chimney Components: Comply with structural design loading specified for structure.
   1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 35 cast iron with milled cover-to-frame bearing surfaces; diameter, 32 inches.
   2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   3. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
   4. Cover Legend: Cast in. Selected to suit system.
   5. All covers shall be provided with 2 inch lettering and with the structure number, assigned by Owner, welded onto the cover if not provided by the manufacturer.
   6. All covers shall be provided with stainless steel drop handles.
   7. Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
   8. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
   9. Seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers' printed instructions.

J. Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

K. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch diameter eye, and 1-by-4 inch bolt.
   1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

L. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
   1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

M. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

N. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

O. Ground Rod Sleeve: 3-inch, PVC conduit sleeve in floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

P. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

Q. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
   1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
   2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
   3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Tests of materials shall be performed by an independent testing agency.
   2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   3. Testing machine pressure gauges shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Notify Architect if there are obstructions or conflicts between areas of excavation and existing structures or archaeological features to remain.

C. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

D. All necessary precautions shall be taken by the contractor during construction to prevent the lodging of dirt, plaster or trash in all conduit, tubing, fittings and boxes.

3.2 UNDERGROUND DUCT APPLICATION

A. Apply underground duct products as specified unless noted otherwise:
   1. Refer to Section 260533, "Raceways and Boxes for Electrical Systems" for additional requirements related to underground conduit below building slabs.
   2. Ducts for Utility Company primary conductors: comply with utility company standards unless noted otherwise.
   3. Ducts for Electrical Service Secondary Conductors: RNC, Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
   4. Ducts for Electrical Cables greater than 600 V: RNC, Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
   5. Ducts for Electrical Feeders 600 V and Less: RNC, Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
   6. Ducts for Electrical Branch Circuits: RNC, Type EPC-40 PVC, in direct buried duct bank unless otherwise indicated.
   7. Ducts for Communications Cables: RNC, Type EPC-40 PVC, in direct buried duct bank unless otherwise indicated.
   8. Underground Ducts 600V and less Crossing Driveways and Roadways: RNC, Type EPC-40-PVC, encased in reinforced concrete. Extend reinforcement a minimum of 5-feet beyond the edge of paved surfaces.

B. Minimum Cover Requirements: Provide reinforced concrete encasement where minimum depths are not achievable.
   1. Electrical Primary or Conductors more than 600V: 42-inches unless otherwise indicated by utility company requirements.
   2. Electrical Secondary Service and Feeders: 36-inches
   3. Electrical Branch Circuits: 24-inches
   4. Communications: 30-inches

C. Transition RNC to GRC for all stub-ups and building enclosure penetrations. Use fittings manufactured for RNC-to-GRC transition.
   1. Arrange stub-ups so curved portions of bends are not visible above grade. Increase burial depth where required to maintain cover for curves and bends.
   2. Do not use steel raceways for equipment stub-ups where prohibited by utility company standards.
   3. Minimum Underground Raceway Size: 1-inch trade size unless noted otherwise on the drawings.

3.3 EARTHWORK

A. Contractor shall accept the site as they find it and remove all trash, rubbish, and material from the site prior to starting excavation work.

B. Subsurface Data
   1. Subsurface investigations have been performed and the results provided with the contract documents. The information was obtained primarily for use in preparing foundation design. Each contractor may draw their own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time the investigations were made.
   2. Materials to be excavated shall be unclassified, and shall include eart, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in excavating.

C. Benchmarks and Monuments
   1. Carefully maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

D. Excavation:
   1. Remove rock by using hand or power tools only. Blasting is not permitted unless authorized in writing by the Architect.
   2. Any damage to existing structures, exterior services, or rock intended for bearing shall be corrected by the Contractor at their own expense.
   3. Take necessary precautions to control runoff of eroded earth onto the property of others or against the structures. All such damage or any other damage incurred in the course of excavation, shall be corrected by the Contractor at their own expense.
   4. Trenching:
   5. Cut trenches neatly and uniformly. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.
   6. Width: Excavate trench a minimum of 3 inches wider than duct bank on each side with a minimum trench width of 12-inches.
   7. Depth: Excavate to a minimum depth that equals ductbank height plus minimum cover requirements.
   8. Hand excavate trench bottom to provide uniform bearing and support of conduits on an undisturbed subgrade matching slope requirement. Remove all debris, stones, and other projections.
   9. For rock or other unyielding soils, excavate trenches 6-inches deeper than required elevation and provide level 6-inch compacted sand bedding course.
   10. For unstable soils or where bedding course is subject to washout, provide concrete trench bottom.
   11. Coordinate protection of roots in tree and plant protection zones with Division 31 requirements.
   12. Keep trenches free from water while construction is in progress. Installation of conduit or cable in trenches with water is not permitted. Contractor is responsible for all costs associated with dewatering of trenches.

E. Final Backfill: Comply with Division 31 and as indicated below:

1. Use satisfactory soil to backfill trenches to final subgrade elevation unless required otherwise by Civil or Structural subgrade requirements.
2. Install final backfill in 6-inch layers.
3. Compact all backfill to 95% standard proctor density.
4. Mechanical means for compaction can be used once conduits have been covered with at least 12-inches of hand tamped backfill. Do not use heavy-duty, hydraulic-operated, compaction equipment.

F. Restoration:
1. Replace area immediately after backfilling is completed or after construction in immediate area is complete.
2. Restore all surface features at areas disturbed by excavation, storing of dirt, cable laying, and other work, and re-establish original grades unless otherwise indicated.
3. Restore vegetation and include 6-inches of clean topsoil, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32.

G. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" requirements in Division 01 and Section 260010, “General Requirements for Electrical”.

3.4 DUCT INSTALLATION

A. Install ducts, spacers, and accessories into ductbank configurations to accommodate duct quantities and sizes indicated on drawings.

B. Install ducts according to NEMA TCB 2.

C. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes, to drain in both directions. Install ducts in such manner to avoid traps and insure against collection of moisture.

D. Curves and Bends:
1. Use 5-degree angle couplings for small changes in direction.
2. Use manufactured long sweep bends with a minimum radius of 36 inches vertically and 60-inches horizontally, unless otherwise indicated.
3. Field manufactured bends are acceptable for a bend radius greater than 35-feet. Install field bends in accordance with NEMA TCB 2.
4. Electrical duct and duct banks: Install no more than the equivalent of three 90-degree bends in any conduit run.
5. Communications duct and duct banks: Install no more than the equivalent of two 90-degree bends in any conduit run and a maximum of 600 feet between pull points.

E. Joints: Use solvent-cemented joints in non-metallic ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same horizontal or vertical plane to ensure encasement or backfill fully surrounds each raceway.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, provide minimum 6-foot separation or perform calculations

showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. Installation Adjacent to Other Utilities:
   1. Provide minimum 12-inches of earth or 3-inches of concrete between power and communications ducts.
   2. Provide minimum 24-inches of earth between power or communications ducts and other parallel utilities. At utility crossings, provide minimum 6-inches of separation except provide 12-inches separation where crossing utility is gas or other line that transports flammable material.
   3. Do not locate power and communications ducts below water and sewer lines.

H. Duct Entrances to Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch (19 mm).
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

I. Building Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Provide sleeves at building penetration and make water-tight with sleeve seal.

J. Duct Support
   1. For concrete encased applications, support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   2. Separator Installation: Space separators at a maximum of 5-feet to prevent sagging and deforming of ducts. Place spacers within 24-inches of duct ends. Stagger separators approximately 6 inches between tiers.
   3. Minimum Space between Ducts: 3 inches between ducts and between ducts and exterior envelope wall.

K. Concrete-Encased Ducts:
   1. Secure separators to earth and to ducts to prevent floating during encasement. Tie entire assembly together using non-ferrous tie-wires or straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   2. Reinforcement: Where indicated, reinforce concrete-encased duct banks for their entire length. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
   3. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
   4. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct and exterior envelope wall.

5. Concreting Sequence: Pour each run of envelope between terminations in one continuous operation.
    a) Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b) If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

L. Concrete Encasement:
1. Use normal strength concrete, minimum 3000 psi at 28 days, 6 to 8 inch slump, with maximum 1/2 inch aggregate.
2. Comply with requirements in "Concrete Placement" Article in Division 03. Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope.
3. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces.
4. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

M. Complete final backfilling after concrete has cured.

N. Direct-Buried Duct Banks:
1. Set elevation of bottom of duct bank below frost line.
2. After installing first tier of ducts, install initial backfill and compact.
3. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process.
4. Perform initial backfilling/encasement in 2-inch lifts. Compact to 95% standard proctor density.
5. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp.
6. Firmly tamp initial backfill around ducts to provide maximum supporting strength. Use hand tamper only.
7. After placing initial backfill over final tier, make final duct connections at end of run and complete backfilling.
8. Initial backfill/encasement material shall be crushed stone, sand, or pea gravel with a maximum aggregate size of 1/2-inch.

O. Warning Tape: Bury warning tape approximately 12 inches above all ducts. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

P. Install pull tape in all spare ducts with 3ft of slack tied off and secured at each pull point.

Q. Duct Sealing:
1. Provide temporary plugs of all ducts upon completion of each portion of work to prevent ingress of foreign material into the duct.

2. After conductors have been installed seal all ducts, including spare ducts, at building entrances and equipment terminations. Use sealing compound and foam plugs capable of withstanding at least 15-psig hydrostatic pressure.

3.5 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. Precast Concrete Handhole Installation:
   1. Comply with ASTM C 891 unless otherwise indicated.
   2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
   3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
   1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

C. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars.

E. Hardware: Turn over removable hardware, including pulling eyes, cable stanchions, cable arms, to Construction Manager for use during next phase.

F. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install hand-holes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a12-inch thick level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade. Install handholes and boxes with bottom below frost line.

D. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

E. For enclosures installed in asphalt paving, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
   1. Concrete: 3000 psi, 28-day strength, complying with Division 03, with a troweled finish.
   2. Dimensions: minimum 10 inches wide and 12 inches deep or as shown on drawings.

3.7 GROUNDING

A. Comply with Section 260526 “Grounding and Bonding for Electrical Systems”.

B. Grounding Handholes: Install a driven ground rod through handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before handhole is placed and provide #1/0 AWG bare, tinned-copper conductor from ground rod into handhole through a waterproof sleeve in handhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

3.8 IDENTIFICATION

A. Comply with Section 260553 “Identification for Electrical Systems”
   1. Where ducts transition through handholes, and at each termination point, provide each duct with a unique identifier to indicate origination point.
   2. Cover legends shall be consistent with the owner’s standard practices, especially within existing facilities, unless otherwise require by codes.

3.9 FIELD QUALITY CONTROL

A. Prior to covering duct or underground structures, perform visual inspections to verify the following:
   1. Proper installation depths and slopes have been maintained.
   2. Proper vertical and horizontal spacing in multi-duct formations.
   3. All conduit sections have been properly jointed.
   4. Proper bend radius of curved sections have been maintained.
   5. Check for damage at changes in grades or at bends.
   6. Perform the following tests and inspections and prepare test reports:
   7. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   8. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for duct deflections or out of round conditions. Provide a minimum 6-inch- long mandrel 1/2-inch smaller in diameter than diameter of duct. If obstructions are discovered, remove obstructions and retest.

B. Correct deficiencies, replace affected duct sections, and retest as specified above to demonstrate compliance.

C. Prepare detailed test and inspection reports with accompanying digital photographs.

D. Concealed Work Photographs: Before proceeding with installing backfill that will conceal work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of all ducts until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of handholes, including sump. Remove dirt and foreign material.

END OF SECTION

SECTION 260544 -SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

B. Related Requirements:
   1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b) For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

c) Advanced Products & Systems, Inc.
d) CALPICO, Inc.
e) Metraflex Company
f) Pipeline Seal and Insulator, Inc.
g) Proco Products, Inc.

B. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon Steel.

D. Connecting Bolts and Nuts: Stainless Steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

h) Presealed Systems.
i) Roxtec
j) EJ Prescot Linkseal.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      k) Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
      l) Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch (6.4-mm**)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install them in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment Nameplates.
   2. Cable and Conductor Labels.
   3. Wiring Device Labels
   4. Safety Labels.
   5. Instruction Signs.
   6. Miscellaneous identification products.

B. Related Requirements
   1. Refer to Section 260573, “Power System Studies” for additional requirements related to fault current and arc flash labeling.
   2. Refer to Section 270553, “Identification for Communications Systems” for additional requirements related to labeling of communications equipment and cabling.

1.3 REFERENCES

A. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. American National Standards Institute (ANSI)
      a. ANSI Z535.4, “Product Safety Signs and Labels”
   2. National Fire Protection Association (NFPA)
      a. NFPA 70E, “Standard for Electrical Safety in the Workplace”
   3. Occupational Safety and Health Administration (OSHA)
      a. 29 CFR 1910.144, “Safety color code for marking physical hazards.”
      b. 29 CFR 1910.145, “Specifications for accident prevention signs and tags”
   4. Underwriters Laboratories Inc (UL)
      a. UL 969, “Marking and Labeling Systems”

1.4 COORDINATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings,

manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes and standards. Use consistent designations throughout Project.

B. All identifications shall be consistent with the owner's standard practices, especially within existing facilities, unless otherwise required by codes. Where the requirements herein are in conflict, the contractor shall notify the engineer in writing prior to ordering any material.

C. All room names and/or numbers for labeling or programming shall use the Owner's approved room name and numbering scheme, not names and numbers indicated on floor plans. All reprogramming shall be included as required to accommodate construction phasing.

D. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

E. Coordinate installation of identifying devices with location of access panels and doors.

F. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT SIGNS AND NAMEPLATES

A. Label all electrical panels, transformers, switchboards, telecoms equipment, disconnect switches, and other electrical equipment with engraved vinyl nameplates.

B. Engraved Plastic Signs and Nameplates.
   1. 3-layer melamine plastic laminate
   2. Weather and UV-resistant for Wet and Damp Locations.
   3. Thickness:
      a. For signs up to 20 sq. in., minimum 1/16 inch thick.
      b. For signs larger than 20 sq. in. or 8 inches in length, 1/8 inch thick.
      c. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
      d. Framed with mitered melamine molding and arranged for attachment at applicable equipment.
   4. Color: Comply with color legend.

2.2 RACEWAY AND CONDUCTOR LABELS

A. Raceway Labels: Pre-printed, self-adhesive, polyester, suitable for indoor or outdoor use, resistant to abrasion, humidity, and weather.
   1. Color: Black Letters on an orange field.
   2. Size: For each raceway size, comply with ANSI/ASME A13.1 for recommended letter height and field length.

B. Wire and Cable Labels: Machine printed, self-adhesive, polyester, self-laminating, suitable for indoor or outdoor use on flexible cables, resistant to abrasion, humidity, and weather.

2.3 SAFETY SIGNS AND LABELS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. All field-applied hazard markings shall warn of hazards using effective words, colors, symbols, or any combination thereof as recommended by ANSI Z535.4-2011. This applies to all instances where caution, warning, or danger signs are required per the NEC and applicable OSHA standards.

C. Self-Adhesive Safety Labels: Polyester, Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for intended use and suitable for installed environment.

D. Provide UV over laminating film for outdoor locations.

2.4 INSTRUCTION SIGNS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. The minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. The minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

B. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system suitable for surface material and location (exterior or interior).

C. Fasteners for Labels and Signs:
1. Self-tapping, stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers.
2. Pop-Rivets.
3. Two-Part Epoxy Adhesive

D. Cable Ties: Self-extinguishing, one-piece, self-locking, UV-stabilized or plenum rated where required by installed environmental conditions. 3/16-inch minimum width.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Verify the identity of each item before installing identification products.

B. Before installation of labels, clean all surfaces using materials and methods recommended by manufacturer of identification device.

C. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

E. Install all labels in a neat manner, plumb and parallel to equipment lines.

F. Attach plastic signs and labels to equipment with mechanical fasteners appropriate to the location and substrate. Where screws cannot or should not penetrate substrate use two-part epoxy adhesive listed for use with intended substrate and environmental conditions.

G. Handwritten, non-permanent, or stenciled labels are not permitted unless noted otherwise.

H. For surfaces that require finish work, apply identification devices to surfaces after completing finish work.

I. Identification shall consist of all UPPER-CASE LETTERS.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

3.2 EQUIPMENT IDENTIFICATION

A. Provide all new and modified equipment with a nameplate consisting of 1/2" letters for equipment designation and 1/4" letters for voltage, source, and feeder information. This includes but is not limited to panelboards, switchboards, switchgear, disconnect switches, transformers, power transfer equipment, generators, motor starters, variable frequency drives, lighting control panels, contactors, cabinets, push button stations, and auxiliary system control panels.

B. Distribution equipment labels shall indicate the following:
   1. Equipment designation.
   2. Voltage system.
   3. Equipment ampacity.
   4. Source equipment designation and location.
   5. Feeder size.

C. Transformer labels shall indicate the following:
   1. Equipment designation.
   2. Primary voltage system and primary feeder ampacity.
   3. Source equipment designation and location.
   4. Primary feeder size.
   5. Secondary voltage system and load equipment designation

D. Equipment disconnect labels shall indicate the following:
   1. Equipment designation.
   2. Voltage system and feeder ampacity
   3. Source equipment designation and location.

E. Locate equipment nameplates at center of top of trim for panelboards, switchboards, switchgear, and centered at side for branch circuit switches.

F. Where equipment is provided with a factory installed disconnecting means or motor controller, install label on factory provided unit.

G. For equipment with multiple power sources, such as transfer switches and control panels, identify each source and its function.

H. Color Legend
   1. Normal Power Systems: Black field with white letters
   2. Emergency Power Systems (As defined by NEC Article 700): Red field with white letters.
   3. Emergency Power Systems (As defined by NEC Article 702): Orange field with white letters.

I. Where electrical distribution equipment, including panelboards, switchboards and switchgear, are connected to an emergency source, the nameplate shall incorporate the word "EMERGENCY" into the legend. Refer to drawings for further details.

J. Where the premise wiring system has feeders and/or branch circuits supplied from more than one nominal voltage system, provide sign at each switchgear, switchboard, and panelboard displaying color coded identification method for each ungrounded, grounded, and equipment grounding conductor.

K. Service Equipment and Building Feeder, Branch Circuit Disconnects.
   1. Provide label for service disconnecting means to permanently identify it as the “SERVICE DISCONNECT”.
   2. Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, provide a permanent sign at each disconnect location identifying all other feeders, branch circuits, or services and the area served by each.

3.3 IDENTIFICATION OF CONDUCTORS

A. Service, Feeder, and Branch-Circuit Conductors: Refer to Section 260519, “Low Voltage Electrical Power Conductors and Cables” for conductor and cable color coding requirements.

B. Indicate source and circuit number of conductors to be extended in the future.

C. Auxiliary Systems Alarm, Signal, and Control Wire Identification: At termination points, identify each conductor by its system, designation, and function.

3.4 IDENTIFICATION OF RACEWAYS AND BOXES

A. Identify all junction, outlet, device, and pull boxes with wiring system, voltage, and circuit designations of conductors.
   1. In concealed locations above accessible ceilings and in exposed unfinished areas such as data, mechanical, or electrical rooms, provide designations on outside of box covers.
   2. For exposed boxes in finished areas, provide designations on inside of box covers.
   3. System Legend shall be as follows:
      a. Power
      b. Emergency
      c. UPS

B. The inside of all junction and backboxes shall be marked with panel and circuit number in permanent marker.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate.

3.5 IDENTIFICATION OF WIRING DEVICES

A. All new and existing receptacle cover plates in the area of work shall be marked with their panel and circuit number(s) with clear, machine printed adhesive labels with black lettering.

3.6 CIRCUIT DIRECTORIES

A. For Distribution Panelboards, Motor Control Centers, Switchboards, and Switchgear provide nameplates at each switch or circuit breaker to indicate load designation.

B. Provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. Insert directories into plastic cardholders on the back of the door in each panel. Provide descriptions to identify each circuit as to its clear, evident, and specific purpose or use. The identification shall include an approved degree of detail that allows each circuit to be distinguished from all others. Spaces and Spare positions shall be described accordingly.
   1. At a minimum, provide the following panel information for each panel directory:
      a. Panel name
      b. Panel bus rating
      c. Voltage System
      d. Mains Configuration and Rating
      e. Short Circuit Current Rating
   2. Circuit Designation Examples:
      a. LIGHTS, ROOM 100
      b. FLOOR RECEPTACLES, ROOM 200
      c. ERV-1 RECEPTACLE, ROOF

C. Panel Schedules and circuit numbers on Record Drawings shall match.

3.7 SAFETY SIGNS

A. Install Warning, Caution, and Danger signs in accordance with NFPA 70 and OSHA requirements to ensure safe operation of electrical equipment and the items to which they connect.

B. Comply with 29 CFR 1910.145 and ANSI Z535.4.

C. Apply to exterior of door, cover, or other access point.

D. Labels and signs shall include, but are not limited to, the following legends:
   1. Identify system voltage with black letters on an orange background.
   2. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   3. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"
   4. Where series combination ratings are allowed: "CAUTION - SERIES COMBINATION SYSTEM RATED ____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED."

3.8 INSTRUCTION SIGNS

A. Operating Instruction Signs: Install instruction signs with minimum 3/8-inch letters to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation, power transfer, and load shedding.

3.9 WORKSPACE INDICATION

A. Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install flush-mounted panelboards and similar equipment in finished spaces.

3.10 IDENTIFICATION FOR EQUIPMENT AND RACEWAYS RATED MORE THAN 600V

A. Provide warning signs for the enclosures of electrical equipment including pad-mounted transformers, pad-mounted switches, and switchgear having a nominal rating exceeding 600 volts.
   1. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2-inch-high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
   2. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH

VOLTAGE KEEP OUT" printed in three lines of nominal 3-inch-high white letters on a red and black field.

B. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
   1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
   2. Wall surfaces directly external to raceways concealed within wall.
   3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

C. Accessible Raceways, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.

END OF SECTION

SECTION 260573 - POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section includes the following computer-based studies:
   1. Fault-current study to determine the minimum interrupting capacity of circuit protective devices.
   2. Overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
   3. Arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

B. Related Requirements
   1. Refer to Section 260553, “Identification for Electrical Systems” for label material and performance requirements.

1.3 REFERENCES

A. Abbreviations
   1. SCCR: Short-circuit current rating.

B. Definitions
   1. Emergency Electrical Systems: Those systems are legally required and classed as emergency by NFPA 70 Article 700, municipal, state, other codes, or by any government agency having jurisdiction.
   2. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing items shall remain functional throughout the construction period.
   3. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
   4. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
   5. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the State of Connecticut.
   6. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

7. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
8. Single-Line Diagram: See "Normal Power Single Line Diagram, Contract Drawing E4.01" and “Emergency Power Single Line Diagram, Contract Drawing E4.02.”

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
1. Institute of Electrical and Electronics Engineers (IEEE)
   a. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   b. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
   c. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   d. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
   e. IEEE 551 - Recommended Practice for Calculating AC Short-Circuit Currents in Industrial and Commercial Power Systems
   f. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
   g. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
   h. IEEE 3002.3 - IEEE Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems
2. American National Standards Institute (ANSI)
   a. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   b. ANSI C37.13 - Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   c. ANSI C37.010 - Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   d. ANSI C 37.41 - Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories
3. The National Fire Protection Association (NFPA)
   a. NFPA 70E - Standard for Electrical Safety in the Workplace

1.4 SEQUENCING

A. The short-circuit and protective device coordination studies shall be submitted for review prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing.

B. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 QUALITY AsSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with the requirements of standards and guides specified in this Section.

C. Manual calculations are not acceptable.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the State of Connecticut and skilled in performing and interpreting the power system studies. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
   1. Engineer shall be a full-time employee of the electrical equipment manufacturer.
   2. The engineer shall have a minimum of five (5) years' experience performing power system studies.

E. Power System Study Certification: Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Personnel Qualifications:
   1. The technician shall be a full-time employee of the electrical equipment manufacturer.
   2. The technician responsible for all field adjusting of the Work shall have a minimum NICET Electrical Power Testing Level III certification or equivalent.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

A. Perform studies using the latest version of one of the following:
   1. Power Tools for Windows by SKM Systems Analysts.
   2. ETAP by Operation Technology, Inc.
   3. EasyPower by Easypower, LLC

B. Comply with IEEE 242, IEEE 399, IEEE 551, IEEE 1584, IEEE 3002.3, and NFPA 70E.

C. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. The computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. The computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 POWER SYSTEM STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:
   1. Protective device designations and ampere ratings.
   2. Conductor types, sizes, and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
   6. Derating factors and environmental conditions.
   7. Any revisions to electrical equipment required by the study.

D. Study Input Data
   1. Available Power source data.
   2. Manufacturer, model, and interrupting rating of protective devices.
   3. Conductors.
   4. Transformer data.

E. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

F. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment SCCR ratings exceed available short-circuit current at equipment installation locations.
   2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
   3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
   4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
   5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that SCCR ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

G. Short-Circuit Study Output Reports:
   1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. Equivalent impedance.
   2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   3.
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

4. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Protective Device Coordination Study:
   1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
      a. Phase and Ground Relays:
         1) Device tag.
         2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
         3) Recommendations on improved relaying systems, if applicable.
      b. Circuit Breakers:
         1) Adjustable pickups and time delays (long time, short time, and ground).
         2) Adjustable time-current characteristic.
         3) Adjustable instantaneous pickup.
         4) Recommendations on improved trip systems, if applicable.
   2. Fuses: Show current rating, voltage, and class.

I. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
   1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
   2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
   3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
   4. Plot the following listed characteristic curves, as applicable:
      a. Power utility's overcurrent protective device.
      b. Medium-voltage equipment overcurrent relays.
      c. Medium- and low-voltage fuses include manufacturer's minimum melt, total clearing, tolerance, and damage bands.
      d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
      e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.

f. Cables and conductors damage curves.
g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.
i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

J. Arc-Flash Study Output Reports:
1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

K. Incident Energy and Flash Protection Boundary Calculations:
1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

2.3 ARC-FLASH WARNING AND AVAILABLE FAULT CURRENT LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each location indicated in the analysis unless noted otherwise.

B. Arc Flash Warning Labels shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include all information required by NFPA 70E and the following information taken directly from the arc-flash hazard analysis:
1. Location designation.
2. Engineering report number, revision number, and issue date.

C. Available Fault Current Labels shall have an orange header with the wording, “WARNING”, and shall include the following information taken directly from the short circuit study.
   1. Location designation.
   2. Maximum available fault current.
   3. Calculation date.
   4. Engineering report number, revision number, and issue date.

D. Labels should be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conducting the study.
   1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Engineer's attention.
   2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
   3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Electrical Survey Data: Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study. Data includes, but is not limited to, the following:
   1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Electrical power utility impedance and available short circuit current at the service.
   3. Power sources and ties.
   4. Short-circuit current at each system bus (three phase and line to ground).
   5. Full-load current of all loads.
   6. Voltage level at each bus.
   7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
   8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
   9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
   10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
   11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.

12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Derating factors.
16. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.2 POWER SYSTEMS STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Base study on device characteristics supplied by device manufacturer.

C. Gather all necessary data from the existing facility as needed to perform the study.

D. The Contractor shall be responsible for modifying settings on existing equipment only at over-current protection devices upstream of new equipment unless noted otherwise.

E. The scope of the studies shall include all new distribution equipment and devices indicated on Drawings as well as all directly affected existing distribution equipment and devices at the customer facility. Begin analysis at the distribution system utility service, extending down to system overcurrent protective devices.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Identify in the report any protective device applied outside its capacity.

I. Short Circuit Study
   1. Calculate short-circuit currents according to IEEE 551.
   2. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
      a. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
   3. Evaluate equipment and protective devices and compare short-circuit ratings.

J. Coordination Study
   1. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
   2. Transformer Primary Overcurrent Protective Devices:
      a. Device shall not operate in response to the following:
         1) Inrush current when first energized.
         2) Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
         3) Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
      b. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
   3. Motor Protection:
      a. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
      b. Select protection for motors served at voltages more than 600 V according to IEEE 620.
   4. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
   5. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Arc Flash Hazard Analysis
   1. Comply with NFPA 70E and its Annex D for hazard analysis study.
   2. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

3. Calculate maximum and minimum contributions of fault-current size.
    a. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
    b. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
4. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
5. Include medium- and low-voltage equipment locations.
6. Calculate the limited and restricted approach boundaries for each location.
7. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
    a. Fault contribution from induction motors shall not be considered beyond three to five cycles.
    b. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
8. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
    a. When the circuit breaker is in a separate enclosure.
    b. When the line terminals of the circuit breaker are separate from the work location.
9. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 LABELING

A. All labels will be based on recommended overcurrent device settings and will be provided to the owner after the results of the analysis have been presented and after any system changes, upgrades, or modifications have been incorporated in the system.

B. Arc Flash Labeling:
1. Provide and install an arc-flash label for each piece of electrical equipment listed below and each piece of equipment that is likely to require examination, adjustment, servicing, or maintenance while energized:
    a. Motor-control centers.
    b. Switchboards.
    c. Meter Enclosures.
    d. Medium voltage and low voltage transformers
    e. Panelboards.
    f. Equipment Control panels.
    g. Motor Controllers.
    h. Disconnect Switches.
    i. Generator
    j. Automatic Transfer Switches

2. Apply arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

C. Available Fault Current Labeling
1. Provide and install an available fault current label for each piece of electrical equipment listed below:
a. Service equipment.
b. Elevator Control Panel.

D. Install warning labels under the direction of the Power System Analysis Specialist.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by a qualified technician from the engineering service division of the equipment manufacturer.

B. Make modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Notify Architect and Engineer in writing of any required major modifications.

D. Equipment shall not be energized until all breakers or protective relays are set either to the recommended values indicated by the studies or to minimum trip settings.

E. Certification: Prior to project Substantial Completion, submit four signed copies of a document certifying that the settings and selection scope have been completed as specified.

3.5 DEMONSTRATION

A. Acquaint personnel with the fundamentals of operating the power system in normal and emergency modes.

B. Hand-out and explain the power system study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.

C. Arc Flash Training
1. Train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels (minimum of 4 hours).
2. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent.
3. Include in Project Close-out Documents training notes, outlines, and Power Point presentation of training session. Also include attendance record of personnel attending the training session.

4. Training session shall be videotaped. Include copy of DVD of training session in Project Close-out Documents.

END OF SECTION

SECTION 260900 - ADVANCED METERING DATA ACQUISITION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 – General Requirements for Electrical Systems apply to this Section.

B. Refer to Electrical Riser for Meter Locations and quantities.

1.2 SYSTEM DESCRIPTION

A. The products specified herein are intended to provide a complete sub-metering solution. This solution shall be utilized to measure and monitor various meters and monitors throughout the building as shown on the drawings or required herein. The system will also allow for compliance with national and local energy codes and provide equipment needed to meet specific energy monitoring objectives. This shall comply with Connecticut State Building Performance Standard (High-Performance Schools) metering requirements.

1.3 SECTION INCLUDES

A. Electrical sub-metering equipment, data collection systems, and data management software systems including:
   1. Multi-point electrical sub-meters, including current transformers
   2. Energy monitoring software

1.4 STANDARDS

A. Provide equipment of this Section in full compliance with the following applicable portions of the latest revisions of the following standards:
   1. ANSI C12.1 & C12.20 at 0.5 Accuracy Class
   2. UL Certified to IEC/EN/UL/CSA 61010-1 2nd Edition.
   3. UL916:
      a. These requirements cover energy management equipment and associated sensing devices rated 600 volts or less and intended for installation in accordance with the National Electrical Code, NFPA 70.
   4. NEMA -ESM-1

1.5 INSTALLATION, OPERATION, AND MAINTENANCE MANUALS

A. Submit installation, operation, and maintenance manuals for the electrical sub-metering components.

1.6 TECHNICAL PERFORMANCE

A. The minimum measured technical performance of each piece of installed equipment shall meet the specifications published by the manufacturer.
   1. Optimize technical performance of all systems to produce the highest achievable technical performance to the satisfaction of consultant and/or client.

B. Any deficiencies in the system, particularly information communication errors or operational deficiencies, shall be cause for rejection. All CT readings shall be field verified in the presence of the engineer. Contractor shall connect CTs to meters and program all CTs correctly to show in the graphical user interface.

1.7 WARRANTY

A. All electrical sub-meters included in this specification to be free from defects in materials and workmanship from the date of substantial completion for a period of 5 Years.
   1. All data collection system components included in this specification to be free from defects in materials and workmanship from the date of substantial completion for a period of 5 Years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: eGauge Pro System
   1. Substitutions:
   2. Provide Manufacturer's reference list.
   3. Clearly delineate all propose substitutions as such and submit in writing for approval by the engineer a minimum of 10 working days prior to the bid date
   4. Prior to rough-in, provide complete engineered shop drawings, including power wiring, with deviations for the original design highlighted in an alternate color, to the engineer for review and approval.
   5. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

2.2 METERS AND CURRENT TRANSFORMERS

A. Multipoint metering devices: eGauge Pro Model EG4030

B. Solid core, Split core, and Rogowski coil current transformers with full scale output 0.333v

2.3 SYSTEM DESCRIPTION – SINGLE POINT METERING DEVICES

A. Provide single point metering devices capable of metering 1PH/2W, 2PH/3W, 3PH/3W, and/or 3PH/4W loads.

1. Meters must be capable of directly metering North American 120/208/V and 277/480V.
2. Metering units must be capable of metering loads between 20A and 2500A. Provide meters specific to each load as indicated on construction drawings.
3. Must meet all ISO 9001 standards for quality control where all meter's test to a minimum of +/- 0.2% or 0.5% accuracy, dependent on stated accuracy class.

B. The system shall be as described below:

2.4

1. To consist of electronic meters with embedded communications capability, and solid core, split core, or Rogowski coil current transformer technology. The current transformers shall have a full-scale output of.333v and secondary voltage clamps for safety purposes.
2. Meters to be used for Energy Monitoring applications
3. The meters will be capable of remote communication from each metering device.
4. Advanced meters shall transmit data via one of the following communication protocols:
   a. BACnet/IP
   b. BACnet MS/TP
5. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system
6. The electronic energy monitoring system shall be fully automated microprocessor-based electrical energy measurement system for Measurement and Verification purposes. The system shall incorporate complete metering, communications, reporting functions, energy monitoring and threshold limit capabilities.

2.5 SYSTEM DESCRIPTION – MULITPOINT METERING DEVICES

A. The system shall be as described below:
   1. To consist of electronic multiple point meters with embedded communications capability, and solid core or split core current transformer technology. The current transformers shall have a full-scale output of.333v A/C outputs and secondary voltage clamps for safety purposes.
   2. Meters to be used for Energy Monitoring applications
   3. Meters shall be capable of external mounting in a NEMA 1 enclosure or internal mounting in electrical panels or switchgear.
   4. The meters will be capable of remote communication from each metering device. Each device shall have IP sockets and RS-485 terminals to accommodate data transmission via BACNet MS/TP, BACNet IP and standard Ethernet. Data shall be transmitted by one or a combination of the following:
      a. Standard Ethernet interface
      b. Ethernet connection to PC or laptop via crossover cable.
      c. RS-485 Network-Modbus BACNet MS/TP
   5. Systems to have backup storage power to key components so no data is lost during power outages. The system shall continue to function after resumption of power.
   6. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

B. Meters shall have 30 sensor ports for inputs of up to (10) 3-phase loads.

2.6 SYSTEM MEASUREMENTS – MULITPOINT METERING DEVICES

A. Meters to connect to a web-based interface to measure the following loads.
   1. Energy Parameters:
   2. kWh real energy consumption
   3. kW instantaneous power
   4. kVAh apparent consumption
   5. kVA apparent power
   6. kVARh reactive consumption
   7. kVAR reactive power
   8. Phase Diagnostics: Parameters to be displayed for each individual phase of each metered load:
   9. Voltage Phase to neutral or phase to phase
   10. Amps Instantaneous amperage for each phase
   11. kW Instantaneous power
   12. PF Power factor
   13. PA Phase angle
   14. kVA Instantaneous apparent energy

PART 3 - EXECUTION

3.1 WIRING AND CONNECTIONS

A. All wiring must meet and or exceed local electrical code.
   1. Install all wiring in conduit.
   2. Provide an Ethernet drop for each meter location.
   3. Perform all necessary system calibration, testing, commissioning, and demonstrations as required. Utilize attached form to submit testing/calibration information. Verification shall be performed with the Engineer present.

B. Prepare and submit record drawings and installation, operation and maintenance manuals for the energy metering system as required.

3.2 TESTING AND COMMIISSIONING (ECO)

A. Perform final testing, adjustment, and commissioning of the systems, report results to the Architect/Engineer, and include the results in the installation, operation, and maintenance manuals. Provide qualified technicians for testing and commissioning.
   1. Perform sufficient technical and operational tests to ensure the technical performance of the system meets the intent of the Contract Documents. Typical testing to include but not be limited to:
   2. Verification of meter readings and proper installation of meter equipment (utilize attached form for recording system verification) shall be in the presence of the project engineer.
   3. Communication system connectivity
   4. Verify communications and delta transfer to BAS / EMS.

3.3 PROVIDE FUNCTIONAL TESTING INCLUDING END TO END VERIFICATION THAT ALL METERS ARE OPERATING PROPERLY.

A. Demonstrate the operation of the system to the Owner at a time suitable to them.

3.4 FIELD VERIFICATION, ACCEPTANCE, AND TRAINING

A. Provide all “AS BUILT” DRAWINGS and data showing each meter, serial number, IP address, MAC address, cross reference, load and CT ratio prior to field verification.
   1. The manufacturer’s representative shall verify, adjust and test the system. Verification of the energy monitoring system is to be carried out with the assistance of an electrical contractor at all times and in the presence of the project engineer. Upon completion, the manufacturer shall issue a “Commissioning Report” to the owner, electrical consultant, contractor and client.
   2. Manufacturer’s representative shall demonstrate operation of the system as follows:
   3. Meter readings
   4. Phase diagnostics
   5. Provide manual of the installed system
   6. Ensure the system is connected to the cloud as required to communicate with software servers.

B. Include (8) hours of training time for the Owner.

3.5 FIELD QUALITY CONTROL

A. Submit a detailed testing and commissioning procedure to the Consultant and Client for review and approval prior to undertaking this Work. The procedure shall indicate all test equipment required and acceptance criteria.
   1. Upon completion of all testing and commissioning, submit a copy of the test results and certify the system as acceptable for revenue metering purposes.
   2. Undertake the testing and commissioning Work with the manufacturer's factory representative(s) and project engineer.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Photoelectric switches.
2. Standalone daylight-harvesting switching and dimming controls.
3. Indoor occupancy and vacancy sensors.
4. Switchbox-mounted occupancy sensors.
5. Emergency shunt relays.

B. Related Requirements:
1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.
2. Section 265116 “Network Lighting Systems” for device integration with head-end lighting control system.
3. Coordinate with mechanical systems/ATC system. All occupancy/vacancy sensors shall be provided with dual contacts to integrate with HVAC system.

1.3 MAINTENANCE MATERIAL

A. Extra Stock Material: Provide two (2) of each type of sensor, switch, dimmer, power pack, and emergency lighting control device installed. Package with protective covering for storage and identified with labels describing contents.

B. Keys and Special Tools: Provide one extra set for access to locked or tamperproof enclosures.

1.4 COORDINATION

A. Preinstallation Conference: Arrange a pre-installation conference between all applicable subcontractors and architect/engineer prior to the installation of rough ins for the lighting controls.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, speakers, fire alarm, HVAC equipment, fire-suppression system, and partition assemblies.

C. Coordinate protocol and interface points of lighting control devices with temperature controls (BAS/DDC) specified in Division 23.

D. Product procurement and coordination:

E. Order products according to application.

F. Confirm the proper and complete catalog number with distributor and agent.

G. Provide additional parts and pieces required to complete the installation in the location and manner intended by the design.

H. Confirm voltages.

I. Contractor shall coordinate with Vendors and other trades, in advance of installation work, to define all infrastructure and installation requirements. Contractor shall coordinate all infrastructure requirements with all approved lighting control devices prior to infrastructure installation. This includes, but not limited to, appropriately sized, positioned, and located junction boxes, structural supports, feeds, power conduits, control conduits, and remote code-compliant power-supply enclosures.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Faulty operation of lighting control software.
      b. Faulty operation of lighting control devices.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
   1. Lutron, Inc.
   2. Wattstopper, Inc.
   3. Cooper Industries

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
   1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
   2. Contact Configuration: SPST.
   3. Contact Rating: 20A, 277V AC.
   4. Programs: Sixteen on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays. Each contact is to be individually programmable.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

C. Electromechanical-Dial Time Switches: Comply with UL 917.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120V AC.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Astronomic time dial.
6. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of [16] hours.

2.2 PHOTOELECTRIC SWITCHES

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
1. Lutron, Inc.
2. Wattstopper, Inc.

B. Description: Solid state, one set of NO dry contacts rated for 24 V dc at 1 A or 24 V ac at 1 A, to operate connected load, complying with UL 773, and compatible with luminaire, power pack, and lighting control panelboard.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: 1/2-inch (13-mm) threaded male conduit..
6. Failure Mode: Luminaire stays ON.
7. Power Pack: Digital controller capable of accepting four RJ45 inputs with two outputs rated for 20-A LED load at 120- and 277-V ac, for 16-A LED at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
a. With integral current monitoring
b. Compatible with digital addressable lighting interface.
c. Plenum rated.

2.3 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
1. Lutron, Inc.
2. Wattstopper, Inc.

B. Description: System operates indoor lighting.

C. Sequence of Operation: As daylight increases, the lights are turned off at a predetermined level. As daylight decreases, the lights are turned on at a predetermined level.
   1. Lighting control set point is based on two lighting conditions:
      a. When no daylight is present.
      b. When significant daylight is present (target level).
      c. System programming is done with two hand-held, remote-control tools.

D. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with integrated power pack, that detects changes in indoor lighting levels that are perceived by the eye.

E. Electrical Components, Devices, and Accessories:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
   3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor shall be powered by the power pack.
   4. Sensor Output: Digital signal compatible with power pack.
   5. Sensor type: Close loop
   6. Zone: Multi
   7. Power Pack: Digital controller capable of accepting 4 RJ45 inputs with two outputs rated for 20A LED load at 120- and 277-V ac, for 13A ballast or LED at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc Class 2 power source, as defined by NFPA 70.
      a. With integral current monitoring
      b. Compatible with digital addressable lighting interface.
      c. Plenum rated.
   8. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.
   9. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
   10. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lux), with an adjustment for turn-on and turn-off levels within that range.
   11. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
   12. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
   13. Test Mode: User selectable, overriding programmed time delay to allow settings check.
   14. Control Load Status: User selectable to confirm that load wiring is correct.
   15. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.4 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
   1. Lutron, Inc.
   2. Wattstopper, Inc.

B. Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.

1. Lighting control set point is based on two lighting conditions:
   a. When no daylight is present (target level).
   b. When significant daylight is present.
2. System programming is done with two hand-held, remote-control tools.
   a. Initial setup tool.
   b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with integrated power pack, to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0- to 10-V dc to operate luminaires. Sensor is powered by controller unit.
3. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

E. Power Pack: Digital controller capable of accepting 4 RJ45 inputs with two outputs rated for 20A incandescent or LED load at 120- and 277-V ac, for 16A ballast load or LED at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc Class 2 power source, as defined by NFPA 70.
1. With integral current monitoring
2. Compatible with digital addressable lighting interface.
3. Plenum rated.

2.5 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
1. Lutron, Inc.
2. Wattstopper, Inc.

B. General Requirements for Sensors:
1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired connection to switch and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:
   a. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: Sensor is powered from the power pack.
8. Power: Line voltages
9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Comaptible with receptacle loads.
11. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. Dual-Technology Type: Wall and Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 3000 square feet (330 square meters) when mounted 48 inches (1200 mm) above finished floor.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 square feet (220 square meters) when mounted 84 inches (2100 mm) above finished floor.

2.6 HIGH-BAY OCCUPANCY SENSORS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
1. Lutron, Inc.
2. Wattstopper, Inc.

B. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Power: Line voltage.
4. Operating Ambient Conditions: 32 to 149 deg F (0 to 65 deg C).
5. Mounting: Threaded pipe.
6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Detector Technology: PIR.

2.7 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
   1. Cooper Industries, Inc.
   2. Hubbell Building Automation, Inc.
   3. Leviton Manufacturing Co., Inc.
   4. Lutron Electronics Co., Inc.
   5. Sensor Switch, Inc.
   6. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
   4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V.

C. Wall-Switch Sensor:
   1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft (196 sq. m).
   2. Sensing Technology: Dual technology - PIR and ultrasonic.
   3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
   4. Capable of controlling load in three-way application.
   5. Voltage: Dual voltage - 120 and 277 V.
   6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
   7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
   9. Color: White, as selected by architect.
   10. Faceplate:
      a. Sporting venues, meeting rooms, corridors, circulation spaces, locker rooms: stainless steel.
      b. Other spaces including offices: white.

2.8 OUTDOOR MOTION SENSORS

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight. Subject to compliance with requirements, alternates can be provided by:
   1. Cooper Industries
   2. Lutron, Inc.
   3. Hubbell
   4. Wattstopper, Inc.

B. Description: Solid-state outdoor motion sensors.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Dual-technology (PIR and ultrasonic) type, weatherproof. Detect occurrences of 6-inch-(150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm). Comply with UL 773A.
   3. Switch Rating:
      a. Separately Mounted Sensor: Dry contacts rated for 20-A LED load at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
   4. Switch Type: SP, field-selectable automatic "on, automatic "off.".
   5. Voltage: Match the circuit voltage type.
   6. Detector Coverage:
      a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
      b. Long Range: 180-degree field of view and 110-foot (34-m) detection range.
   7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
   8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.

C. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" according to UL 773A.

2.9 PLUG LOAD CONTROL POWER PACK

A. Manufacturers: Basis of design shall be Acuity, Inc./nLight NPP20-PL. Subject to compliance with requirements, alternates can be provided by:
   1. Cooper Industries
   2. Lutron, Inc.
   3. Hubbell
   4. Wattstopper, Inc.

B. Provide (1) power pack device for every 120V/20A circuit shown with controlled plug load symbol control on contract drawings. Integrate into occupancy sensor serving that space.

2.10 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Philips Bodine, GTD20A
   2. Lighting Control and Design.
   3. Watt Stopper.

B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
   1. Coil Rating: 277V.

2.11 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

B.

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

C. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Provide a minimum of (4) hours training.

END OF SECTION

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

B. Description: Section includes requirements for the provision of Low-Voltage, dry type distribution transformers including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

C. Section includes distribution, energy efficiency, dry-type transformers with a nominal primary and secondary rating of 600 V and less.

D. Transformers shall be dry type, electro-static shielded transformers.

E. Related Requirements:
   1. Refer to Section 260500 “Common Work Results for Electrical Systems” for requirements related to equipment bases, supports, and vibration pads.

1.3 REFERENCES

A. Abbreviations
   1. DOE: Department of Energy
   2. XFMR: Transformer

B. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA)
   2. NECA 409, “Standard for Installing and Maintaining Dry-Type Transformers”.
   3. National Electrical Manufacturers Association (NEMA)
   4. NEMA ST20, “Dry Type Transformers for General Applications”.
   5. Underwriters Laboratories Inc (UL)
   6. UL 1561, “Dry-Type General Purpose and Power Transformers”.
   7. Federal Regulations and Policies
   8. DOE 10 CFR Part 429, “Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment”.
   9. DOE 10 CFR Part 431, “Energy Efficient Program for Certain Commercial and Industrial Equipment”.

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace access fencing, doors, lift-out panels, and structures as required to provide pathway for moving transformers into place.

B. Comply with manufacturer instructions for storage of electrical equipment to prevent damage from condensation or other environmental concerns.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with dimensions of transformer provided.

B. Coordinate installation of wall and ceiling mounting hardware and structural supports with transformer provided.

C. Distribution equipment sizes and equipment layouts shall be considered the basis of design. Equipment sizes vary by manufacturer. If the proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

D. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner.

E. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

F. Coordinate inrush current values of transformer provided with overcurrent protection device settings as described in Section 260573, “Power System Studies”. Adjust overcurrent protection device size, settings, and feeder size to eliminate nuisance operation in response to the actual transformer inrush current.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace transformers, finishes, controls, wiring, and all of its components that fail in materials or workmanship within 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Co.
   2. Square D.; Schneider Electric.
   3. ABB.

B. Source Limitations: Obtain transformers and all other electrical distribution equipment through one source from a single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, NEMA ST 20, and list and label as complying with UL 1561.

C. Comply with (DOE) 10 CFR 431 for minimum energy efficiency levels. Transformers shall bear the UL Energy Efficiency Verification Mark to confirm that the unit meets minimum efficiency levels.

D. Description: Factory-assembled and tested, air-cooled units for 60-Hz service.

E. Phase, kVA Ratings, and Primary and Secondary Voltages: as indicated on drawings.

F. Cores: Grain-oriented, non-aging silicon steel with high permeability and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating.
   1. One leg per phase.
   2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
   3. Visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
   4. Cores shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling.

G. Coils: Continuous windings without splices except for taps. Coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire.
   1. Coil Material: Copper.
   2. Internal Coil Connections: Brazed or pressure type.
   3. Terminal Connections: Welded.

H. Insulation Class: Minimum 220 deg C, UL-component-recognized insulation system.
   1. Temperature Rise: 115 deg C unless noted otherwise.
   2. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635
   3. Wire left bare will not be accepted, all conductors must have insulation material.

I. Enclosure: Ventilated
   1. NEMA 250, Type 2 unless otherwise required by environmental conditions. Provide weather shield for ventilation openings where located outdoors.
   2. Heavy gauge steel construction.
   3. The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure.
   4. Core and coil shall be encapsulated within non-hygroscopic thermosetting varnish, sealing out moisture and air.
   5. Wiring Compartment: Sized for conduit entry and wiring installation.
   6. Minimum clearances from ventilated openings to obstructions shall be indicated on the nameplate and not exceed 6-inches.
   7. The maximum top of case temperature shall not exceed 35 deg C above 40 deg C ambient.
   8. Finish: Gray weather resistant baked enamel, complying with NEMA 250.

J. Taps:
   1. Three-phase transformers rated 15 kVA and larger shall be provided with six 2-1/2% full capacity taps, two above and four below rated primary voltage.
   2. Three-phase transformers rated below 15kVA shall be provided with two 5% full capacity taps rated below primary voltage.

K. K-Factor Rating: Transformers shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
   1. Neutral rated 200 percent of full load current.
   2. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
   3. Indicate value of K-factor on transformer nameplate.

L. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
   1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
   2. Include special terminal for grounding the shield.
   3. Shield effectiveness:
   4. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
   5. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHZ; minimum of minus 65 dBA at 1.5 to 100 kHz.
   6. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

M. Grounding: Provide ground bar installed on the inside of the transformer enclosure.

N. Wall and Ceiling Brackets: Manufacturer's standard brackets.

O. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

P. Terminations: Mechanical Lugs listed to accept specified wiring method, conductor size, and temperature rating.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91 and IEEE C57.12.91.
   1. Ratio tests at the rated voltage connection and at all tap connections.
   2. Polarity and phase relation tests on the rated voltage connection
   3. Applied potential tests.
   4. Induced potential test.
   5. No-load and excitation current at rated voltage on the rated voltage connection

B. Sound level as determined in accordance with NEMA standards shall not exceed the following:
   1. 0-50 kVA: 45 dB
   2. 51-150 kVA: 50 dB
   3. 151-300 kVA: 55 dB
   4. 301-500 kVA: 60 dB

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are needed to maintain working clearances and equipment operation required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at the location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers level and plumb with vibration dampening supports.
   1. Provide wall and ceiling mounted transformers with brackets fabricated by transformer manufacturer.
   2. Coordinate installation of structural steel supports with actual transformer provided.

B. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions.

C. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

D. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Provide flexible connections at all conduit and conductor terminations and supports according to Section 260533, "Raceways and Boxes for Electrical Systems" and Section 260500, "Common Work Results for Electrical Systems" to eliminate sound and vibration transmission to the building structure.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, "Identification for Electrical Systems".
   1. Where primary disconnecting means is not provided within sight of transformer, identify transformer with equipment designation and location of remote lockable disconnecting means by permanent nameplate.
   2. All distribution equipment shall be shipped from the manufacturer with factory-applied warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
   3. Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections: Perform the following tests and inspections. Certify compliance with test parameters.
   1. Visual and Mechanical Inspection
   2. Document equipment nameplate data on the test report. Verify that transformer nameplate ratings are in accordance with drawings.
   3. Inspect the physical and mechanical condition of the equipment.
   4. Inspect anchorage, alignment, and grounding.
   5. Verify that resilient mounts are free and that any shipping brackets have been removed.
   6. Inspect bolted electrical connections for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
   7. Electrical Tests

8. Perform insulation-resistance tests. Measurements shall be made from winding-to-winding and each winding-to-ground. Test voltages and minimum resistance shall be in accordance with the manufacturer's published data.
9. Verify correct secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

B. Test and Inspection Reports: Prepare a written report to certify compliance with test parameters and record the following:
1. Test procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Products will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.6 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.7 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration, and installation for low voltage switchboards as required for the complete performance of the Work, as shown on the Drawings as specified herein.

B. Section Includes:
1. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Instrumentation.
4. Control power.
5. Accessory components and features.
6. Identification.

C. Related Requirements:
1. Refer to Section 260500, “Common Work Results for Electrical Systems” for requirements related to equipment pads.

1.3 REFERENCES

A. Abbreviations
1. SPD: Surge Protective Device
2. SWBD: Switchboard

B. Definitions:
1. Switchboard: A large single panel, frame, or assembly of panels on which are mounted switches, over-current, and other protective devices, buses, and instruments.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
1. National Electrical Contractors Association (NECA):
   a) NECA 400, “Standard for Installing and Maintaining Switchboards"
2. National Electrical Manufacturers Association (NEMA):
   a) NEMA PB 2, "Deadfront Distribution Switchboards."

b) NEMA PB 2.1, "General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less."

3. Underwriter Laboratories (UL):

a) UL 50, "Enclosures for Electrical Equipment, Non-Environmental Considerations."
b) UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures."
c) UL 891, "Standard for Switchboards"

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, "Power Systems Studies".

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Minimum of five years of successful installation experience with projects utilizing switchboards similar in type and scope to that required for this Project.
2. An employer of qualified workers as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver Switchboards in sections or lengths that can be moved past obstructions in delivery path. Remove and replace access fencing, doors, lift-out panels, and structures as required to provide pathway for moving switchboards into place.

B. Handle and prepare Switchboards for installation according to NECA 400 and NEMA PB 2.1. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

C. Comply with manufacturer instructions for storage of electrical equipment to prevent damage from condensation or other environmental concerns.

D. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

E. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

F. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.7 COORDINATION

A. Coordinate layout and installation of Switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with dimensions of actual equipment provided.

C. Distribution equipment sizes and equipment layouts shall be considered the basis of design. Equipment sizes vary by manufacturer. If the proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

D. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboards, circuit breakers, finishes, controls, wiring, and all of its components that fail in materials or workmanship within 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.
   2. Square D.; a brand of Schneider Electric.
   3. ABB.

B. Source Limitations: Obtain switchboards, overcurrent protection devices, and all other electrical distribution equipment through one source from a single manufacturer.

2.2 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 2, NFPA 70, and UL 891.

C. Front-Connected, Front-Accessible Switchboards unless otherwise indicated:

4. Main Devices: Fixed, individually mounted unless otherwise indicated.
5. Branch Devices: panel mounted.
6. Sections front and rear aligned.

D. Nominal System Voltage and Main Bus Ratings as indicated in the drawings.

E. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit current rating of 100,000 AIC, unless otherwise indicated on drawings. Short circuit rating shall be confirmed by the Power systems Study.

F. Service Entrance: Where switchboards are used as service equipment with one or more main service disconnecting and overcurrent protective devices, provide marking by an NRTL acceptable to authority having jurisdiction indicating panelboard is suitable for use as service equipment. Coordinate with utility company for any additional requirements.

G. Utility Metering Compartment: Where indicated, provide barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers, or potential taps as required by utility company. If a separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

H. Indoor Enclosure: Steel, NEMA 250, Type 1 unless otherwise.
1. Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface. The switchboard enclosure shall be painted on all exterior surfaces.
2. Provide removable steel base channels bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed of code gauge steel, rigidly welded together to support all cover plate, bussing and component devices.
3. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.

I. Customer Metering Compartment: Provide a separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks. Coordinate all requirements with utility (United Illuminating).

J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

K. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

L. Buses and Connections: Three phase, four wire unless otherwise indicated.
1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase-, Neutral, and Ground -Bus Material: Hard-drawn copper of 98 percent conductivity.

3. Copper feeder circuit-breaker line connections.
4. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
5. Ground Bus: Size per current NEC and UL 891 Tables 28.1 and 28.2, equipped with pressure connectors for feeder and branch circuit ground conductors.
6. Main-Phase Buses, Neutral Buses, and Equipment-Ground Buses: Uniform full capacity for entire length of switchboard's main and distribution sections to comply with ampacity indicated. Tapered bus is not permitted. Provide sufficient cross-sectional area to meet UL 891 temperature rise requirements. Provide for future extensions from both ends.
7. Disconnect Links:
    a) Isolate neutral bus from incoming neutral conductors.
    b) Bond neutral bus to equipment-ground bus with an appropriately sized main bonding conductor for switchboards utilized as service equipment or separately derived systems.

M. Future Devices: Equip all unused spaces and compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment to allow future installation of OCPDs.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 225 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings where indicated:
    a) Instantaneous trip.
    b) Long- and short-time pickup levels.
    c) Long- and short-time adjustments.
    d) Ground-fault pickup level, time delay, and I squared t response.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. MCCB Features and Accessories:
    a) Standard frame sizes, trip ratings, and number of poles.
    b) Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits: Type HACR for heating, air-conditioning, and refrigeration equipment.
    d) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable

pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

f) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

g) Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

h) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

B. Provide ground fault protection for all overcurrent protective devices 1000 amps or greater on 480Y/277V systems.

C. Provide arc energy reduction maintenance switch for all overcurrent protective devices rated 1200 amps or greater or where the continuous current trip setting can be adjusted to 1200A or greater.

2.4 MAIN SECTION DEVICES

A. Two-step stored energy electronic trip insulated molded case circuit breaker:

1. Circuit protective devices shall be two-step stored energy type circuit breaker(s)].
2. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated drawings.
3. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
4. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
5. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously when applied in QED switchboards.
6. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.

    a) Long Time Pickup & Long Time Delay
    b) Short Time Pickup & Short Time Delay (I^2t IN & I^2t OUT)
    c) Instantaneous Pickup
    d) Ground Fault Pickup & Ground Fault Delay (I^2t IN and I^2t OUT)

7. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
8. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
10. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

11. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Provide one (1) Universal Equipment Test Set for this project job for final inspection. This test set shall be suitable for testing all electric circuit breakers specified for this project. No disassembly of the circuit breaker is required for testing.
12. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence: CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN.
13. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.
14. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.
15. All circuit breakers shall be equipped with electrical accessories as noted on drawings.
16. Equipment Ground Fault Protection
    a) Circuit breaker(s) shall be provided with integral equipment protection for grounded systems.
    b) The ground fault system shall be of the residual type.
    c) Circuit breaker(s) shall be provided with zone selective interlocking (ZSI) on the Ground Fault function in order to limit thermal stress caused by a fault, yet permit optimum coordination with all other electronic trip circuit breakers.
17. Terminations
    a) All lugs shall be UL Listed to accept solid and/or stranded copper conductors only. Lugs shall be suitable for 75° C rated wire.
18. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs.
19. Main circuit breaker shall be individually fixed mounted.

2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, ANSI/IEEE C57.13, and the following:
   1. Potential Transformers: Secondary voltage rating of 120 volts and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
   2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
   3. Control Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
   4. Current Transformers for Neutral and Ground Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit breaker ground fault protection.

2.6 METERING

A. Overcurrent Protective Device Communication Capability: Where indicated provide electronic trip circuit breakers and integral communication module with functions and features compatible with power monitoring and control systems.

2.7 SURGE PROTECTIVE DEVICES

A. Where Switchboards are indicated with integral SPD, comply with requirements in Section 264300, “Surge Protective Devices”. Surge protective devices shall be installed by, and shipped from, the electrical distribution equipment manufacturer’s factory.

2.8 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer, if required.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for #8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.9 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Lock-out, Tag-out: All circuit breakers in the Switchboard to include fixed padlock attachments.

2.10 IDENTIFICATION AND MARKINGS

A. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components complete with lettering designations.

B. Service Equipment Label: Where Switchboard is provided with one or more service disconnecting and overcurrent protective devices, provide NRTL label indicating use as service equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400 and NEMA PB 2.1.

B. Examine Switchboard interior and exterior before installation. Reject Switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive Switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
   1. Verify concrete pads are level and free of irregularities.
   2. Ensure area to receive switchboard has adequate clearance for switchboard installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install Switchboards and accessories according to manufacturer's written guidelines, NECA 400 and NEMA PB 2.1.

B. Equipment Mounting: Install Switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03 and Section 260500, “Common Work Results for Electrical Systems.”
   1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to Switchboards.

C. Temporary Lifting Provisions: Remove any temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from Switchboard units and components.

D. Operating Instructions: Frame and mount basic operating instructions for Switchboards, including any control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of Switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

B. Provide ground bushings and bonding conductor connections to the equipment ground bus sized per NFPA 70 on each metallic conduit entering or leaving the switchboard and at the terminal end for each continuous metallic feeder conduit.

C. Support and secure conductors within the switchboard according to NFPA 70.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”
   1. Identify field-installed conductors, interconnecting wiring, and components.
   2. Provide warning signs and labels to advise personnel of possible hazards in accordance with UL, NFPA 70, NFPA 70E, and other applicable standards.
   3. Provide nameplate for each switchboard compartment. Nameplates shall be screwed into front of switchboard.
   4. Provide nameplate for each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors.
   5. All distribution equipment shall be shipped from the manufacturer with factory-applied warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
   6. Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Visual and Mechanical Inspection: Provide manufacturer’s standard start-up inspections, including the following:
      a) Examine equipment nameplate data and confirm proper identification.
      b) Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers’ instructions.

c) Inspect anchorage, alignment, and grounding.
d) Verify controls and instrumentation, ensuring that current and potential transformer ratios are correct.
e) Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
f) Exercise all active components.
g) Inspect all mechanical indicating devices for correct operation.
h) Physically test key interlock systems to check for proper functionality prior to energizing.

2. Electrical Acceptance Testing: Provide manufacturer's standard start-up testing, including the following:

a) Perform insulation resistance test for one minute on each switchboard bus section. Open control and metering circuits within the switchboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test. Test voltages and minimum resistance shall be in accordance with the manufacturer's published data.
b) Perform a control wiring performance test by applying control voltage.

3. Circuit Breaker Testing: For all circuit breakers with electronic trip units, determine minimum pickup current, long-time and short-time pickup and delay, and instantaneous pickup by secondary current injection. Certify compliance with test parameters and ensure settings match recommendations from final approved power system study.
4. Test ground-fault protection of equipment for service equipment per NFPA 70.
5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
6. Perform the following infrared scan tests and inspections:

a) Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard.
b) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device in report.

C. The switchboard will be considered defective if it does not pass tests and inspections.

D. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest as specified above.

E. Prepare test and inspection reports, including a certified report that identifies Switchboards included. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges and time delay settings to recommended values identified in the final approved power system study.

3.7 OWNER TRAINING

A. Engage a factory-authorized instructor to train Owner's maintenance personnel to adjust, operate, and maintain Switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram any microprocessor-based trip, monitoring, and communication units.

B. Training shall consist of two (2) sessions with four (4) hours of onsite classroom and hands-on instruction at each session for a minimum of four attendees. Training shall cover the following topics at a minimum:

7. Theory of operation
8. Operation of Switchboard and components
9. Maintenance and configuration
10. Troubleshooting and Repair
11. Replacement of components.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Section includes requirements for the provision of Panelboards including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

B. Section Includes:
   1. Distribution panelboards
   2. Lighting and appliance branch-circuit panelboards
   3. Disconnecting and overcurrent protective devices.

C. Related Requirements:
   1. Refer to Section 260500, “Common Work Results for Electrical Systems” and 260529 “Electrical Hangers and Supports” for requirements related to equipment supports.

1.3 REFERENCES

A. Abbreviations
   1. AFCI: Arc-fault circuit interrupter.
   2. GFCI: Ground-fault circuit interrupter.
   3. GFPE: Ground-fault protection of equipment.
   4. MCCB: Molded Case Circuit Breaker
   5. SWD: Switching Duty
   6. VPR: Voltage protection rating.

B. Definitions
   1. Panelboard: A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA):

a. NECA 407, “Standard for Installing and Maintaining Panelboards"

2. National Electrical Manufacturers Association (NEMA):
   a. NEMA AB 1, "Molded Case Circuit Breakers and Molded Case Switches."
   b. NEMA PB 1, "Panelboards."
   c. NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."
3. Underwriter Laboratories (UL):
   a. UL 50, "Enclosures for Electrical Equipment, Non-Environmental Considerations.”
   b. UL 67, "Standard for Panelboards."
   c. UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.”

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of qualified workers as defined in NEMA PB 1.1 and trained in electrical safety as required by NFPA 70E.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1. Handle carefully to avoid damage to internal components, enclosure, and finish.

B. Comply with manufacturer instructions for storage of electrical equipment to prevent damage from condensation or other environmental concerns.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Distribution equipment sizes and equipment layouts shall be considered the basis of design. Equipment sizes vary by manufacturer. If the proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

C. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards, circuit breakers, finishes, controls, components, and accessories that fail in materials or workmanship within 24 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.
   2. Square D.; a brand of Schneider Electric.
   3. ABB.

B. Source Limitations: Obtain panelboards, overcurrent protection devices, and all other electrical distribution equipment through one source from a single manufacturer.

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 and NEMA PB 1.

C. Provide circuit breaker type panelboards unless noted otherwise.

D. Enclosures: Flush- or surface-mounted, dead-front cabinets as indicated on drawings.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor and Wet Locations: NEMA 250, Type 3R.
      c. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 3R, Stainless Steel.
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box and keep tight to wall with no gaps allowing access to live parts. Oversize trims will not be acceptable.
   4. Interior trim shall be of dead-front construction to shield user from all energized parts.

5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Materials and Finishes:
   a. Panel Fronts and Trim: Galvanized Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. For panelboards located in corridors and public areas (not within MEP or other back-of-house spaces), architect shall select color from full range for panel to be painted.
   c. Back Boxes: Galvanized steel.
7. Boxes shall have removable end walls. End walls shall not be provided with concentric knockouts. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
8. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
9. All lock assemblies shall be keyed alike.

E. Incoming Mains:
1. Circuit breaker or Lugs only as indicated on drawings.
2. Location: Top or bottom to match feeder conduit entry.
3. Feeders routed through the side gutters to reach the top or bottom main breakers from the opposite end of the panel are not acceptable.
4. Main lugs or main breakers shall have barriers on five sides.

F. Phase, Neutral, and Ground Busses:
1. Material: Hard-drawn copper, 98 percent conductivity.
   a. Bus shall be fully rated the entire length, with one continuous bus bar per phase.
2. Phase bussing shall be pre-drilled to accommodate field installable options.
3. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
4. Equipment Ground Bus: Extend full length of panelboard and adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
5. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box, where applicable.
6. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating. Terminations shall be suitable for the size and quantity of conductors specified on the one line diagram.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type.
6. Feed-Through Lugs: Where indicated provide mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. Provide where indicated on drawings.

7. Subfeed (Double) Lugs: Where indicated provide mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus where indicated.

H. Service Entrance: Where panelboards are used as service equipment with one or more main service disconnecting and overcurrent protective devices, provide marking by an NRTL acceptable to authority having jurisdiction indicating panelboard is suitable for use as service equipment. Coordinate with utility company for any additional requirements.

I. Future Devices: Provide mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices. Where panelboards. are noted to have "space" or "space only", this shall be prepared space with all bussing, lugs, etc. as required to accept future installation of over-current devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Panelboard and overcurrent protective device short circuit ratings shall be at least 110 percent of the actual available fault current.
1. Panelboards rated 240V or less: minimum 22,000 A.
2. Panelboards rated above 240V: minimum 42,000 A.

K. Provide dead front panelboards with copper bus bars, arranged for 208Y/120V, three phase, four wire, solid neutral or 480Y/277V, three phase, four wire, solid neutral as shown on drawings. Panels shall meet or exceed all requirements of NEMA PB-1 and UL 67. Panels shall be minimum 20" wide.

L. Provide full size insulated neutral bus where neutral indicated on the schedules.

M. Provide ½ inch spaces for panels mounted at exterior walls below grade to establish air space behind panels.

N. Provide bolt-on, molded case, circuits breakers with thermal-magnetic trips. Muti-pole breakers shall be single handle, common trip. Provide handle locks for emergency lighting circuits, fire alarm, security, or other similar functions. Circuit breakers rated 125A or less shall be marked for 60 and 75 degrees C conductors.

O. Provide fully rated circuit breakers equal to short circuit interrupting ratings as scheduled on Drawings.

P. Provide adjustable magnetic trip units for circuit breakers rated 125A to 600A serving motors, with range of 5-10 times (10 percent tolerance) trip unit rating.

Q. Provide UL-listed shunt trip attachment for breakers where indicated on Drawings.

R. Provide HACR listed circuit breakers where breakers serve HVAC packaged units.

2.3 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Provide bolt-on circuit breakers for overcurrent protective devices.

C. Doors: Secured with three-point vault-type latch with tumbler lock; keyed alike. For doors more than 36 inches high, provide two latches.

D. All panelboards shall be capable of accepting 225-amp 3 pole branch breakers as a minimum unless otherwise noted.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. The outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

D. All panelboards shall have space to accept forty-two 20-amp single pole circuit breakers unless otherwise noted.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 225 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers:
      a. Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic trip circuit breakers for circuit breaker frame sizes 400A and larger, as well as all main circuit breakers associated with NEC 700 Emergency System:
      a. RMS sensing.
      b. Field-replaceable rating plug or field-replicable electronic trip.
      c. Digital display of settings, trip targets, and indicated metering displays.
      d. Multi-button keypad to access programmable functions and monitored data.
      e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
      f. Integral test jack for connection to portable test set or laptop computer.
      g. Field-adjustable Instantaneous, Long- and short-time pickup, and Ground-fault pickup settings.
   4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
   5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
   6. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

7. MCCB features and accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. The breaker handle indicates tripped status.
   c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120 V or 24V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
   g. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
   h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle on or off position.

B. Provide Ground Fault protection for circuit breakers rated 1000 A and higher on solidly grounded wye systems more than 150V to ground.

C. Provide Arc Flash energy reducing maintenance switch with local status indicator for circuit breakers rated 1200A and higher or where circuit breaker trip setting can be adjusted to 1200A or greater.

2.6 METERING

A. Where indicated comply with requirements shown on drawings.

2.7 SURGE PROTECTION DEVICES

A. Where panelboards are indicated with integral SPD, comply with requirements in Section 264300, “Surge Protective Devices”. Factory install SPDs prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work. Ensure area to receive panelboard has adequate clearance for panelboard installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

C. Temporary Lifting Provisions: Remove any temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated or where required to maintain center of trip handle on overcurrent protection devices below 79-inches. Where mounted in groups, align top of trim or tub for all panels in an area.

E. Mount panelboard cabinet plumb and rigid without distortion of box.

F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Provide steel slotted support structures where required for freestanding equipment or where building mounting surface is unsuitable.

H. Install overcurrent protective devices and controllers not already factory installed. Set field-adjustable, circuit-breaker trip ranges.

I. Install filler plates in unused spaces.

J. Stub four (4) 1-inch and two (2) 1-1/4-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Provide suitable closures for spare conduits and identify with a suitable label.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

L. Comply with NECA 1.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL

486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, "Identification for Electrical Systems" and as noted below:
   1. Provide a directory card inside each door, covered with a plastic non-yellowing shield. Directory Card to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer to create directory in Microsoft Excel; handwritten directories are not acceptable. Digital versions to be provided to Owner.
   2. The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme unless the Contractor is directed to do so by the Architect or Engineer.
   3. Provide nameplate for each panelboard.
   4. For distribution panelboards, provide nameplate for each branch circuit device.
   5. All distribution equipment shall be shipped from the manufacturer with factory-applied warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
   6. Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.

3.5 FIELD QUALITY CONTROL

A. Perform the following Tests and Inspections:
   1. Visual and Mechanical Inspection:
      a. Examine equipment nameplate data and confirm proper identification.
      b. Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers' instructions.
      c. Inspect anchorage, alignment, and grounding.
      d. Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
      e. Exercise all active components.
      f. Inspect all mechanical indicating devices for correct operation.
      g. Physically test key interlock systems to check for proper functionality prior to energizing.
   2. Electrical Acceptance Testing:
      a. Perform an insulation resistance test for one minute on each panelboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the panelboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.

Test voltages and minimum resistance shall be in accordance with manufacturer's published data.

3. Circuit Breaker Testing: For all circuit breakers with electronic trip units, determine minimum pickup current, long-time and short-time pickup and delay, and instantaneous pickup by secondary current injection. Certify compliance with test parameters and ensure settings match recommendations from final approved power system study.
4. Test ground-fault protection of equipment for service equipment per NFPA 70.
5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match the original finish.

3.7 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573, "Power System Studies".

C. All circuit breakers identified as spares shall be left in the OFF position.

D. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes:
1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, with a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This section of the specifications covers all wiring devices and cover plates, standard, weatherproof and dust-tight.

B. All 120/208V receptacles installed in public areas shall be tamper proof type.

C. Section Includes:
1. Straight Blade receptacles.
2. GFCI receptacles.
3. USB receptacles.
4. SPD receptacles.
5. Twist-locking receptacles.
6. Controlled receptacles.
7. General use snap switches.
8. Manual Motor Control switches.
9. Wall Plates.
10. Cord and plug sets.
11. Floor service fittings.
12. Poke-through assemblies.
13. Prefabricated multioutlet assemblies.
14. Service poles.
15. Cord Reels

1.3 REFERENCES

A. Abbreviations
1. AFCI : Arc-fault circuit interrupter.
2. CR: Corrosion Resistant
3. EMI: Electromagnetic interference.
4. GFCI: Ground-fault circuit interrupter.
5. IG: Isolated Ground
6. SPD: Surge Protective Device
7. TR: Tamper Resistant.
8. USB: Universal Serial Bus.
9. WR: Weather Resistant.

B. Definitions
   1. Outlet: A point on the wiring system at which current is taken to supply utilization equipment.
   2. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
   3. Receptacle. A receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA):
      a) NECA 130, “Standard for Installing and Maintaining Wiring Devices"
   2. National Electrical Manufacturers Association (NEMA)
      b) NEMA WD 1, “General Color Requirements for Wiring Devices”
      c) NEMA WD 6, “Wiring Devices—Dimensional Specifications”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product indicated or equal from one of the following:
   1. Eaton/Arrow Hart
   2. Hubbell
   3. Leviton
   4. Pass & Seymour/Legrand

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Devices for Fixtures, Furnishings, and Equipment:
   1. Receptacles: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

E. All terminations shall be side-wired clamping type. “Backstab” terminations or modular connectors are not permitted.

F. Device Color:
1. Wiring devices in finished spaces connected to normal power system: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices in unfinished spaces connected to normal power system: Grey unless otherwise indicated or required by NFPA 70 or device listing.
3.
4. Wiring devices connected to emergency power system: Red unless otherwise indicated or required by NFPA 70 or device listing.

G. Wall Plate Color:
1. Color as selected by Architect from manufacturer’s full range

2.3 SPECIFICATION GRADE STRAIGHT-BLADE RECEPTACLES

A. Specification Grade Receptacle, Comply with NEMA WD 6, UL 498, FS W-C-596

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex	20A, 125V	NEMA 5-20R	Hubbell 5362
Single	20A, 125V	NEMA 5-20R	Hubbell 5361
Duplex-TR	20A, 125V	NEMA 5-20R	Hubbell 5362TR
Duplex-IG	20A, 125V	NEMA 5-20R	Hubbell IG5362
Duplex-WR	20A, 125V	NEMA 5-20R	Hubbell 5362WR
Duplex-CR	20A, 125V	NEMA 5-20R	Hubbell HBL53CM62
Single	30A, 250V	NEMA 6-30R	Hubbell HBL9330
Single	50A, 250V	NEMA 6-50R	Hubbell HBL9367
Single	20A, 250V	NEMA 10-20R	Hubbell HBL9326

2.4 SPECIFICATION GRADE GFCI RECEPTACLES

B. Specification Grade GFCI Receptacles, Comply with UL 498, FS W-C-596, and UL 943 Class A.

C. Non-feed through type unless otherwise required, Integral self-testing GFCI with "Test" and "Reset" buttons and LED indicator light that is lighted when the unit is tripped. If critical components are damaged and ground fault protection is lost, power to receptacle shall be discontinued.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex GFCI	20A, 125V	NEMA 5-20R	Hubbell GFRST20
Duplex GFCI with Alarm	20A, 125V	NEMA 5-20R	Hubbell GFRST20A
Duplex GFCI - TR	20A, 125V	NEMA 5-20R	Hubbell GFTRST20
Duplex GFCI - WR	20A, 125V	NEMA 5-20R	Hubbell GFTWRST20

Duplex GFCI - CR	20A, 125V	NEMA 5-20R	Hubbell GFRST52M
GFCI Blank Face	20A, 125V		Hubbell GFBFST20

2.5 USB RECEPTACLES

A. USB Charging Receptacle and Outlet, Comply with UL 1310 and USB 3.0 devices.

B. Dual port, combination USB Type A and C, 5 V dc, and 5 A per receptacle (minimum).

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex USB - TR	20A, 125V	NEMA 5-20R	Hubbell USB20AC5
Duplex USB - WR	20A, 125V	NEMA 5-20R	Hubbell USB20AC5WR

C. Twist-Lock, Single Receptacles, with matching plug as required by equipment. Comply with NEMA WD 6, UL 498, FS W-C-596.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single	20A, 125V	NEMA L5-20R	Hubbell HBL2310
Single	20A, 250V	NEMA L6-20R	Hubbell HBL2320
Single	20A, 277V	NEMA L7-20R	Hubbell HBL2330

2.6 CONTROLLED RECEPTACLES

A. Specification Grade Receptacle, Permanently marked and suitable for use with automatic switching means. Comply with NEMA WD 6, UL 498B, FS W-C-596.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex Single Face Control	20A, 125V	NEMA 5-20R	Hubbell 5362C1TR
Duplex Two Face Control	20A, 125V	NEMA 5-20R	Hubbell 5361C2TR

2.7 GENERAL USE SNAP SWITCHES

A. Switches, 120/277 V, Comply with UL 20, and FS W-S-896.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221
Double Pole	20A, 120/277V		Hubbell 1222
Three Way	20A, 120/277V		Hubbell 1223
Four Way	20A, 120/277V		Hubbell 1224

B. Pilot-Light Switches, illuminated when switch is ON:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221PL

C. Illuminated Switches, illuminated when switch is OFF:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221IL

D. Key-Operated Switches, Factory-supplied key in lieu of switch handle:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221L
Three Way	20A, 120/277V		Hubbell 1223L
Four Way	20A, 120/277V		Hubbell 1224L

E. Double-Throw, Momentary-Contact, Center-off Switches.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1557
Low Voltage	5A, 24VDC		Hubbell 1557LV

2.8 MANUAL MOTOR CONTROL SWITCHES

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle type for manual control of single or three phase motors up to 3/4 HP where overload protection is not required or is provided separately, marked to indicate whether unit is on or off.
   1. Standard: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle type with integral overload protection for use with single phase motors up to 1HP; marked to show whether unit is off, on, or tripped.
   1. Configuration: Non-reversing unless noted otherwise on drawings.
   2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor and ambient temperature; external reset push button; melting alloy type.
   3. Red pilot light where indicated on drawings.
   4. HOA selector switch with dry contact inputs where indicated on drawings.

C. Provide NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere.

D. All manual starters located in finished areas shall be in flush-mounted enclosures.

2.9 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking type plug and receptacle body connector, heavy-duty grade.

B. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

C. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.10 CORD AND PLUG SETS

A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.11 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, 0.060-inch high-impact thermoplastic or satin-finished, type 304 stainless steel.
   3. Material for Unfinished Spaces: Aluminum or type 430 stainless steel.
   4. Material for rough service or corrosive locations including gymnasiums, kitchens, mechanical rooms, material management, and food service areas: satin-finished, Type 304 stainless steel.

      d) For kitchen and food service areas, provide foam gasket behind plate to help prevent water infiltration.

B. Material for Interior Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

C. Wet-location, Weatherproof, in-use cover plates: extra duty, suitable for use with and decorator style devices, die-cast aluminum lockable cover, self-closing, gasketed, standard box mounting.
   1. Vertical mounting - Hubbell WP26E or equal.
   2. Horizontal mounting - Hubbell WP26EH or equal.

D. Cover plates for lighting control devices exposed to severe physical damage: Low profile, flip-up clear polycarbonate cover. STI Stopper or equal.

2.12 FLOOR BOXES AND POKE-THROUGH ASSEMBLIES

A. Description: Single or multi-service, recess activated, multi-gang floor outlet with devices capable of supplying combinations of power, data, voice, and AV services in a single assembly.

B. Manufacturers: Subject to compliance with requirements, provide product indicated on drawings or approved equal by one of the following:
   1. FSR
   2. Hubbell
   3. Legrand (Wiremold) Basis of Design is Wiremold. Refer to electrical drawings for sizes and quantities of floor boxes.

C. Floor Boxes and Poke-Thru Assemblies
   1. Comply with UL514A.
   2. Material: Cast metal or sheet metal with finished interior
   3. Type: Fully adjustable before and after floor installation.
   4. Shape: Rectangular or Round
   5. Designed for use with industry standard wall plates, devices, and modular inserts.
   6. Painted with corrosion resistant fusion-bonded epoxy where used in on-grade floor applications.
   7. Classified for fire resistance up to 2 hours where used in rated floors.
   8. Evaluated by UL to meet U.S. safety standards for scrub water exclusion.
   9. Provide separate paths for management of telecommunications and power cables in compliance with NFPA 76.
   10. Cover: ADA-compliant, with less than 0.15-inch rise to cover flange, hinged for 180-degree opening, Gasketed, Die-cast powder coated aluminum suitable for multiple floor surfaces.
       e) Surface style for carpet and VCT floor finishes.
       f) Flush style for wood, tile, finished concrete, and terrazzo floor finishes.

2.13 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Components shall be products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Multioutlet Harness:
   1. Receptacles: 20-A, 125-V.
   2. Receptacle Spacing: 18 inches unless noted otherwise.
   3. Wiring: No. 12 AWG solid, Type THHN copper.

2.14 SERVICE POLES

A. Dual-Channel Service Poles

1. Description: Factory-assembled and -wired units to route power and communications cabling from connections above ceiling to outlets below ceiling.
2. Listed and labeled in accordance with UL 5 for exposed power raceway and fittings, and UL 2024 for communications raceway and fittings.
3. Poles: Minimum 2.5-inch- square cross-section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
4. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
5. Material: Aluminum.
6. Finishes: Manufacturer's standard painted finish and trim combination.
7. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.
8.

2.15 CORD REELS

A. Description: Reel equipped with, or intended for use with, length of flexible cord, providing means for cord to be unwound by user as desired, providing spring take-up mechanism to rewind cord on reel, and providing latch to restrain action of spring take-up mechanism while cord reel is in use.

B. Comply with UL355.

C. Spring Driven, suitable for industrial and commercial use, No. 12 AWG conductors, 20A rating, Black aluminum housing, Ball stop, pivot base, 30ft spool capacity with 20A quadraplex or double duplex receptacles unless noted otherwise.

PART 3 - EXECUTION

3.1 APPLICATION

A. Provide receptacles and cover plates listed for the installed environment.

B. Outdoor receptacles and receptacles located in wet locations shall be weather resistant, GFCI type, with weatherproof enclosure.

C. Provide GFCI receptacles where required by the NEC in addition to the locations noted on the drawings.
1. Bathrooms
2. Kitchens and food preparation or cooking areas
3. Rooftops
4. Outdoor/Exterior locations
5. Within 6 feet of sinks, tubs, showers stalls, eyewash stations, and emergency showers
6. Indoor Wet and Damp locations
7. Locker Rooms and Showers
8. Mechanical/Janitor Rooms

9. Laundry areas

D. Provide weather-resistant rating for GFCI receptacles installed in wet locations.

E. Where GFCI receptacles are located in areas that are not readily accessible, provide GFCI blank face device in readily accessible location approved by Architect.

F. Provide tamper resistant receptacles where required by the NEC in addition to the locations noted on the drawings. Drawings indicate all receptacles in areas accessible to students shall be tamper resistant.

3.2 INSTALLATION

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA 130.

B. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.

C. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed. Replace stained or improperly painted wiring devices and coverplates.

D. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required. Where GFCI receptacles share a single circuit with other devices, a ground fault on any GFCI receptacle shall not interrupt power to downstream devices.

E. Coordination for all receptacles: Confirm receptacle configuration of all special purpose receptacles with approved submittals prior to installation and provide devices to match equipment plugs. Contractor shall replace any incompatible receptacle discovered during owner move-in.

F. Coordination with Other Trades:
1. Adjust locations of outlets to suit arrangement of partitions and furnishings. Locate outlets to avoid blocking by supports, furnishings, and other architectural fixtures.
2. Adjust locations of floor boxes and poke-throughs to coordinate with locations of structural members, concealed piping, and concealed conduit.
3. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
4. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
5. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
6. Install wiring devices after all wall preparation, including painting, is complete.

G. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

H. Device Installation:
1. Replace all devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until all finish work is complete.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than #12 AWG are installed on 15- or 20-A circuits, splice #12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Install devices and assemblies' level, plumb, and square with building lines. Align devices vertically and horizontally. Securely fasten devices into boxes.

I. Device Orientation:
1. Install switches with "OFF" position down.
2. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left so the neutral blade is at the top.

J. Device Plates:
1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.
3. Align coverplate mounting screw slots in the same direction, either vertical or horizontal. Do not overtighten coverplate mounting screws. Overtightening can cause the coverplate to warp, dimple, bend, and in the case of plastic faceplates, crack or break.

3.3 IDENTIFICATION:

A. Comply with Section 260553 "Identification for Electrical Systems."
1. All device wall plates shall be labeled with panel and circuit designation by means of machine printed adhesive tape.
2. All device boxes shall have panel and circuit designations identified within the box.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Using a test plug, perform the following tests and inspections for receptacles:
   1. Insert and remove test plug to verify that devices are securely mounted.
   2. Verify correct configuration of hot, neutral, and ground pins.
   3. Verify correct operation of ground fault protective devices.

C. Nonconforming Work:
   1. Device will be considered defective if it does not pass tests and inspections.
   2. Remove and replace defective units and retest.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Provide labor, material, equipment, related services, and supervision required for the installation of cartridge fuses that were utilized for overcurrent and/or current limitation applications.

B. Section Includes:
   1. Cartridge fuses rated 600V-AC and less for use in control circuits, enclosed switches, panelboards, switchboards, and motor controllers.
   2. Spare fuse cabinet.

1.3 REFERENCES

A. Definitions
   1. Fuse: A protective device that opens a circuit during specified overcurrent conditions by means of a current responsive element.

B. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.
   1. National Electrical Contractors Association (NECA)
      a. NECA 420, “Fuse Applications”

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels indicated in power system study.

1.6 MAINTENANCE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to10 percent of quantity installed for each size and type, but no fewer than three of each 100 amps and above, and not less than six of each size and type for below 100 amps.
   2. Fuse Pullers: Two for each size and type.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace fuses that fail in materials or workmanship within 18 months from date of Substantial Completion.

1.8 FIELD CONDITIONS

A. Where ambient temperature to which fuses are exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Bussmann, Inc.
   2. Littlefuse, Inc.
   3. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with:
   1. NEMA FU 1 – Low Voltage Cartridge Fuses.
   2. UL 248 – Standard for Low Voltage Fuses.
   3. UL 512 – Fuseholders.

2.3 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC minimum, fast acting or time delay.
   2. Type RK-5: 250 or 600-V, zero- to 600-A rating, 200 kAIC minimum, fast acting or time delay.
   3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC minimum, fast acting or time delay.
   4. Type J: 600-V, zero-to-600-A rating, 200 kAIC minimum, time delay.
   5. Type L: 600-V, 601- to 6000-A rating, 200 kAIC minimum, time delay option.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

C. Provide dual element fuses with separate overload and short circuit elements.

2.4 SPARE-FUSE CABINET

A. Manufacturer: Bussmann #SFC-FUSE-CAB spare fuse cabinet or equal.

B. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1-1/2-inch-high white letters on black lamicoid plate. Mount plate on exterior of door.
   4. Fuse Pullers: For each size of fuse, where applicable and available, from manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPICATIONS

A. Service, Feeders, and Branch Circuits (601-6000A): Class L, time delay. Bussmann HI-CAP Fuses KRP-C or equal. Fuses shall hold 500% of rated current for a minimum of 4 seconds.

B. Feeders and Branch Circuits (0-600A): Class RK1, time delay. Bussmann Low-Peak Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts) or equal. The fuse shall hold 500% of rated current for a minimum of 10 seconds.

C. Motor Circuits – Class RK1 or Class L, time delay as indicated above.
   1. Motor with 1.15 service factor: Size at 125% of motor FLA. For high inrush current applications size 150% to 200% of motor FLA.
   2. Motor with 1.0 service factor: Size at 115% of motor FLA.

D. Control Circuits: Class CC, time delay. Bussmann Low-Peak Fuses LP-CC or equal. Fuses shall hold 200% of rated current for a minimum of 12 seconds.

E. Adjust fuse type and selection as required to ensure available fault current at equipment controllers indicated in power systems study does not exceed labeled SCCR values.

3.3 INSTALLATION

A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energizing at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energizing of the circuit in which it is applied.

B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to ensure retention of selective coordination, as designed.

C. Provide a complete set of fuses for all fusible devices. Arrange fuses so rating information is readable without removing fuse.

D. Install spare-fuse cabinet(s). Locate in Main Electrical Room.

E. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in Spare-Fuse Cabinet.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems".
   1. Indicate fuse rating and type on the outside door of each fused switch.

END OF SECTION

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Section includes requirements for the provision of individually enclosed switches and circuit breakers including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the drawings and specifications

B. Section includes:
   1. Fusible and Non-Fusible Switches.
   2. Enclosed Circuit Breakers.
   3. Elevator Shunt Trip Switches.
   4. Enclosures.

1.3 REFERENCES

A. Abbreviations
   1. HD: Heavy Duty
   2. MCCB: Molded Case Circuit Breaker
   3. NC: Normally Closed
   4. NO: Normally Open
   5. SCCR: Short Circuit Current Rating

B. Definitions
   1. Disconnect: A switch, device, group of devices, or other means used to disconnect conductors of a circuit from their source of supply.
   2. Switch (switching device): A device, manually operated, unless otherwise designated, for opening and closing or for changing the connection of a circuit. Also referred to as safety switches or disconnect switches.

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 COORDINATION

A. Product Selection for Restricted Space: Drawings indicate space available for enclosed switches including clearances between enclosed switches and adjacent surfaces and other items. Furnish and install equipment to comply with NEC clearances.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace devices that fail in materials or workmanship within 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB/General Electric.
   2. Eaton Electrical Inc.
   3. Square D

B. Source Limitations: Obtain enclosed switches, overcurrent protection devices, and all other electrical distribution equipment through one source from a single manufacturer unless approved otherwise.

2.2 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Service-Rated Switches and Circuit Breakers: Labeled for use as service equipment.

D. Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Switch and overcurrent protective device short circuit ratings shall be at least 110% of the actual available fault current.

2.3 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 250-VAC or 600-VAC, 1200 A and Smaller unless noted otherwise.

B. Quick-make, quick-break operating handle and switch mechanism integral to box.

C. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses where indicated.

D. Externally operable dual interlocked handle to prevent opening front cover with switch in ON position, or closing switch when door is open. Visible load interrupter knife switch blades in the off position with door open.

E. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

F. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

G. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: UL Listed, mechanical type, front removeable, and suitable for number, size, and conductor material at 75 deg C.
4.
5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating as required for application.
6. Electrical Interlock Kit: Pivot arm operated from the switch mechanism, breaking a control circuit before the main switch blades break.

H. For receptacle switches provide interlocking linkage between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

2.4 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. MCCBs shall be equipped with a device for locking in the open position.

E. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Long-time, Short-time, and Instantaneous trip unless noted otherwise on drawings.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single-, two-pole, and three-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: UL Listed, mechanical type, suitable for number, size, trip ratings, and conductor material at 75 deg C.
   3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
   4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact. Coordinate coil voltage and provide control circuits as required for application.

2.5 ELEVATOR SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bussmann
   2. Eaton
   3. Littlefuse
   4. Mersen

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses.

E. Accessories:
   1. Key switch for key-to-test function.
   2. Red ON pilot light.
   3. Isolated neutral lug.
   4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
   5. Form C alarm contacts that change state when switch is tripped.
   6. Three-pole, double-throw, fire-safety, and alarm relay; 24-V dc coil voltage.

F. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.6 ENCLOSURES

G. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor and Wet Locations: NEMA 250, Type 3R.
   3. Kitchen and Wash-Down Areas: NEMA 250, Type 3R, stainless steel.

H. Enclosure Finish: The enclosure shall be finished with the standard manufacturer gray finish.

I. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Securely fasten each switch and circuit breaker to the supporting structure or wall, utilizing a minimum of four (4) 1/4-inch bolts. Do not mount in an inaccessible location or where the passageway to the switch may become obstructed.

D. After equipment has been installed, inspected, and is ready to be energized, install fuses in fusible devices in accordance with equipment nameplates and requirements in Section 262813, “Fuses”.

E. Comply with NFPA 70 and NECA 1.

F. Provide electrical interlock kit and low voltage wiring where utilized on the line side of VFD controller to shut down VFD prior to disconnection of power. Coordinate control wire termination with Division 25.

G. Provide electronic trip breakers where required to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

H. Provide fusible switches with current limiting fuses or current limiting circuit breaker for equipment disconnecting means where equipment short circuit current rating is insufficient for available fault current.

I. Where battery lowering devices are specified with Elevators, provide connection between an auxiliary contact at the elevator disconnect and the battery lowering device.

J. Where enclosed breakers or switches are provided on the load side of a VFD, provide connection between and auxiliary contact at the disconnect and the VFD that will trigger a freewheel stop on the VFD before the disconnect contacts open.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with nameplate.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Visual and Mechanical Inspection:
      a. Examine equipment nameplate data and confirm proper identification.
      b. Verify and record fuses sizes and types are in accordance with nameplates and power systems study.

c. Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers' instructions.
d. Inspect anchorage, alignment, and grounding.
e. Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
f. Exercise all active components to ensure proper mechanical operation.
g. Check all interlocking systems for correct operation.

2. Circuit Breaker Testing: For all circuit breakers with electronic trip units, determine minimum pickup current, long-time and short-time pickup and delay, and instantaneous pickup by secondary current injection. Certify compliance with test parameters and ensure settings match recommendations from final approved power system study.
3. Test ground-fault protection of equipment for service equipment per NFPA 70.
4. Test all auxiliary devices/system interfaces and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switches and Circuit Breakers will be considered defective if they do not pass tests and inspections.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.

D. Prepare test and inspection reports, including a certified report that identifies switches and circuit breakers included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Power System Studies".

END OF SECTION

SECTION 262900 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Extent of motor starter work is indicated by drawings and schedules.

B. Section includes:
   1. Combination full voltage, non-reversing Motor Controllers.
   2. Combination Soft Start Motor Controllers

C. Related Requirements:
   1. Refer to Section 260500 “Common Work Results for Electrical Systems” for additional requirements related to motors connections.
   2. Refer to Section 262726 “Wiring Devices” for information on manual motor controllers.
   3. Refer to Division 25 for coordinating requirements related to control system interface points.

1.3 REFERENCES

A. Abbreviations
   1. FVNR: Full Voltage Non Reversing
   2. MCP: Motor Circuit Protector
   3. OCPD: Overcurrent protective device
   4. SCCR: Short Circuit Current Rating
   5. SCPD: Short-circuit protective device
   6. SCR: Silicon Controlled Rectifier

B. Definitions
   1. Soft Starter: Solid state reduced voltage non-reversing motor controller

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 MAINTENANCE MATERIAL

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to one spare for every 10 installed units, but not less than 5 units for each size and type.
   2. Overloads: Equal to one spare for every 9 installed units, but not less than 3 units for each size and type.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace enclosures, starters, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within 18 months.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. UL Compliance and Labeling: Fabricate and label motor controllers to comply with UL 508.

C. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of motor starters.

D. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to motor controllers/starters and enclosures.

2.2 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products from one of the following:
   1. ABB/General Electric
   2. Eaton
   3. Siemens.
   4. Square D. Co.

2.3 MANUAL MOTOR CONTROLLERS

A. Refer to Section 262726 “Wiring Devices” for manual motor controller requirements.

2.4 COMBINATION FULL VOLTAGE MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage, non-reversing magnetic motor controller consisting of the controller, indicated disconnecting means, SCPD, OCPD, pushbuttons, selector switch(es), and indicator lights in a single enclosure.

B. All combination starter/disconnect switches shall have low-voltage protection, solid state overloads, start / stop pushbuttons, Hand-Off-Auto selector switch and Red and Green pilot lights.

C. All combination starter/disconnect switches shall be Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Combination motor starters shall be rated in accordance with NEMA sizes and horsepower ratings. No starter shall be listed as a fractional size. Contactor contacts shall be silver alloy, double break, and shall allow for inspection on NEMA Sizes 00 through 4 without the use of tools. Size 5 and larger shall allow for inspection utilizing standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.

E. Contactor coils shall be the encapsulated type, and shall be replaceable on NEMA Sizes 00 through 4 without the use of tools. Size 5 and larger shall be replaceable with standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.

F. Overload protection shall be provided by solid state electronic overload relay. Single-phase starters shall provide one- or two-leg overload protection; three-phase starters shall provide three-leg overload protection. Overload protection shall be class 10/20 selectable, have visible trip indicator, and manual or remote reset function.

G. Starter shall include phase failure relay with under-voltage protection.

H. Starter shall have integral controls transformer with primary and secondary fusing.

I. Starter to have two normally closed and two normally open auxiliary contacts.

J. Combination starter shall be suitable for straight through wiring.

K. Fusible Disconnecting Means: Heavy Duty, quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

L. All safety switches shall have a factory installed neutral lug, when a neutral is necessary.

M. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

N. Provide the following Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.5 COMBINATION SOFT START MOTOR CONTROLLER

A. Description: Factory Assembled, Solid state, reduced voltage, non-reversing motor controller consisting of controller, disconnecting means, protection devices, microprocessor with digital keypad in a single enclosure.

B. Enclosure shall include a door mounted digital keypad for adjusting the soft starter parameters and viewing process values and viewing the motor and soft starter status without opening the enclosure door. Provisions shall be available for padlocking the enclosure door.

C. The enclosed product shall be provided with molded case disconnect switch and in-line fuse block for Class J power fuses from 10 to 600A or Class L power fuses from 601 to 1600A for Type 1 short circuit protection.

D. The motor must be automatically protected from solid state component failure by an isolation contactor that opens when the motor is stopped or when the controller detects a fault condition including a shorted SCR.

E. The soft starter shall utilize an SCR bridge consisting of at least two SCRs per phase to control the starting and stopping of industry standard motors.

F. The soft start shall provide torque control for linear acceleration independent of motor load or application type without external feedback. The gating of the SCRs will be controlled in such a manner to ensure stable and linear acceleration ramp.

G. The soft starter shall be controlled by a microprocessor that continuously monitors the current and controls the phasing of the SCRs. Analog control algorithms shall not be allowed.

H. A shorting contactor shall be standard on soft starters in all enclosure configurations. Protective features and deceleration control options integral to the soft starter shall be available even when the shorting contactor is engaged.

I. The SCRs shall have a minimum P.I.V. rating of 1800 Vac. Lower rated SCRs with MOV protection are not acceptable.

J. All programming/configuration devices, display units, and field control wiring terminals shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.

K. Digital indication shall provide, as a minimum, the following conditions:
   1. Soft starter status - ready, starting/stopping, run.
   2. Motor status - current, torque, thermal state, power factor, operating time, power in kW.

3. Fault status - Motor thermal overload, soft starter thermal fault, loss of line or motor phase, line frequency fault, low line voltage fault, locked rotor fault, motor underload, maximum start time exceeded, external fault, serial communication fault, line phase reversal fault, motor overcurrent fault.

L. The soft starter must be preset to the following for adjustment-free operation in most applications:
1. Linear (torque-controlled) acceleration ramp of 15 seconds.
2. Current limitation to 400% of the motor full load current rating.
3. Class 10 overload protection.
4. Motor current preset per NEC / NFPA 70 table 430.150 for standard hp motors.

M. A digital keypad shall be utilized to configure operating and controller parameters such as FLA, acceleration ramp, torque, braking type, thermal overload Class, reset functions, etc.

N. Provide output relays to provide the following status indications:
1. One Form A (N.O.) minimum for indication of fault.
2. One Form A (N.O.) for indication that acceleration ramp is complete and current is below 130% motor FLA (end of start).
3. One Form A (N.O.) assignable to one of the following functions: motor thermal alarm, motor current level alarm, and motor underload alarm.

O. A microprocessor-based thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft starter and provides:
1. A motor overload pre-alarm that indicates by relay contact or logic output that the motor windings have exceeded 130% of its rated temperature rise. This function shall be for alarm only.
2. A motor overload fault will stop the motor if the windings have exceeded 140% of temperature-rise.
3. An electronic circuit with a time-constant adjustable to the motor's thermal cooling time-constant ensuring the memorization of the thermal state even if power is removed from the soft starter.
4. The soft starter shall provide line and motor phase loss, phase reversal, underload, stall, and jam protection.
5. The integral protective features shall be active even when the shorting contactor is used to bypass the SCRs during steady state operation.
6. The soft starter control circuit shall be fed from the line supply and be completely independent of the power circuit and separate from the control logic.

P. The peripheral soft starter control circuitry shall be operated at 120 Vac 60 Hz from a control power transformer included within the enclosure.

Q. Operator devices shall be door mounted and shall be:
1. Red STOP and black START push buttons.
2. Three position H-O-A switch which provides for manual (HAND) start or remote signal (AUTO) start from user-supplied relay contacts.
3. Three position FWD-OFF-REV switch provides forward, off and reverse selector switch mounted on the door (available with reversing starter only).
4. Red RUN pilot light illuminated whenever the soft starter is provided a run command and no-fault condition is present.

5. Green OFF pilot light illuminated whenever the soft starter is supplied with control power and no run command is present.
6. All operator devices shall be remote-mounted using supplied 120 Vac control logic. Clearly labeled terminals shall be provided for field installation.

R. Provide a shorting contactor that shall close, shorting the SCRs after the acceleration ramp is compete and motor current is below 130% of motor FLA, and open on a stop command to allow a deceleration ramp. Overload protection integral to the soft starter shall continue to protect the motor when shorting is engaged. A microprocessor shall control the operation of the shorting contactor via an output relay.

S. Provide full voltage bypass starter with overload protection to provide motor operation in the event of soft starter failure. Provide "NORM/BYPASS" selector switch on enclosure door.

PART 3 - EXECUTION

3.1 MOTOR CONTROLLER APPLICATION

A. FVNR and Soft Starter type motor controllers shall be combination type starter and disconnect switch unless noted otherwise on plans.

B. Starters smaller than 10HP shall be full voltage non-reversing type (FVNR). Starters 10HP and larger shall be soft starters.

C. SCCR ratings shall exceed the available fault current calculated by the power system study as required by Section 260573, "Power System Studies".

D. The starter shall be designed to operate in the environment in which installed including ambient temperature, humidity, and elevation.

E. Enclosure:
1. Type of each starter to comply with environmental conditions at installed location:
   a. Indoor, Dry and Clean Locations: NEMA 250, Type 1
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
2. Provide provisions for padlocking the enclosure door.

3.2 EXAMINATION

A. Examine elements and surfaces to receive motor starters for compliance with installation tolerances, relationship to motors, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF MOTOR CONTROLLERS:

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA standards, and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Securely fasten each switch, circuit breaker and combination starter to the supporting structure or wall, utilizing a minimum of four (4) 1/4 inch bolts.

D. Maintain minimum clearances and workspace at equipment according to manufacturer’s written instructions and NEC. Do not mount in an inaccessible location or where the passageway to the switch may become obstructed.

E. Install fuses in fusible devices in accordance with Section 262813, “Fuses”.

F. Select and set overloads on the basis of full-load current rating as shown on motor nameplate.

G. Verify that overcurrent and overload protection devices are properly matched to actual motor nameplate data and service class.

H. Provide conductor reducers, taps and splices, as required, for proper termination of all branch circuits and feeders at disconnect switches, panelboards, motor starters, VFDs, etc. This shall include where conductors have been oversized to accommodate voltage drop, motor circuit conductor protection, and all instances where conductors are unable to terminate at factory lugs.

I. Final 18 inch of power wiring to motor shall be in liquid tight flexible conduit.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”
   1. Identify field-installed conductors, interconnecting wiring, and components.
   2. Provide Warning Signs.
   3. Label each enclosure with nameplate.

3.6 FIELD QUALITY CONTROL:

A. Perform Test and Inspections:
   1. Visual and Mechanical Inspection:
      a. Compare equipment nameplate data with drawings and specifications.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, and grounding.
      d. Verify the unit is clean.
      e. Inspect contactors:
         1) Verify mechanical operation.
         2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
      f. Motor Protection:
         1) Verify overload element rating is correct for its application.
         2) If motor-running protection is provided by fuses, verify correct fuse rating.
      g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench or low resistance ohmmeter. Bolt-torque levels and/or bolted connection resistance values shall be according to manufacturer's published data.
      h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
   2. Electrical Tests:
      a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data.
      b. Test motor protection devices according to manufacturer's published data.
      c. Verify voltages at the controller locations are within plus or minus 10 percent of the motor nameplate rated voltages. If outside the range for any motor, notify the design team before starting the motor.
      d. Perform operational tests by initiating control devices.
      e. Test all auxiliary devices/system interfaces and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Motor controller will be considered defective if it does not pass tests and inspections.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance, otherwise replace with new units and retest.

D. Prepare test and inspection reports, including a certified report that identifies motor controllers included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 263213 - ENGINE GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets suitable for use in applications with the features as specified and indicated where the engine generators will be used as the Standby power source for the system.

B. As part of this contract, provide all fuel (fill empty tank 100% full), engine fluids, filters, reinforced concrete pad/base and labor. Provide load bank and labor required for testing of the engine generator. At completion of all testing, completely fill all fuel tanks 100% in accordance with manufacturer’s recommendations prior to system turn-over.

1.3 DEFINITIONS

A. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer’s authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within Connecticut, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).

E. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).

F. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.

G. Comply with UL 2200.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: 0F to 104°F
   2. Relative Humidity: 0 to 95 percent.
   3. Altitude: Sea level to 500.0 feet (152.4 m).

1.7 WARRANTY

A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Onan/Cummins Power Generation; Industrial Business Group. (Basis of Design)
   2. Kohler
   3. Generac

B. The diesel engine shall be EPA Certified in accordance with the Federal and State of Connecticut Emission Laws.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:
   1. Power Output Ratings: Electrical output power rating for Standby operation at 600kW/ 750kVA, at 80 percent lagging power factor, 480/277 V, Three phase, 4 - wire, 60 hertz.
   2. Alternator shall be capable of accepting maximum 825kVA in a single step and be capable of recovering to a minimum of 90% of rated voltage based on requirements of NEMA MG1-32.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.
   4.

D. Generator-Set Performance:
   1. Steady-State Voltage Operational Bandwidth: 1.0 percent of rated output voltage from no load to full load.
   2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   5. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.
   6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
   7. Sustained Short-Circuit Current: (For engine-generator sets using a PMG-excited alternator) For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
   8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.
   9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.3 ENGINE

E. Fuel: Diesel

F. Rated Engine Speed: 1800RPM.

G. Lubrication System: The following items are mounted on engine or skid:
1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
2. Filter and Strainer: Fleetgaurd provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used, Fleetgaurd or equal.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

H. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions.

I. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

J. Governor: Adjustable isochronous, with speed sensing and a product of the engine manufacturer.

K.

L. Cooling System: Closed loop, liquid cooled
1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 50 deg C.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

M.

N. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.

O. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

P. Starting System: 24V, as recommended by the engine manufacturer; electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Cycle: As required by NFPA 110 for level 1 systems.

3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Included required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:
    a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
    f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Sub Base-Mounted Fuel Oil Tank: Provide a double wall secondary containment type sub base fuel storage tank. The tank shall be constructed of corrosion resistant steel and shall be UL 142 listed and labeled. The fuel tank shall include the following features:
    1. Capacity: Fuel for 24 Hour(s) continuous operation at 100 percent rated power output.
    2. Tank rails and lifting eyes shall be rated for the full dry weight of the tank, genset, and enclosure.
    3. Electrical stub up(s)
    4. Normal & emergency vents
    5. Lockable fuel fill
    6. Mechanical fuel level gauge
    7. High and low level switches to indicate fuel level
    8. Leak detector switch
    9.
    10. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.

11. Fill port with overfill prevention valve (OFPV)
12. Tank design shall meet the regional requirements for the Project location

2.5 CONTROL AND MONITORING

A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
   1. AC voltmeter (3-phase, line to line and line to neutral values).
   2. AC ammeter (3-phases).
   3. AC frequency meter.
   4. AC kVA output (total and for each phase). Display shall indicate power flow direction.
   5. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
   6. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
   7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
   8. DC voltmeter (alternator battery charging).
   9. Engine-coolant temperature gage.
   10. Engine lubricating-oil pressure gage.
   11. Running-time meter.
   12. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)

13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.
14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.
15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

G. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.

H. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Provide additional stop-switches within main electrical room and next to fire alarm control panel.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications

C. The alternator shall be provided with an overcurrent protection relay that is UL-listed under category NRGU. The overcurrent protection system shall be coordinated with the thermal damage curve of the specific alternator provided. Submit thermal damage curve for alternator and protection curve (and settings if applicable) for the overcurrent protective system.

D. A 1200A output breaker with LSIG protection shall be provided. Coordinate with requirements of section 260573 “Power System Studies.”

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 105 degrees C over 40 degrees C ambient.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Voltage Regulator: SCR type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified and provide a pulse-width modulated signal to the exciter.

I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound Attenuated Aluminum Factory Skin-Tight housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:
1. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
2. Exhaust System:
3. Muffler Location: Within enclosure.
4. Hardware: All hardware and hinges shall be stainless steel.
5. Wind Rating: Wind rating shall be 150 mph
6. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
7. A coastal-rated weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 70 dBA measured at any location 7 meters from the engine generator in a free field environment.

E. Site Provisions:
1. Lifting: Complete assembly of engine generator, enclosure shall be designed to be lifted into place as a single unit, using spreader bars.

2.9 FINISHES

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

2.10 SOURCE QUALITY CONTROL

B. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
   1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 70 and NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

G. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe, the full size of the drain connection, with welded joints.

H. Fuel Piping: Comply with Division 23 for fuel piping, valves, and specialties for fuel distribution.

I. Install electrical devices and components that are not factory mounted.

J. Provide all interconnection wiring between system components and equipment.

K. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer’s recommended practice.

3.2 CONNECTIONS

L. Coordinate with all trades for generator interface with other building systems.

M. Provide flexible connections for all connections to the generator and between its components to reduce vibrations transmitted to surrounding structures.

N. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

O. Connect engine exhaust pipe to engine with flexible connector.

P. Fuel Connections:

Q. Comply with manufacturer’s instructions.

R. Connect fuel piping to engines with a gate valve and union and flexible connector.

S. Install manual shutoff valve in a remote location to isolate fuel supply to the generator.

T. Provide raceways for all wiring according to Section 260533 “Raceways and Boxes for Electrical Systems.”

U. Install and connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

V. Provide Class D extra flexible stranded conductors for all connections to genset.

W. Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring in accordance with NEC. Start signals shall be provided with 2-hour rated wiring.

X. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

Y. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.3 GROUNDING

A. Ground and bond equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install a minimum of two auxiliary grounding electrodes at outdoor generator locations. Connect the electrodes to the equipment grounding conductor and to the frame of the generator in accordance with the generator manufacturer's recommendations.

C. If the grounded neutral conductor is switched at a 4-pole transfer switch, provide a main bonding jumper between the generator's grounded terminal (neutral) and the equipment grounding terminal.

3.4 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:

C. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque. Pre-Operational Test and Inspections include:
   1. Visual and Mechanical Inspection:
      a. Examine equipment nameplate data and confirm proper identification.
      b. Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers' instructions.
      c. Inspect anchorage, alignment, and grounding.
      d. Verify the unit is clean.
      e. Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
      f. Exercise all active components.
      g. Inspect all mechanical indicating devices for correct operation.
      h. Physically test key interlock systems to check for proper functionality prior to energizing.
   2. Electrical and Mechanical Tests
      a. Perform insulation-resistance tests in accordance with IEEE 43.
         1) Machines larger than 200 hp. Test duration shall be 10 minutes. Calculate polarization index.
         2) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
      b. Test protective relay devices.
      c. Verify phase rotation, phasing, and synchronized operation as required by the application.
      d. Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
      e. Verify correct functioning of the governor and regulator.

D. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Functional Acceptance Testing:
   1. Test the complete automatic transfer switch system and generator control system concurrently to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.
   2. Perform tests required by NFPA 110 and additional testing specified herein.
      a. Provide resistive load bank and temporary connections as required to supplement building load equal to 100 percent of the nameplate kW rating.
      b. Factory test data showing run-test loads is not acceptable.
      c. Record fuel consumption, coolant temperature, lube oil pressure, output voltage (each phase), output current (each phase), room temperature at 15-minute intervals during testing.
   3. Cold start test: Demonstrate the engine generator set will attain proper voltage and frequency within the specified time limit from a cold start after the closing of a single contact.
   4. Full load one step pickup: Verify system can achieve full nameplate kW rating in one step and achieve acceptable steady state operation.
   5. Full load operation test: Run the generator for a minimum of two hours while delivering the full nameplate kW rating.
   6. Transient Test: Verify voltage and frequency deviations are within acceptable limits while adding and dropping each step load.
      a. Verify ability to allow starting and running the largest motor load at its full load current rating while supplying all other simultaneous loads.
   7. Power Failure Testing: Open the power supply from the utility service(s), and observe proper sequence of operation of the system. Where multiple sources and/or generators are included in the project, simulate all possible power failure scenarios. Coordinate timing and obtain approval for start of test with site personnel.

G. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and retest as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable settings, measured values, and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

L. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.
   1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
   2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided.

B. Training shall consist of not less than eight hours of hands-on instruction for a minimum of four attendees. Training shall cover the following topics at a minimum:
   1. Theory of operation
   2. Operation of Generator and components
   3. Maintenance and configuration
   4. Troubleshooting and Repair
   5. Replacement of components.

3.6 SERVICE AND SUPPORT

C. Initial Maintenance Service: Beginning at Substantial Completion, provide 18 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by the manufacturer service manual and any calibration required for proper operation. Include emergency service. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

D. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year.

E. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization should be physically located within 50 miles of the site.

END OF SECTION

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches.
   2. Remote annunciation systems.
   3. Remote annunciation and control systems.
   4. 3-way manual transfer switches with (2) breaker interlock

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory(NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain automatic transfer switches, remote annunciators, and remote annunciator and control panels through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.4 SEQUENCING

J. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Equipment sizes and equipment layouts shall be considered basis of design. Equipment sizes vary by manufacturer. If proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

C. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner

1.6 WARRANTY

A. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Emerson; ASCO Power Technologies, LP.
2. Russelectric, Inc.
3. ESL Power Systems, Inc.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 per- cent or better over an operating temperature range of minus 20 to plus 70 degrees C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed volt- age-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Switch Action: Double throw; mechanically held in both directions.
   2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have sepa- rate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device and be BACnet compatible or provide means to communicate BACnet protocol.

K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26.
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

L. Enclosures: General-purpose NEMA 250, Type 1 or 3R (outdoors), complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

D. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

E. Provide automatic transfer switches of number and rating as shown on Drawings. Current rating shall be based on classes of loads including tungsten and inductive loads. Switch shall be electrically-operated, mechanically-held, with one or two electric operators momentarily energized and connected to transfer mechanism by simple over- center linkage. Switch shall be inherently double throw, contactor design rated for continuous duty with power transfer section and control section interconnected to provide complete automatic operation. Switch shall be totally front accessible and mounted in lockable 12 gauge steel NEMA 1 enclosure. Switch shall meet NEMA and UL-1008 standards for use in emergency systems.

F. Automatic transfer switches with components of molded case circuit breakers or components not designed for continuous duty or repetitive load transfer will not be accepted.

G. Provide 30 cycle closing and withstand ratings for automatic transfer switches used on emergency systems where directly protected by a Power Circuit Breaker where instantaneous trip settings can be turned off to allow selective coordination of upstream over- current devices with downstream devices.

H. Provide heavy duty, silver-tungsten alloy main contacts protected by arcing contacts with magnetic blowouts. Provide wiping action for main contacts. Main contact with- stand rating shall not be less than 20 times continuous duty rating for minimum of three cycles.

I. Provide mechanical interlock to ensure only one of two possible positions, normal or emergency. Operating transfer time in either direction shall not exceed 30 cycles, except where longer period is permitted for motor load transfer.

J. Provide four pole transfer switches on systems with ground fault protection, with four poles mounted on common shaft with continuous current rating and closing and with standard rating of fourth pole equal to main poles.

K. Provide external, manual operator with same transfer speed as electrical operator.

L. In addition to requirements of Part 1, manufacturer shall include following:
   1. Descriptive literature.
   2. Plan, elevation, side, and front view arrangement drawings, including overall dimension, weights, and clearances, as well as mounting or anchoring requirements and conduit entrance locations.
   3. Schematic diagrams.
   4. Wiring diagrams.
   5. Accessory list.

M. Transfer switch shall be equipped with internal welded steel pocket, housing operations, and maintenance manual.

N. Transfer switch shall be top and bottom accessible.

O. Main contacts shall be capable of being replaced without removing main power cables.

P. Main contacts shall be visible for inspection without any major disassembly of transfer switch.

Q. Bolted bus connections shall have Belleville compression type washers.

R. When solid neutral is required, provide fully rated bus bar with required AL-CU neutral lugs.

S. Control components and wiring shall be front accessible. Control wires shall be multi-conductor 18 gauge 600 volt SIS switchboard type point to point harness. Control wire terminations shall be identified with tubular sleeve-type markers.

T. Switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.

U. Complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with specification requirements. Furnish copy of factory test report upon request.

V. Automatic Transfer Switch Operation:
   1. Transfer switch shall be double throw, actuated by single electrical operator momentarily energized and connected to transfer mechanism by single over center type linkage. Total transfer time shall not exceed 30 cycles.
   2. Normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both normal and emergency positions without use of hooks, latches,
   3. magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided. Interlocked, molded case circuit breakers or contactors will not be acceptable.
   4. Transfer switch shall be equipped with safe external manual operator, designed to prevent injury to operating personnel. Manual operator shall have same contact to contact transfer speed as electrical operator to prevent flashover from switching main contacts slowly. External manual operator shall be safely operated from outside of transfer switch enclosure while enclosure door is closed.

W. Automatic Transfer Switch Controls:
   1. Transfer switch shall be equipped with microprocessor-based control system, to include operational functions of automatic transfer switch. Controller shall have two asynchronous serial ports. Controller shall have real time clock with NiCad battery back-up.
   2. CPU shall be equipped with self-diagnostics, which perform periodic checks of memory I/O and communication circuits, with watchdog/power fail circuit.
   3. Controller shall use industry standard open architecture communication protocol for high speed serial communications via multidrop connection to other controllers and to master terminal with up to 4,000 feet of cable, or further, with addition of communication repeater. Serial communication port shall be RS422/485 compatible.
   4. Serial communication port shall allow interface to either manufacturer's or Authority's furnished remote supervisory control.
   5. Controller shall have password protection required to limit access to qualified and authorized personnel.

6. Controller shall include 20 character, LCD display, with keypad, which allows access to system.
7. Controller shall include three phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.
8. Controller shall be capable of storing following records in memory for access either locally or remotely:
    a. Number of hours transfer switch is in emergency position (total since record reset).
    b. Number of hours emergency power is available (total since record reset).
    c. Total transfer in either direction (total since record reset).
    d. Date, time, and description of last four source failures.
    e. Date of last exercise period.
    f. Date of record reset.

X. Sequence of Operation:
1. When voltage on any phase of normal source drops below 70 percent, or 30 percent voltage differential between phases occurs, after programmable time delay period of 0-9999 seconds (factory set at 3 seconds) to al- low for momentary dips, engine starting contacts shall close to start generating plant.
2. Transfer switch shall transfer to emergency when generating plant has reached specified voltage and frequency on all phases.
3. After restoration of normal power on all phases to preset value of at least 90 per- cent to 110 percent of rated voltage, and at least 95 percent to 105 percent of rated frequency, and voltage differential is below 20 percent, adjustable time de- lay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If emergency power source should fail during this time delay period, switch shall automatically return to normal source.
4. After retransfer to normal, engine generator shall be allowed to operate at no load for programmable period of 0-9999 seconds, factory set at 300 seconds.

Y. Automatic Transfer Switch Accessories:
1. Provide programmable three phase sensing of normal source set to pick up at 90 percent and dropout at 70 percent of rated voltage and overvoltage to pick up at 120 percent and dropout out at 110 percent of rated voltage. Provide programmable frequency pickup at 95 percent and dropout at 90 percent and over frequency to pick up at 110 percent and dropout at 105 percent of rated frequency. Provide programmable voltage differential between phases, set at 20 percent, and phase sequence monitoring.
2. Provide time delay for override of momentary normal source power outages (de- lays engine start signal and transfer switch operation), programmable for 0-9999 seconds and set at 3 seconds.
3. Provide time delay to control contact transition time on transfer to either source, programmable for 0-9999 seconds and set with Programmed Neutral Time Delay Emergency to Normal at 0 seconds and Time Delay Normal to Emergency set at 2 seconds.
4. Provide time delay on retransfer to normal, programmable for 0-9999 seconds, factory set at 300 seconds, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds (5 minutes), unloaded engine operation after retransfer to normal.
5. Provide time delay on transfer to emergency, programmable, set at 3 seconds. Time delay for each ATS shall be staggered.

6. Provide maintained type load test switch to simulate normal power failure, key- pad initiated.
7. Provide remote type load test switch to simulate normal power failure, remote switch initiated.
8. Provide contact to initiate engine starting rated 10 Amps, 30 volts DC, to close on failure of normal source.
9. Provide contact for customer functions rated 10 Amps, 30 volts DC, to open on failure of normal source.
10. Provide light emitting diodes mounted on microprocessor panel to indicate switch is in normal position, switch is in emergency position, and controller is running.
11. Provide plant exerciser in largest switch with 10 seven day events, programmable for any day of week and 24 calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one mi- nute increments. Also include selection of either "no load" (switch will not trans- fer) or "load" (switch will transfer) exercise period, keypad initiated.
12. Provide option to select either "no commit" or "commit" to transfer operation in event of normal power failure. In "no commit position," load shall transfer to emergency position unless normal power returns before emergency source has reached 90 percent of its rated values (switch will remain in normal). In "commit position" load shall transfer to emergency position after any normal power failure, keypad initiated.
13. Provide two auxiliary contacts rated 10 Amp, 120 volts AC (for switches 100 to 800 amps) 15 amp, 120 volts AC (for switches 1000 to 4000 amps), mounted on main shaft, one closed on normal, other closed on emergency. Both contacts shall be wired to terminal strip for ease of customer connections.
14. Provide 3 phase digital LCD voltage readout, with one percent accuracy to dis- play three separate phase to phase voltages simultaneously, for both normal and emergency source.
15. Provide digital LCD frequency readout with one percent accuracy to display frequency for both normal and emergency source.
16. Provide LCD readout to display normal source and emergency source availability.
17.
18. Provide two time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts shall close after time delay upon transfer, programmable for 0-9999 seconds after transfer.
19. Provide block transfer function energized from 24 VDC signal from generator control switchgear, to allow transfer to emergency.
20. Provide load shed function energized from 24 VDC signal from generator control switchgear, to disconnect load from emergency source when overload condition occurs.
21. Provide peak shave function energized from 24 VDC signal from generator control switchgear. This function shall start emergency generator and transfer ATS to emergency source reducing utility supply to building. After peak shave signal is removed, transfer switch shall retransfer to normal supply, bypassing retransfer time delay.

Z. Generator Control Wiring:
1. Provide control wiring for engine start circuit between generator and emergency automatic transfer switch(es). Wiring shall be independent of any fire pump start circuit wiring . Provide a listed two-hour fire rated wiring method in accordance for engine start circuit where the ATS is an NEC 700 or 701 system.
2. Provide control wiring in 3/4 inch C. between elevator machine room and (elevator) transfer switch.

3. Provide control wiring in 3/4 inch C. between ATS and remote generator annunciator for confirmation of ATS position.

AA. Approval:

1. As condition of approval, manufacturer shall verify that switches meet Standard UL-1008 with three-cycle short circuit closing and withstand unless specified as 30 cycle for applications where for selective coordination the instantaneous trip is disabled, as follows:
   a. RMS Symmetrical Amperes 480 VAC

Amperes	Closing and With-stand	Current Limiting Fuse Rating
100-400	42,000	200,000
600-800	65,000	200,000

2. During three-cycle closing and withstand tests, there shall be no contact welding or damage. Three-cycle tests shall be performed without use of current limiting fuses. Test shall verify that contact separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by UL.
3. When conducting temperature rise tests to UL-1008, manufacturer shall include post-endurance temperature rise tests to verify ability of transfer switch to carry full rated current after completing overload and endurance tests.
4. Microprocessor controller shall meet the following requirements:
   a. Storage conditions – 25 degrees C to 85 degrees C.
   b. Operation conditions – 20 degrees C to 70 degrees C ambient.
   c. Humidity 0 to 99 percent relative humidity, non-condensing.
   d. Capable of withstanding infinite power interruptions.
   e. Surge withstand per ANSI/IEEE C-37.90A-1978.
5. Manufacturer shall furnish copies of test reports upon request.

BB. Manufacturer:

1. Automatic transfer switches shall be by Russelectric RMTD, Asco 7000, or equal.
2. Transfer switch manufacturer shall employ nationwide factory-direct, field service organization, available on 24 hour per day, 365 days per year, call basis.
3. Manufacturer shall include 800 telephone number, for field service contact, af- fixed to each enclosure.
4.
5. Manufacturer shall maintain records of each transfer switch, by serial number, for minimum of 20 years.

CC. Provide adequate lifting means for ease of installation of wall or floor mounted enclosures.

DD. Provide access and working space according to code requirements.

EE. Tighten assembled bolted connections with appropriate tools to manufacturer's torque recommendations prior to first energization.

FF. Supplier shall maintain full time in-house parts and service organization. Suppliers that depend on others for service will not be accepted.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
   1. Sources available, as defined by actual pickup and dropout settings of transfer- switch controls.
   2. Switch position.
   3. Switch in test mode.
   4. Failure of communication link.
      a. Capable of withstanding infinite power interruptions.
      b. Surge withstand per ANSI/IEEE C-37.90A-1978.
   5. Manufacturer shall furnish copies of test reports upon request.

B. Manufacturer:
   1. Automatic transfer switches shall be by Russelectric RMTD, Asco 7000, or equal.
   2. Transfer switch manufacturer shall employ nationwide factory-direct, field service organization, available on 24 hour per day, 365 days per year, call basis.
   3. Manufacturer shall include 800 telephone number, for field service contact, affixed to each enclosure.
   4. Manufacturer shall maintain records of each transfer switch, by serial number, for minimum of 20 years.

C. Provide adequate lifting means for ease of installation of wall or floor mounted enclosures.

D. Provide access and working space according to code requirements.

E. Tighten assembled bolted connections with appropriate tools to manufacturer's torque recommendations prior to first energization.

F. Supplier shall maintain full time in-house parts and service organization. Suppliers that depend on others for service will not be accepted.

2.5 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
   1. Sources available, as defined by actual pickup and dropout settings of transfer- switch controls.
   2. Switch position.
   3. Switch in test mode.
   4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
   1. Indicating Lights: Grouped for each transfer switch monitored.
   2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
   3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
   4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.6 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

2.7 3-WAY MANUAL TRANSFER SWITCH

A. 3-way manual transfer switch shall consist of (2) mechanically -interlocked molded case circuit breakers, and (1) independent load bank breaker with a shunt trip (shunt trip voltage to be per the drawings), male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a pad lockable enclosure. The use of trapped key locks (kirk locks) as a interlocking device shall NOT be accepted. Breakers should be interlocked via a mechanical linkage which prevents unsafe operation of the various breakers through the use of operator handles.

B. 3-way manual transfer switch enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated galvanneal steel. The main access shall be through a hinged door that extends the full height of the enclosure. Access for both portable generator cables with female cam-style plugs and for load bank cables with male cam-style plugs shall be via a hinged lower flap door. Hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened. Enclosure shall be powder coated after fabrication; color shall be wrinkle gray RAL 7035.

C. Cam-style male connectors (inlets) and cam-style female connectors (outlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC. All cam-style connectors shall be color coded. Cam-style connectors shall be provided for each phase and for ground, and shall also be provided for neutral. Each of the phase cam-style connectors and the neutral cam-style connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. None of the cam-style connectors shall be accessible unless all (3) molded case circuit breakers are in the “OFF” position and the main access door is open.

D. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.

E. Molded case circuit breakers shall be UL Listed 3-pole and the short circuit interrupt rating shall be a minimum of 50kAIC at 480VAC. Trip rating of the molded case circuit breakers

shall be as shown on the drawings. One molded case circuit breaker shall control the connection between the permanent generator and the automatic transfer switch. A second circuit breaker shall control the connection between the permanent generator and the load bank female cam-style connectors. A third circuit breaker shall control the connection between the portable generator (via male cam-style connectors) and the automatic transfer switch. All (3) molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless all (3) breakers are in the "OFF" position. All (3) molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The (2) molded case circuit breakers controlling the connections between the permanent generator and the automatic transfer switch, and the connection between the portable generator and automatic transfer switch shall be safety interlocked by mechanical means to ensure that only one of these breakers can be closed at any given time.

F. An auxiliary contact shall be provided in the circuit breaker controlling the connection from the Permanent Generator to the ATS and shall be factory wired to terminal blocks within the enclosure. The auxiliary contact is provided in compliance with NEC 2017 700.3 (F)(5) which requires a means to activate an annunciator circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.

B. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Division 26.

E. Set field adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Division 26 Section 260526.

C. Connect wiring according to Division 26 Section 260519.
   a. Provide 2-hour rated conductors conductors for all connections to genset.
   b. Control conductors installed between the transfer equipment, emergency generator, and docking station shall be kept entirely independent of all other wiring in accordance with NEC.
   c. Install wiring in raceways except within electrical enclosures. Size raceways to accommodate manufacturer's wiring requirements. Comply with Section 260526 "Raceways and Boxes for Electrical Systems".
   d. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.
   e. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner, if necessary, to accommodate required wiring.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Authority will engage a qualified independent testing and inspecting agency to perform tests and inspections and prepare test reports.

B. Testing Agency's Tests and Inspections:
   1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
   4. Check for electrical continuity of circuits and for short circuits.
   5. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   6. Verify that manual transfer warnings are properly placed.
   7. Perform manual transfer operation.
   8. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
      a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
      b. Simulate loss of phase-to-ground voltage for each phase of normal source.
      c. Verify time-delay settings.
      d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Perform contact-resistance test across main contacts and correct values exceeding 500 microohms and values for one pole deviating by more than 50 percent from other poles.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

9. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests. Reports shall be type written format.

E. Remove and replace malfunctioning units and retest as specified above.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 3 WAY SWITCH INSTALLATION AND TESTING

A. Installation
1. Prior to installation of 3-way manual transfer switches, contractor shall examine the areas and conditions under which the 3-way manual transfer switch is to be installed and notify the engineer in writing if unsatisfactory conditions exist.
2. 3-way manual transfer switch shall be installed as shown on the drawings and per the manufacturer's written instructions. In addition, the installation shall meet the requirements of local codes, the National Electric Code and National Electrical Contractors Association’s “Standard of Installation.”
3. Conduit entry into the 3-way manual transfer switch shall be by Contractor; Contractor shall furnish and install listed watertight conduit hubs, as manufactured by MYERS or T&B, for each conduit entry on the 3-way manual transfer switch. The incoming hub size shall match the conduit size for feeders and ground as shown on the drawings. The outgoing hub size shall match the conduit size for loads and ground as shown on the drawings. Hubs shall be properly installed and tightened to maintain Type 3R integrity of the 3-way manual transfer switch enclosure.

4. Contractor shall terminate feeder conductors, load conductors and ground per the manufacturer's instructions. All field wiring terminations shall be torqued as required per the instructions on the 3-way manual transfer switch's power distribution blocks, circuit breakers, and ground lugs.

B. Field Testing

1. Prior to energizing 3-way manual transfer switch, the contractor shall perform the following checks and tests as a minimum:
   a. Verify mounting and connections are complete and secure.
   b. Verify internal components and wiring are complete and secure.
   c. Perform continuity check or all circuits.
   d. Perform 1,000 VDC megger test on feeder and load cables. Prior to testing, all auxiliary circuits must be turned OFF and all fuses, microswitches and shunt trip circuits must be disconnected. It is required to take out the rating plug of any electronic trip circuit breakers that will be performing a megger (insulation) test.
   e. Verify deadfront is secure.
   f. With the 3-way manual transfer switch deadfront in place and the main access door closed and properly latched, actuate all (3) Operator Mechanisms; verify:
      1) With the breaker controlling the connection between he permanent generator and the automatic transfer switch (ATS) in the "ON" position, the breaker controlling the connection between permanent generator and the load bank can be turned to the "ON" and "OFF" position and the breaker controlling the connection between the portable generator and the automatic transfer switch cannot be turned "ON".
      2) With the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "OFF" position, the other (2) breakers controlling the connection between the permanent generator and load bank can be turned "ON" or "OFF", and the breaker controlling the connection between the portable generator and the ATS can be turned "ON" and "OFF".
      3) With the breaker controlling the connection between the portable generator and the ATS is in the "ON" position, the breaker controlling the connection between the permanent generator and the ATS cannot be turned "ON" and the breaker controlling the connection between the permanent generator and the load bank can be turned "ON" and "OFF".
   g. Confirm operation of the 3-way manual transfer switch ground receptacle by attaching a plug to the 3-way manual transfer switch ground receptacle and then verify that the plug is grounded to the facility ground.
   h. Once normal power has been applied, confirm operation of 3-way manual transfer switch by following directions on main access door.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection system for ordinary structures. The Electrical Contractor shall provide the necessary labor, materials, services necessary to provide the complete lightning protection system as specified herein

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Regularly engaged in manufacturer of lightning protection equipment, of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than 5 years. The firm shall be a member of and certified by the Lighting Protection Institute.

B. Installer Qualifications: A firm with at least 3 years of successful installation experience on projects with lightning protection work similar to that required for project

C. The System Design shall be completed, and the shop drawing stamped by an LPI Certified Master Installer – Designer of Lightning Protection Systems.

D. The installing contractor shall be listed with the Lightning Protection Institute, and Underwriters’ Laboratories, Inc.

E. The installation contractor shall have personnel on staff Certified by the LPI as a Master Installer – Designer of lightning protection systems.

F. LPI qualified staff, Journeyman or higher, shall provide on-site supervision of the installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Heary Bros. Lightning Protection Co. Inc.

1. nVent (ERICO).
2. Thompson Lightning Protection, Inc.
3. VFC/Lyncole

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class I buildings.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Comply with minimum Class I material requirements as listed in NFPA 780.

B. Air Terminals:
1. Copper
2. 3/8-inch (10-mm) diameter by 12 inches (305 mm) long.
3. Rounded tip.
4. Integral base support.

C. Class 1 Main Conductors:
1. Stranded Copper: 57,400 circular mils in diameter.

D. Class II Main Conductors:
1. Stranded Copper: 115,000 circular mils in diameter.

E. Secondary Conductors:
1. Stranded Copper: 26,240 circular mils in diameter.

F. Ground Loop Conductor: Stranded copper.

G. Ground Rods:
1. Material: Solid copper.

2. Diameter: 3/4 inch (19 mm).
3. Rods shall be not less than 120 inches (3050 mm) long.

H. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

I. Adhesives: High performance, solvent free, UV resistant, for durable bond with substrate. All adhesives must be compatible with the roofing material and approved by the roofing system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed systems in NFPA 780.
   1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
   2. Install conduit where necessary to comply with conductor concealment requirements.
   3. Structural elements and design features shall be used whenever possible to minimize the visual impact of exposed conductors.
   4. Coordinate sequence of installation with other trades to avoid coring, cutting, and patching.
   5. Do not install conductors in gutters, downspouts, or on surfaces where water is retained.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

E. Provide bonding between the LPS grounding electrode system and the Building grounding electrode system in accordance with NEC and NFPA 780 requirements.

F. Install surge suppression at all power service entrances and at all entrances of conductive communications systems.

G. Provide cutting and patch as necessary for installation of work in existing structures. Refer to Section 260500, “Common Work Results for Electrical Systems”.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: exothermic weld.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified third-party special inspector to perform the following special inspections:
   1. Perform inspections as required to obtain a UL Master Label for system.
   2. Perform inspections to obtain an LPI certification.

B. Upon completion of installation of lightning protection system, test resistance-to-ground with resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods. Provide to the Owner and Engineer a certificate of compliance upon completion of testing.

C. Prepare test and inspection reports and certificates.

END OF SECTION

SECTION 264300 - SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include but is not necessarily limited to provision of Surge Suppression Units at certain points in the power distribution network and proper installation in accordance with manufacturer’s instructions.

B. Section includes:
   1. Requirements for both field mounted SPDs (externally mounted), and integrated SPDs (installed from the factory) for low voltage power distribution and control equipment.

1.3 REFERENCES

A. Abbreviations
   1. MCOV: Maximum continuous operating voltage.
   2. OCPD: Overcurrent protective device.
   3. SCCR: Short-circuit current rating.
   4. SPD: Surge protective device.
   5. VPR: Voltage protection rating.

B. Definitions
   1. Inominal: Nominal discharge current.
   2. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
   3. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
   4. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
   5. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
   6. Type 3 SPDs: Point of utilization SPDs.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. ANSI/IEEE C62.41.1, “Guide on the Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits.”
      b. ANSI/IEEE C62.41.2, “Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits.”
      c. ANSI/IEEE Standard C62.45, “Guide on Surge Testing for Equipment Connected to Low-Voltage Ac Power Circuits.”
   2. Underwriters Laboratories, Inc. (UL)
      a. UL 1283, “Standard for Safety for Electromagnetic Interference Filters.”
      b. UL 1449, “Standard for Surge Protective Devices.”

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within a period of ten years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB/General Electric Company.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   3. Square D; a brand of Schneider Electric.
   4. Siemens

B. Source Limitations: SPDs installed internal to the distribution system shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified in accordance with UL standards.

2.2 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. SPDs: Comply with UL 1449
   1. Provide Type 1 SPDs installed on the line side of the service entrance OCPD and Type 2 SPDs installed on the load side of the service entrance OCPD.

C. Electrical Noise Filter: Comply with UL 1283 for Type 2 SPDs.

1. Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz

D. Unit Operating Voltage: Refer to drawings.

E. MCOV of the SPD shall not be less than 115% of the nominal system voltage.

F. The suppression system shall incorporate thermally protected MOVs as the core surge suppression component for all distribution levels. Each MOV shall be individually fuse-protected to avoid cascading faults. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

G. SPDs shall be provided with the following features and accessories:
1. Integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.
2. Internal fusing that disconnects the SPD before damaging internal suppressor components.
3. Indicator light display (Red and Green) for power and protection status with push-to-test capabilities.
4. Audible alarm with silencing switch. Alarm shall activate when any one of the surge current modules has faulted or reached an end-of-life condition.
5. Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
6. Surge counter with LCD display, reset switch, non-volatile memory, and battery backup to retain memory upon loss of AC power.

H. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

I. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than the following values. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
1. Category C, Service Entrance larger than 1200A: 400 kA/phase.
2. Category C, Service Entrance 1200A and below: 240 kA/phase.
3. Category B, Distribution larger than 1200A: 300 kA/phase.
4. Category B, Distribution 1200A and below: 160 kA/phase.
5. Category B, Branch: 120kA/phase.

J. Protection modes and UL 1449 VPR for grounded wye circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277V and 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120 V.

K. SCCR: The short circuit current rating of the SPD shall be a minimum of 200kA and equal to or greater than the available short circuit current at the point on the system where installed.

L. Minimum Inominal Rating: 20 kA

2.3 SURGE SUPPRESSION FOR PANELBOARDS

A. All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC.

2.4 TELEPHONE AND TELEVISION SURGE SUPPRESSION

A. As a part of this section of work, the Contractor shall provide or arrange for the installation of U.L. listed lightning and surge arrestors on the incoming telephone and television service lines, as well as on AM-FM- antenna downleads coming into the building from satellite dish antennas and all other types of exterior antennas installed by the Contractor or Owner.

B. Arrestors shall be U.L. listed, properly grounded per N.E.C., and shall be located at the service entrance points for each cable installed by a utility company or at the point of building entry for Contractor-installed cables leading in from antennas. Also provide surge arrestors of the proper type for any copper cables that are installed between buildings by the Contractor, if such a condition occurs within the project.

C. The Contractor shall arrange for the telephone company to install M-O-V, gas-type or other U.L. listed lightning arrestors on each of their incoming telephone circuits that are terminated for building use.

D. Devices as manufactured by Lucent Technologies, Winegard or Liebert Corporation will be acceptable.

E. Provide a ground lug for individual surge suppression unit installations, with the recommended ground wire size routed back to the building main electrical ground or ground bar in wiring closet.

F. Where multiple surge suppression units are installed, as at service entrance locations, provide a ground bar, copper, with multiple tapped holes and a properly sized ground lead routed back to the building main electrical ground.

2.5 SURGE SUPPRESSORS FOR OTHER SYSTEMS

A. Refer to specific specification sections for additional information on surge suppressors related to other building systems.

2.6 ENCLOSURES

A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.
   1. Indoor locations: NEMA 250, Type 1.
   2. Outdoor or wet locations: NEMA 250, Type 3R.

3. Corrosive Environnments: NEMA 250, Type 4X.

2.7 CONDUCTORS AND CABLES

B. Power Wiring: Provide sizes to match SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Factory install integral SPDs as part of the distribution equipment and connect through a disconnect.
1. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

C. Provide an OCPD as required to comply with the UL listing of the SPD and selected to comply with power system study. Minimum 30A circuit breaker shall be provided. Refer to panel schedules in contract documents.

D. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible with no sharp bends and adjust circuit-breaker positions to achieve shortest and straightest leads.

E. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

F. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

G. Twist input conductors together to reduce the input inductance.

H. Use crimped connectors and splices only. Wire nuts are not acceptable.

3.2 FIELD QUALITY CONTROL

I. Perform the following tests and inspections:
1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

J. An SPD will be considered defective if it does not pass tests and inspections.

K. Prepare test and inspection reports.

3.3 STARTUP SERVICE

L. Complete startup checks according to manufacturer's written instructions.

M. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.

N. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

O. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 265000 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This section covers general lighting fixtures, back of house (BOH) lighting fixtures, exit signs, and site lighting pole mounted fixtures.

1.3 REFERENCES

A. Abbreviations
   1. CRI: Color Rendering Index
   2. LED: Light Emitting Diode

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide lighting fixtures, equipment and components where shown on Drawings, as listed in fixture schedules and as specified, wired and assembled. Provide approved aligned canopies, hangers and other appurtenances as required, for a complete and functional system.

B. All new lighting fixtures shall be UL listed and shall have an individual IES test report indicating fixture performance.

C. Coordinate fixture mountings with ceiling types and provide the required components for correct mounting of the fixture, including plaster frames, slope adjusters, etc. Review architectural reflected ceiling drawings and notify Architect of discrepancies prior to ordering fixtures or submitting shop drawings. No additional compensation will be allowed if wrong fixtures are ordered because coordination was not performed.

2.2 LED FIXTURES

A. LED SOURCES
   1. LED’s shall be manufactured by a manufacturer who has produced commercial LEDs for a minimum of five (5) years.

2. Lumen Output – minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
3. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours at the rated ambient operating temperature.
4. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
5. LED Boards shall be suitable for field maintenance and have with plug-in connectors. LED boards shall be upgradable
6. Light Color/Quality:
    a. Correlated Color temperature (CCT) range as per specification, between 3000K, 3500K and 4000K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
    b. Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.
    c. The color rendition index (CRI) shall be 80 or greater
    d. LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

B. LED DRIVERS
1. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Driver should be UL Recognized under the component program and shall be modular for simple field replacement.
3. Electrical characteristics: 120 – 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
4. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100 percent to 0.1 percent of rated lumen output with a smooth shut off function.
5. Dimming shall be controlled by a 0-10V signal, or if require "DMX".
6. Driver shall include ability to provide no light output when the control signal drops below 0.5 V, and shall consume 0.5 watts or less in this standby.
7. Driver shall be capable of configuring a linear or logarithmic dimming curve.
8. Drivers shall track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range regardless of the controller type
9. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have: Less than 1 percent flicker index at frequencies below 120 Hz and less than 12 percent flicker index at 120 Hz, and shall not increase at greater than 0.1 percent per Hz to a maximum of 80 percent flicker index at 800Hz
10. Driver disconnect shall be provided where required to comply with codes.

C. LED ELECTRICAL
1. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage and meet ANSI C82.11 maximum allowable THD requirements.

2. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A. To reduce false circuit breaker tripping due to turn on inrush, the following statement ensures that electronic dimming driver will meet NEMA inrush recommendations.
3. Rush Current: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps2 – seconds.
4. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions
5. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance.
6. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.

D. EXIT SIGNS
1. General requirements: Comply with UL 924, NFPA 70, AND NFPA 101.
2. All exit signs shall be LED type.
3. Provide single or double face as scheduled, indicated on plans or as required by the local Authority Having Jurisdiction. Adjust installation position if required for clear visibility, in accordance with applicable codes.
4. Provide directional arrows (chevrons) as indicated on floor plans and to suit the means of egress or as required by the local Authority Having Jurisdiction.
5. Complete unit to be furnished in color/finish as selected by the Architect.

2.3 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Provide poles designed for site specific wind loading (minimum of 120 miles per hour) determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have full base metal covers with matching finish to conceal the mounting hardware, pole-base welds, and anchor bolts.

B. Structural Characteristics: Comply with AASHTO LTS
1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.3 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners, unless otherwise indicated.

D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

E. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

F. Pole Base Concrete Foundations:
1. Cast in place, with anchor bolts to match pole-base flange. Anchor bolts shall be steel rod having minimum yield strength of 50,000 psi and shall be galvanized in accordance with ASTM A153/A153M. Concrete shall be as specified in Division 03 Section, Cast-In-Place Concrete.
1. Use 4000-psi, 28-day compressive-strength concrete unless otherwise noted. Comply with Division 03 Section "Cast-in-Place Concrete" and ACI standards for subbase requirements, concrete materials, reinforcement, placement, and cover requirements.

G. Breakaway Supports: Provide frangible breakaway supports where noted on plans, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS.

H. Brackets and Supports
1. ANSI C136.3, ANSI C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1-1/4 inch secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head. Detachable, cantilever, without underbrace.

I. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

J. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire.

K. Finish: Same as luminaire.

PART 3 - EXECUTION

3.1 GENERAL

A. Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

B. Lamps shall be handled with cotton gloves to avoid fingerprint markings.

3.2 FIXTURES

A. Accessories
   1. Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

B. Suspended Fixtures
   1. Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods, or chains 4 feet or longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Maximum distance between adjacent tubing or stems shall be 10 feet. Rods shall be of not less than 3/16 inch diameter. Flexible raceway shall be installed to each fixture from an overhead junction box unless flexible cord specified on the schedule.
   2. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

C. Ceiling Fixtures
   1. Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03.
   2. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Division 09 Specification Sections for ceilings.
   3. Support fixtures with four (4) wires with one (1) at each corner.
   4. Hanger wires: Install within 15 degrees of plumb or additional support shall be provided. Wires shall be attached to fixture body and to the building structure (not to the supports of other work or equipment). Where building structure is located such that 15 degrees cannot be maintained, provide "strut" or similar supports secured to structure to meet this requirement.
   5. Support Clips: Provide four (4) clips per fixture minimum. Fasten to light fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application. Install clips per manufacturer's requirements. If screws are required, they shall be provided. Installation shall meet applicable seismic codes.
   6. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4-inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.
   7. Downlights, exit signs and battery pack supported by or attached to ceiling grid or tile shall be provided with one hanger wire at each end. Provide a minimum of two, located at opposite corners.
   8. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires per fixture spaced

approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels.

D. Wall mounted fixtures:
   1. Do not attach light fixtures directly to gypsum board.
   2. Attach to structural members in walls or backing plate attached to wall structural members.

E. Do not install fixtures until work of other trades that may damage fixtures is completed.

F. Provide plaster frames for fixtures recessed in gypsum board or a plaster ceiling.

G. Do not suspend or support lighting fixtures or safety chains from hung ceiling, conduit or duct. Support fixtures with safety chain from structural members only.

H. Provide unistrut below ducts where fixture locations coincide with HVAC duct or mechanical piping runs. Provide threaded rods to support unistrut.

I. Support luminaries at least two points to prevent rotation.

J. Handling of reflectors shall be done only with cotton gloves to avoid imprinting fingerprints on reflective surfaces.

K. Exterior Fixtures:
   1. Exterior building mounted light fixtures shall not be installed until after the building exterior has been rinsed clean of any corrosive cleaning materials. Damaged fixtures shall be replaced by the Contractor at no cost.
   2. Provide exterior rated weather proof junction boxes for all fixtures and splices.
   3. Utilize weatherproof silicone filled wire nuts and seal all junction boxes and conduit with potting compound to create waterproof barriers. Inspect all splices and fixtures for continuity prior to potting.
   4. Lubricate all threaded parts with a high temperature waterproof anti-seize lubricant to prevent seizing and corrosion.
   5. All low-voltage wiring to be UV resistant, UL approved for use without conduit, stranded low-voltage wire for use in outdoor and underground applications, gauge as appropriate to avoid voltage drop.
   6. Provide surface mounted fixtures with conduit hub for end of fixture entrance.

L. Transformers (applies to all transformers including (but not limited to) low voltage, neon, remote ballast, LED power supplies, exterior locations):
   1. Electrical Contractor to locate all transformers (including low voltage, neon, remote ballasts, led power supplies, etc.) near fixtures in a well-ventilated and accessible location. Transformers must be installed (per codes) in accessible areas large enough to dissipate the heat of the transformer. Temperatures should not exceed 100°F (38°C) or that required by manufacturer if more stringent.
   2. Electrical Contractor to determine wire size according to load and wire length to eliminate voltage drop. If voltage drop is a problem after installation, the Electrical Contractor is responsible for reinstallation (at no additional cost) of transformer and wire to solve problem.
   3. Electrical Contractor to label front of transformer/driver. Example: “Large Display Case @ Entry to Main Dining Room.”

M. Spare inventory:

N. The contractor shall provide at least five (5) spare fixtures for each fixture used in the common areas as part of the spare inventory .

3.3 POLE, LIGHT COLUMN AND BOLLARD INSTALLATION

A. Alignment: Align foundations, poles light columns and bollards for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
   1. Fire Hydrants and Storm Drainage Piping: 60 inches
   2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet
   3. Trees: 15 feet from tree trunk.

C. Excavation: Restrict excavation in size to that which will provide sufficient working space for installation of concrete forms. Should soil conditions at the bottom of the excavation be unsuitable as a foundation, as determined by the Architect, take the excavation down to firm soil and fill to required grade with concrete or satisfactory soil materials as directed.

D. Backfill: Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell.

E. Concrete Pole Foundations:
   1. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
   2. Concrete Pole Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
   3. Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.
   4. Formwork: Construct forms of wood, plywood, steel, or other acceptable materials fabricated to conform to the configuration, line, and grade required. Reinforce formwork to prevent deformation while concrete is being placed and consolidated. Wet or coat formwork with a parting agent before placing concrete.
   5. Cast conduit into concrete pole foundations.
   6. Prior to concrete pour, install a ground rod and a separate insulated equipment grounding conductor at each pole, light column and bollard in addition to grounding conductor installed with branch-circuit conductors.
   7. Finish by troweling and rubbing smooth. Round all above-grade concrete edges to approximately 0.25” radius.
   8. Refer to Pole Base Detail on drawings for additional requirements.

F. Foundation-Mounted Poles:
   1. Install according to pole manufacturer's instructions using a template supplied by pole manufacturer in accordance with the lighting standard manufacturer's recommendations.
   2. Use galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end, and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   3. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout

firmly packed to fill space.

4. Mount pole with leveling nuts and tighten top nuts to torque level recommended by pole manufacturer. Provide base covers.

G. Poles and Pole Foundations Set in Concrete Paved Areas (Slabs): Install poles with minimum of 6-inch wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable). Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location. Alterations to poles after fabrication will void manufacturer's warranty and shall not be allowed.

I. Bollard and light column luminaire installation:

1. Install on concrete base with top level with finished grade or surface at luminaire location. Shape base to match shape and diameter of bollard and/or light column base.

3.4 GROUND-MOUNTING LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location.

3.5 IN-GRADE LUMINAIRE INSTALLATION

A. All in-grade fixtures shall be installed per manufacturer’s installation instructions.

B. Verify design type, Flow Through or Sealed, prior to installation.

C. Flow Through in-grades fixtures shall have drainage system installed below fixture per manufacturer’s requirements. If site has poor drainage soil, a sealed in-grade shall be installed. Coordinate soil type with civil engineer prior to submittals.

D. Provide all conduit connections to in-grade fixture with seal off compound.

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.7 GROUNDING

A. Comply with Section 260526 “Grounding and Bonding for Electrical Systems.”

B. Bond luminaires and metal accessories to the grounding system per NEC.

C. Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

D. At each light pole, light column, light bollard and support structures, provide a driven ground rod into the earth so that after the installation is complete, the top of the ground rod will be approximately 1 foot below finished grade. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.8 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."
   1. Light fixtures served from multiple power sources, such as emergency fixtures fed from emergency transfer relay or split wired fixtures, shall have the following label affixed to it: “DANGER - ELECTRICAL SHOCK HAZARD - LIGHT FIXTURE HAS MULTIPLE POWER SOURCES”

3.9 CLEANING

A. At completion of each phase and the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturer.

B. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens/louvers prior to final acceptance. Cleaned with solvent recommended by the manufacturer to a like-new condition or replaced. All reflectors shall be free of paint other than factory-applied, if any.

END OF SECTION

SECTION 25116 - NETWORK LIGHTING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (occupancy), and manual lighting control.

B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)

C. The system architecture shall provide stand-alone groups (rooms) of devices to function.

D. The system should not require any centrally hardwired switching equipment.

E. The system should be wired architecture, but can be capable to support wireless.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Retain the “Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 01 40 00 "Quality Requirements," which also defines "NRTL" (nationally recognized testing laboratory).

B. All steps in the sensor manufacturing process shall occur in the USA, including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

C. All components and the manufacturing facility where the product was manufactured must be ROHS compliant.

D. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40-degree Fahrenheit (and Celsius) operation.

E. All applicable products must be UL/CUL Listed or other acceptable national testing organization.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

1.6 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. The installation contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.7 WARRANTY

A. All devices in the lighting control system shall have a 5-year warranty. The warranty shall start at Final Project Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight Stand Alone Control System from Sensor Switch, equals by Watt Stopper, Cooper Controls, Lutron, or Hubbell.

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon two main concepts: 1) intelligent lighting control devices 2) standalone lighting control zones

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches.

D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, capable of stand-alone operation.

F. Devices within a lighting control zone shall be connected with CAT-5 low voltage cabling in any order.

G. The lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Power for devices within a lighting control zone shall come from either resident device already present for switching (relay device) or dimming purposes. Standalone "bus power supplies" shall not be required in all cases.

I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

J. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

K. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information.

L. System shall be capable of operating a lighting control zone according to several sequences of operation. The system shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of space. Note operating modes should be utilized only in manners consistent with local energy codes.

M. The system shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Stand Alone Occupancy Sensors
   1. Occupancy sensors system can sense the presence of human activity within the desired space and fully control the on/off function of the lights.
   2. Sensors should utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus, preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
   3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
   4. Dual technology sensors shall have one of its two technologies that do not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable. Provide this type of sensor in all group restrooms.
   5. All sensing technologies shall be acoustic passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic whiteboard readers). Acceptable detection technologies

include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

6. Sensors should be including two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 /
7. 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @
8. 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
9. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
10. Sensors should be available in multiple lens options which are customized for specific applications.
11. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
12. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
13. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
14. All occupancy/vacancy sensors shall be dual-contact for integration with the HVAC system. For integration into the building automation system, ATC contractor shall wire dual contact to HVAC system.
15. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
16. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
17. Wall switch sensors should recess into single-gang switch box and fit a standard GFI opening.
18. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in unoccupied (Off) condition.
19. Wall switch sensors have optional features for photocell/daylight over, vandal resistant lens, and low temperature/high humidity operation.
20. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray). Wall plates shall be brushed stainless steel
21. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls
22. Fixture mount sensors shall be capable of powering themselves via a line power feed.
23. Sensors have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
24. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
25. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output

B. Stand Alone Daylight (Photocell and or Dimming) Sensors

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Combination units that have all features of on/off photocell and dimming sensors should also be available.
6. A dual zone option shall be available for on/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
7. Line voltage versions of the above-described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.

C. Stand Alone Metering Power (Relay) Packs
1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system and come capable of metering connected load.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into the junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
8. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming of LED drivers.
9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of LED drivers.
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
11. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
12. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.

D. Stand Alone Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Devices shall be available with zero or one integrated Class 1 switching relay.
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. All sensors shall have two RJ-45 ports.
5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
7. Devices with dimming control outputs can control 0-10 VDC
8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
10. Devices with mechanical push-buttons shall be made available with custom button labeling
11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

E. Stand Alone Graphic Wall Station
1. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
3. Device shall enable user supplied .jpg screen saver image to be uploaded.
4. Device shall surface mount to single-gang switch box
5. Device shall have a micro-USB style connector for local computer connectivity.
6. Device shall have two RJ-45 ports for communication

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment in accordance with the manufacturer’s installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

D. Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

E. Install plenum cable in environmental air spaces, including plenum ceilings.

F. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installation. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2.
   3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup check according to manufacturer's written instructions.

B. Required factory-trained personnel site visits:
   1. Pre-installation: The system shall be provided with visits from factory-trained technician(s) for a pre-installation visit with the contractor prior to system installation.
   2. Commissioning and Programming: A second visit shall be included for commissioning and programming of the system including testing of switches and sensors.
   3. Owner Training: A third visit shall be provided for owner training after the owner has occupied the building. Minimum four-hour training to be video recorded.
   4. Owner Re-Training and System Adjustment: A fourth visit 6 months after the owner has occupied the building shall be provided to tweak the system for occupant preferences and for additional training.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from the date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 SEQUENCE OF OPERATION

A. Classrooms, Science Classrooms, Health Classrooms, Band Room, Chorus Room, Business/Finance Classrooms, Vibe Classroom, Marketing/Web Animation Rooms, CTE Seminar Rooms:
   1. Control Switch: 4-scene controller
   2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
   3. Sensors: Dual technology Vacancy, Daylighting
   4. Dimming: 0-10V
   5. Scenes:
      a. Scene 1: The first preset shall be labeled “AV” and shall turn the lighting closest to the teaching wall to 10% output with the rest of the lighting at 30% output.
      b. Scene 2: The second preset shall be labeled “Full” with all lighting at 80% output.
      c. Scene 3: The third preset shall be labeled “Low” and shall be all lighting at 10% output.
      d. Scene 4: TBD
   6. Plug Load Control: Yes
   7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

B. Art Classrooms, Graphics/Photoshop Rooms:
   1. Control Switch: 4-scene controller
   2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
   3. Sensors: Dual technology Vacancy, Daylighting
   4. Dimming: 0-10V
   5. Scenes:
      a. Scene 1: Track Lighting only, track lights at 60% output.
      b. Scene 2: The second preset shall be labeled “Full” of all lighting at 80% output.
      c. Scene 3: The third preset shall be labeled “Low” and shall be all lighting at 10% output.
      d. Scene 4: Drawing Study, all downlights off, spotlight track on at 75% output.

6. Plug Load Control: Yes
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

C. Wellness Room:
1. Control Switch: On/Off, Raise/Lower switch
2. Automatic Controls: Automatic upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: N/A
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

D. Prep Rooms, Art Rooms, Makerspace:
1. Control Switch: On/Off, Raise/Lower switch
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual Technology Vacancy, Daylighting
4. Dimming: 0-10V
5. Plug Load Control: Yes
6. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

E. Corridor/Lobbies/Vestibules:
1. Control Switch: Timeclock and 2-scene controller
2. Automatic Controls: Timeclock shall turn on all lighting during business hours, TBD by MHHS. Outside of business hours, the dual technology occupancy sensor shall turn the lighting on/off, when no occupancy has been detected for 20 minutes the lights shall turn off.
3. Sensors: Timeclock, Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
   a. Scene 1: Daytime: The first preset shall be labeled “Full” with all lighting at 80% output.
   b. Scene 2: Evening: The second preset shall be labeled “Evening” with wall lights set to 80% output and general lighting set to 60% output.
6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

F. Admin Areas- Reception, Waiting:
1. Control Switch: On/Off, Raise/Lower Switch
2. Automatic Controls: Automatic upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: Yes

7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

G. Offices/Conference Rooms:
1. Control Switch: On/Off, Raise/Lower Switch
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual Technology Vacancy, Daylighting
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: Yes
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

H. Large Restrooms, :
1. Control Switch: N/A
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

I. Small Restrooms, Single Shower, Coaches Restrooms/Shower:
1. Control Switch: On/Off, Raise/Lower Switch
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual Technology Vacancy
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

J. Locker Room:
1. Control Switch: On/Off, Raise/Lower Switch located in remote location (Coaches Room, Athletic Directors office)
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: No
7.
8. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

K. BOH Rooms (Storage, MEP, Janitor):
1. Control Switch: On/Off Switch with integral sensor. MEP rooms to have switch only.
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.

3. Sensors: Dual Technology Vacancy
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

L. Gym:
1. Control Switch: On/Off Switch & 5-scene controller
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
   a. Scene 1: Daytime: The first preset shall be labeled “Full” with all lighting at 80% output.
   b. Scene 2: Game: The second preset shall be labeled “Game” with downlighting at 90% output and wall-wash lighting at 75% output
   c. Scene 3: The third preset shall be labeled “Assembly” with downlighting at 65% output and wall-wash lighting at 50% output.
   d. Scene 4: TBD
   e. Scene 5: TBD
6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

M. Auditorium:
1. Control Switch: On/Off Switch & 5-scene controller. Provide one switch at each entry.
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
   a. Scene 1: Daytime: The first preset shall be labeled “Full” with down-lighting at 80% output., wall-wash lighting at 60% output, proscenium lighting at 70% output, step lights off.
   b. Scene 2: Assembly: The second preset shall be labeled “Assembly” with down-lighting at 65% output., wall-wash lighting at 50% output, proscenium lighting at 50% output, step lights off.
   c. Scene 3: with down-lighting at 30% output., wall-wash lighting at 30% output, proscenium lighting at 50% output, step lights off.
   d. Scene 4: TBD
   e. Scene 5: TBD
6. Plug Load Control: N/A
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.
8. Additional Notes: Provide one fixed touchscreen at the control station in gymnasium, refer to drawings, capable of controlling up to 5-scenes. Each fixture shall be individually Addressed.

N. Recording Studio, Video Broadcast Control Room:
1. Control Switch: On/Off Raise Lower Switch
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: Yes
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

O. Video Broadcast Classroom and Studio:
1. Control Switch: On/Off Switch & DMX Touch Screen controller with 4 scenes, additional switch for On-Air Light
2. Automatic Controls: Automatic on upon occupancy, and automatic off after 20 minutes of vacancy.
3. Sensors: Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
6. Scene 1: Daytime: The first preset shall be labeled “Full” with all lighting at 80% output.
7. Scene 2: Low
8. Scene 3: AV
9. Scene 4: Recording
10. Plug Load Control: Yes
11. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

P. Dressing Room:
1. Control Switch: On/Off, Raise/Lower Switch
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual Technology Vacancy, Daylighting
4. Dimming: 0-10V
5. Scenes: Separate switch for downlights and mirror lights
6. Plug Load Control: N/A
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

Q. Cafeteria:
1. Control Switch: 4-scene controller
2. Automatic Controls: Timeclock shall turn on all lighting during business hours, TBD by MHHS. Outside of business hours, the dual technology occupancy sensor shall turn the lighting on/off, when no occupancy has been detected for 20 minutes the lights shall turn off.
3. Sensors: Timeclock, Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
    a. Scene 1: Daytime: The first preset shall be labeled “Full” with all lighting at 80% output.
    b. Scene 2: Evening: The second preset shall be labeled “Evening” with all lighting at 65% output

c. Scene 3: Event: The third preset shall be labeled “Event” with all lighting at 50% output.
d. Scene 4: TBD

6. Plug Load Control: No
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

R. Kitchen, Servery:
1. Control Switch: On/Off, Raise/Lower switch
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual Technology Vacancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
a. Scene 1: The first preset shall be labeled “Full” with all lighting at 80% output.
b. Scene 2: The second preset shall be labeled “Low” and shall be all lighting at 10% output.
c. Scene 3: TBD
6. Plug Load Control: N/A
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

S. Media Center:
1. Control Switch: 3-scene controller
2. Automatic Controls: Automatic off via vacancy sensor after 20 minutes of vacancy.
3. Sensors: Dual technology Vacancy, Daylighting
4. Dimming: 0-10V
5. Scenes:
a. Scene 1: The first preset shall be labeled “Full” with all lighting at 80% output.
b. Scene 2: The second preset shall be labeled “Evening” and shall be all lighting at 10% output.
c. Scene 3: TBD
6. Plug Load Control: Yes
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL924 relay.

T. Stairs:
1. Control Switch: Timeclock
2. Automatic Controls: Timeclock shall turn on all lighting during business hours, TBD by MHHS. Outside of business hours, the dual technology occupancy sensor shall turn the lighting on/off, when no occupancy has been detected for 20 minutes the lights shall turn off.
3. Sensors: Timeclock, Dual Technology Occupancy, Daylighting
4. Dimming: 0-10V
5. Scenes: N/A
6. Plug Load Control: N/A
7. Emergency Control: Upon loss of power, lights denoted as emergency shall go to 100% output via UL 924 relay.

U.

V. Exterior:
   1. Control Switch: Astronomical Timeclock and Occupancy Sensors for canopy mounted fixtures
   2. Automatic Controls: Lights shall automatically turn on at dusk and turn off at dawn. Between one hour after school closing and one hour before school opening, all lights shall be set to 50% output. During dark times, dual technology occupancy sensor shall turn the lighting on/off, when no occupancy has been detected for 20 minutes the lights shall turn off.
   3. Sensors: Astronomical Timeclock, Occupancy Sensors
   4. Dimming: 0-10V
   5. Scenes: N/A
   6. Plug Load Control: N/A
   7. Emergency Control: N/A

3.8 SERVICE AND SUPPORT

A. A Digital-Network Lighting Control System requires multiple site visits for proper startup. The first site visit ensures that the contractor is trained to install the system correctly. The second visit starts up the system and ensures that the system is operating per specification. The third visit trains the owner/end user on system operation and functionality.

B. Provide factory certified field service engineer to make minimum of three site visits to ensure proper system installation and operation under following parameters
   1. Qualifications for factory certified field service engineer:
      a. Minimum experience of 2 years training in the electrical/electronic field.
      b. Certified by the equipment manufacturer on the system installed.
   2. Make my first visit prior to installation of wiring. The contractor must schedule a meeting with the Electrical Engineer and Manufacturer representative to review system and functionality prior to installation of wire and equipment.
   3. Make a second visit upon completion of installation of Lighting Control System for system start up. Schedule start up with owner and engineer with 2 weeks prior notice.
   4. A total two (2) Owner training session with the electrical contractor, the lighting controls contractor, the factory authorized representative, engineer of record, and the owner (and staff) shall be conducted at the project site. The training session shall be scheduled for a minimum of 2 weeks prior. The training session shall not be conducted until the lighting controls system has been programmed and is fully operational.
   5. A total of two (2) walk thrus shall be conducted after completion of construction to assure that the system is fully operational. The walk thrus shall be schedule a minimum of 2 weeks prior and shall be conducted at the request of the owner or engineer of record. In lieu of a formal request from the owner or engineer of record the walk thrus shall be conducted 3 months and 9 months after completion of construction. Reports shall be issued at each walk-thru.

END OF SECTION

SECTION 265600 – SITE LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 312333 Trench Excavation for Utilities

C. Section 321216 Asphaltic Concrete Paving

D. Site Electrification

E. Construction Documents

1.2 SCOPE OF WORK

A. Exterior luminaries and accessories, underground conduit, wiring, and termination.

B. Poles and foundations.

C. Component installation and system testing.

D. Removal of existing overhead wires, light fixtures, and light poles as shown on the Drawings.

1.3 REFERENCE STANDARDS

A. ANSI C78.379 - Electrical Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns

B. ANSI/NFPA 70 - National Electrical Codes

C. ANSI/IES RP-8 - Recommended Practice for Roadway Lighting

D. ANSI/IES RP-20 - Lighting for Parking Facilities

E. IES Lighting Handbook - Current Edition

F. NEMA – Best practices for metal halide lighting systems

G. IES DG-5-94 – Recommended lighting for walkways and class I bikeways

H. NECA/IESNA 501-2000 – Recommended practice for installing exterior lighting systems.

I. IESNA G-1-02 – Guideline for security lighting for people, property and public spaces

J. IESNA RP-06-01 – Recommended practice for sports and recreational area lighting

K. AASHTO – Standard specifications for structural supports for highway signs, luminaries and traffic signals, 4th edition (2003 interim)

L. IESNA LM-79 - Electrical and Photometric Measurements of Solid-State Lighting Products

M. IESNA LM-80 - Approved Method for Measuring Lumen Maintenance of LED Light Sources

1.4 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.5 QUALITY ASSURANCE

A. Contractor to verify that all specified site lighting satisfies all applicable guidelines and regulations of local utility provider.

B. Once Shop Drawings, are approved, all lighting is to be ordered in a timely manner. The Contractor is then to inform the Landscape Architect/Engineer immediately, in writing, the date when equipment orders are completed and delivery scheduled.

C. The Owner reserve the right to request standard production model fixture samples for inspection and to order such tests as the Owner deems necessary to insure compliance with these specifications and to reject those luminaires failing such tests, or those luminaries with improper or inadequate light distributions. The Owner shall be the sole judge as to acceptability.

1.6 SUBMITTALS

A. Contractor shall submit 3 color samples for all new light fixtures and poles to the Landscape Architect for approval.

B. When required by the Owner, each submittal transmitted for approval shall contain:

C. Computer prepared photometric layout of the proposed lighted area, which indicates by isofootcandle readings the system performance.

D. A photometric report from a national independent testing laboratory with report number, date, fixture catalog number, luminaire and lamp specifications; IES calculations, candlepower tabulations, zone lumen summary and isolux plot.

E. The Underwriters Laboratory listing and file number for the specific fixture(s) to be utilized.

F. Pole manufacturer AASHTO calculations indicating the pole and anchor bolts being submitted are capable of supporting the pole and fixture systems being utilized in accordance with specifications.

G. Catalog cuts proving complete conformance to the specifications.

1.7 SYSTEMS PERFORMANCE

A. All luminaries as indicated on the drawings shall be "cut-off luminaries". A "cut-off luminaire" is defined by the following limitations of light distributions:

B. At any lateral angle around the luminaire, the candle power per 1000 lumens shall not exceed 25 lumens at an angle of 90 degrees above horizontal and 100 lumens at a vertical angle 80 degrees above horizontal.

C. All site lighting shall minimize light trespass and spillover onto adjacent properties. Internal house-side shields shall be incorporated on all pole-mounted luminaries abutting adjacent properties.

1.8 WARRANTY

A. Provide Owner with one year warranty certificate signed by Contractor and by the company providing actual warranty labor. This certificate must be received by the Owner prior to final payment.

PART 2 - PRODUCTS

2.1 HIGH INTENSITY DISCHARGE LAMPS (HID)

A. Lamps shall be provided from the following manufacturers or approved equal. The Contractor is responsible that all lamps conform to the site lighting schedule and luminaire manufacturer specifications. If any discrepancies exist, the Contractor shall notify the owner’s representative, or Project Landscape Architect.

1. Venture lighting international, 3200 Aurora Road, Solon, OH 44139, Phone: (800) 451-2606.
2. Eye Lighting International of North America, Inc. Phone: (888) 665-2677.
3. Phillips Lighting Company, 200 Franklin Square Drive, P.O. Box 6800, Somerset, NJ 08875-6800, Phone: (800) 555-0050.

4. GE Lighting, Phone (800) GE Lamps.
5. Sylvania, 100 Endicott Street, Danvers, MA, Phone (978) 777-1900.

2.2 DRIVERS FOR LED LAMPS

A. General Requirements

1. LED Engines / Drivers: Comply with UL 1993, UL 8760.
2. Designed for type and quantity of lamps served.
3. Designed for the full light output unless dimmable controls are indicated.

B. Dimmable control shall pulse width modulation or other approved technology.

C. Power Factor: 0.90 or higher unless otherwise indicated.

D. Total Harmonic Distortion: Less than 20 percent.

E. Transient Voltage Protection: IEEE C62.42.1. and IEEE C62.42.2, Category A or better.

F. Interference: Comply with 47 CFR 18, Ch. 1, Subpart b, for regulations concerning the emission of electronic noise.

2.3 LED LAMPS

A. General Requirements

1. Integral LED lamps: Comply with UL 1993, UL 8750.
2. LED packages and LED arrays: Comply with UL 8750.
3. Color temperature as indicated

B. LEDs shall utilize appropriate technology to achieve the indicated color.

C. Average rated life shall be a minimum 50,000 hours unless otherwise indicated.

D. LEDs shall be wired so that a failure of one LED will not adversely affect output of the lamp.

E. Circuitry shall prevent perceptible flicker over the operating voltage range even when in dimmable mode.

F. LED’s shall meet the LM-80 testing criteria as set forth by the Federal Department of Energy

2.4 LED LUMINAIRES

A. Refer to site lighting plan and schedule on contract documents for luminaire locations, additional specifications, accessories, and specific model numbers.

B. LED Light Fixtures shall meet the LM-79 testing criteria as set forth by the Federal Department of Energy.

C. LED Fixtures must have a lighting facts report to confirm efficacy and energy consumption.

D. Integral and remote Emergency Battery pack must be approved by the Light Fixture Manufacturer unless otherwise noted.

E. An L-70 or greater rating shall be published by the manufacturer to confirm expected life/ performance.

2.5 HIGH INTENSITY DISCHARGE LUMINAIRES

A. Refer to site lighting plan and schedule on contract documents for luminaire locations, additional specifications, accessories, and specific model numbers.

2.6 POLES, SUPPORT ARMS AND BRACKETS

A. Poles: Refer to site lighting plan and schedule on contract documents for luminaire locations, additional specifications, accessories, and specific model numbers.

2.7 PRE-CAST CONCRETE FOUNDATIONS

A. Pre-cast concrete light pole foundations shall be supplied by the following manufacturer(s){OR APPROVED EQUAL}:

Cromwell Concrete
P.O. Box 99
Cromwell, CT 06416-1429
Phone: (860) 635-5146
Fax: (860) 635-7469

Modern Concrete, Inc.
3900 Clover Road
Easton, PA 18040
Phone: (484) 548-6200
Fax: (610) 258-8165

B. All pre-cast foundations shall be reinforced per the Contract Documents.

2.8 ROUND CONCRETE FORMS

A. Concrete forms shall be supplied by the following manufacturer:

Sonoco Products Company
One North Second Street
Hartsville, SC 29550

2.9 Sonotube Concrete Forms

1. Description: Multiple layers of 100 percent recycled paperboard, spirally wound, and laminated with adhesive.
2. Interior Surface: Smooth with spiral seam. Alathon release and moisture barrier coating.
3. Exterior Surface: Micryl moisture barrier coating.
4. Spiral Mark: Impact visible spiral mark on concrete columns.
5. 1-piece, 1-time-use forms.
6. Recyclable.
7. Inside Diameter: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide concrete base for light poles at location indicated on the construction documents.

B. Install poles plumb. Provide shims or double nuts where necessary to adjust plumb. Grout around each base.

C. Install lamps in each luminaire. Contractor shall exercise caution when handling lamps. Contractor shall avoid handling lamps without clean gloves or a protective cloth wrap.

D. Bond luminaries, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

B. Measure illumination levels to verify conformance with performance requirements as specified on the construction drawings and/or local ordinances.

C. Take measurements during the night sky, without moon or with heavy overcast clouds effectively obscuring the moon.

D. Aim and adjust luminaire to provide illumination levels and distribution as indicated on the construction drawings or as directed.

3.3 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.4 PROTECTION OF FINISHED WORK

A. Contractor shall protect all work while construction is in progress. Contractor is responsible for any damage incurred during construction.

B. Relamp luminaries which have failed or been damaged during construction at substantial completion.

3.5 TESTING

A. Perform and record voltmeter measurements according to standard testing procedures. In addition, provide labor, material, and energy to conduct a parking lot light test at least 30 days prior to Substantial Completion date. This test shall consist of continuous operation of fixtures and lamps for a time period of 100 hours. Contractor shall witness and certify the continuous operation and time duration of the test. At the end of the testing period, immediately request warranty parts and replace defective components at least three days prior to Substantial Completion date.

END OF SECTION

SECTION 266100 – PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the minimum requirements for a Turn-Key Photovoltaic System.

B. This Section includes, but is not limited to the following:

1. Photovoltaic Modules
2. Photovoltaic Inverters
3. Photovoltaic Monitoring and Reporting System, Software and Services
4. Infrastructure, Wiring, Connections, and Testing
5. Identifications and Signs

C. Provide all labor and materials, and make all necessary connections, so that a complete and fully operational system shall be turned over to the owner. Any errors, omissions, or ambiguities concerning the photovoltaic (PV) system specifications shall be brought to the Engineers attention ten (10) working days prior to bid.

1.3 SCOPE OF WORK

A. For all work associated with the new photovoltaic system including photovoltaic modules, mounting rails, inverters, wire management system, photovoltaic monitoring and reporting services, disconnects, cabling, installation, terminations and devices shall be provided and performed by a qualified Photovoltaic System Contractor for a complete and operational photovoltaic system.

B. Photovoltaic System Contractor shall provide a functioning photovoltaic (PV) system with the minimum requirements of this section.

C. Mounting system: Contractor shall provide racking system as indicated on drawings. System shall be galvanized steel or aluminum. Mounting system shall not void the roof warranty. PV modules shall be installed and located to avoid shadowing from skylights, tubular daylighting devices, HVAC equipment and parapets.

D. Roof penetrations: Contractor shall minimize roof penetrations and shall not void the roof warranty.

E. Inverters: Inverters shall be IEEE 929 compliant and shall be inspected by utility company before commissioning, testing and operation of the system.

F. Electrical interconnection: Contractor shall install conductors, conduit, pull boxes, etc per NEC and requirements of specifications and drawings. All DC conductors shall be copper and 90 degree C, wet location rated with USE-2 insulation.

G. All membrane roof mounted conduits shall be supported off the roof with Cooper B-Line Dura-Blok rooftop support system.

H. All work shall be in accordance with the NEC and local codes.

I. All equipment shall be listed and labeled per UL and installed per the listing requirements and the manufacturer's instructions.

J. All outdoor equipment shall be minimum NEMA 3R.

K. All equipment shall be properly grounded per NEC 250 and NEC 690.

L. All circuits connected to more than one source shall have overcurrent devices located so as to provide overcurrent protection from all sources. NEC 690.9 (a)

M. Installation of PV panel arrays shall resist sliding and pop-up resulting from seismic events and shall comply with ASCE standard 7-05, chapter 13.

N. PV System Contractor shall coordinate all work with the Engineer, Architect, General Contractor, Electrical Contractor and all other contractors to ensure the PV system is installed and coordinated with the contract documents.

O. All roof penetrations and associated labor costs shall be at the expense of the PV contractor, but shall be installed by the roofing contractor in order to maintain any applicable roof warranties. Any deviations necessary by this contractor shall first be submitted to the Architect's office for review. Any costs associated with changes to this system that are a result of proposed details not being acceptable to the Owner, Architect or Engineer shall be at the expense of the PV Contractor. All required connection devices shall be reviewed by the architect and engineer. Penetration devices through standing seam metal roof areas shall be provided by the sheet metal roofing contractor.

P. Provide all necessary electrical distribution equipment, feeders, branch circuits, etc as required for a complete and functioning system.

1.4 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide photovoltaic, electrical and mounting materials that are compatible with one another under conditions of service and application required, as demonstrated by photovoltaic manufacturer based on testing and field experience.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Provide on standard 30” by 42” size for photovoltaic system shall include but not limited to:

   1. Plans, elevations, sections, details, and attachments to other Work.
   2. All diagrams must be submitted by the approved Contractor along with a point to point PV system interconnection diagram. Diagram shall identify all DC and AC components, conduit and wiring characteristics,
   3. Site plan showing infrastructure layouts, PV array locations, and identifiable features.
   4. Annual yield simulation report from Helioscope or similar software.
   5. Riser diagram and General Notes:
      a. Connection to utility AC disconnects and main electrical switchboard.
      b. Indicate conduits, power and communication wires, and combiners, disconnects, inverters, meters, etc.
      c. Provide PV system(s) power production calculations and total system(s) rating.

   6. Assembly Details. Provide as minimum the following details:
      a. Array attachment details.
      b. Support details and spacing dimensions.
      c. Roof mounted conduit supports and roof penetrations.
      d. Indicate all system(s) interface connections.
      e. Provide AC and DC wiring plans.
      f. Provide electrical equipment room layouts and equipment elevation details.

   7. Complete point to point PV System interconnection diagram(s):
      a. Identify all DC and AC components.
      b. Indicate conduit and wire characteristics, sizes and quantities.
      c. Indicate conduit fill and voltage drops.
      d. Provide combiner box schedule.
      e. Provide list of all materials.
      f. System monitoring details.

   8. Warranties: Sample copy of Warranties and Special Warranties to be issued with submittal.

C. Inspection Report: Copy of photovoltaic system manufacturer's inspection report of completed photovoltaic installation.

D. Manufacturer Approval of Testing Agency: Copy of manufacturer’s letter indicating acceptance of qualifications of testing agency to perform inspections specified under Part 3 Article “Field Quality Control,” including manufacturer’s compliance with testing agency’s requirements for final roofing inspection and manufacturer’s warranty certification.

1.6 QUALITY ASSURANCE

A. Installer Shall: Be certified by the North American Board of Certified Energy Practitioners (NABCEP)

B. Manufacturer Qualifications: A qualified manufacturer that has testing listings for photovoltaic system for this Project.

1. Photovoltaic modules shall comply with the latest revision of the following standards and the Contractor shall provide evidence of certification to the Engineer:
   a. UL Listed to 1000 Vdc
   b. Meet IEC 61646
   c. UL 1703
   d.
   e. Inverters shall comply with the latest revision of the following standards and the Contractor shall provide evidence of certification to the Engineer:
   f. UL 1741
   g. IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems (including use of IEEE 1547.1 testing protocols to establish conformity)
   h. IEEE 1547.1 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
   i. UL 1741 Inverters, Converters, and Controllers for Use in Independent Power Systems
   j. NFPA 70 - National Electrical Code
   k. ANSI 62.41
   l. IEEE 929-2000
   m. Inverters shall be considered certified for interconnected operation if the generation equipment and all related interconnection components have been tested and listed by a Nationally Recognized Testing Laboratory (NRTL certification by Department of Labor) for continuous interactive operation with an electric distribution system in compliance with the codes and standards outlined above.
   n. “Utility-Interactive” Labeled

2. Electric Installation
   a. NFPA 70: National Electric Code

C. Electrical and Fire Safety Characteristics: Provide photovoltaic materials with the electrical and fire safety characteristics for use in systems up to 1000 Vdc as determined by UL. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A for slopes up to 2:12 and Class C for unlimited slopes.

D. Pre-installation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner, Architect and Engineer, photovoltaic installer, roofing installer, lightning protection installer, mechanical contractor and other installers whose work interfaces with or affects photovoltaic installation including installers of electrical components.

2. Review methods and procedures related to photovoltaic installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review governing regulations and requirements for insurance and certificates if applicable.
6. Review temporary protection requirements for roofing system during and after installation.

1.7 QUALITY CONTROL

A. Contractor shall have adequate experience installing systems of similar size and complexity.

B. Qualifications of Installer: Minimum 5 years of experience installing products and systems of similar scope and complexity.

C. Installer shall have completed at least one (1) project of similar products and 300kW minimum project size and two (2) additional projects of similar products and 100kW minimum project size.

D. Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and/or is trained on the installations of the specified PV system products.

E. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment.

F. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.

G. Contractor shall have completed and commissioned a minimum of one (1) service agreement that provides similar support services to those needed for this project.

H. System startup and testing shall be performed by a factory engineer under the direct observation of the Engineer and Owner.

I. The installer shall provide the system components required by code and for the life safety of the service personnel.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver photovoltaic materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, and directions for storing and mixing with other components. Ensure that any materials temporarily stored on roof do not damage membrane if applicable.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit photovoltaic system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. System Warranty: Contractor shall provide an unconditional warranty for the complete installed system for a period of five (5) years following acceptance of the completed project. Warranty shall include labor and materials to repair, reprogram, or replace components at no charge to the Owner during the warranty period. All corrective work or system modifications shall be updated on all user documentation.

1. Warranty shall include annual on-site inspection, including: system testing (operating current of each electrical system), system adjustments and routine maintenance. Annual inspection shall take place during Spring.
2. Warranty shall include repair and/or replacement of defective parts.
3. System performance monitoring and historical data access for customer via secure website. Data is required to include: system energy and power production.
4. Monthly system monitoring by vendor, including reporting of problems to customer and dispatch of resources for expeditious resolution of problems.
5. The warranty shall include a response time of 24 hours for major system failures (emergency service), and 72 hours for minor repairs (routine service). Proposed agreement shall include annual site visits for preventative maintenance inspection so that all systems are validated prior to the warranty expiration date.
6. Provide a list of all applicable warranties for all equipment and components, this list shall include warranty information, names, addresses, telephone numbers, and procedures for filing a claim and obtaining warranty services.
7. Contractor shall respond to the Owner’s request for warranty service within 24 hours during normal business hours. For all calls, the Contractor shall submit records of the nature of the call, the work performed, and the parts replaced or service rendered.

B. Component Warranty:
1. Crystalline photovoltaic panels: Manufacturer shall provide a 12 year performance warranty at 90% of its rated power output, 25 years at 80% of its rated power output. Warranty shall include all travel, labor and materials to repair, reprogram, or replace components at no charge to the Owner during the warranty period.
2. AC/DC inverters: 5 year material. Warranty shall include all travel, labor and materials to repair, reprogram, or replace components at no charge to the Owner during the warranty period.

1.11 INSPECTIONS AND PREVENTATIVE MAINTENANCE

A. Service and Maintenance Agreement: Provide biannual inspection, cleaning and maintenance during the warranty period of five (5) years following Owner acceptance of the completed project. Provide the following:

1. Inverter maintenance: Visual inspection and verify performance via monitoring service.
2. Photovoltaic panel and wiring maintenance: Check electrical connections at combiner boxes, check electrical output at combiner boxes with volt meter to ensure proper electrical output.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products the manufacturers specified.

B. Photovoltaic modules: as indicated on drawings.

C. Inverters: as indicated on drawings.

D. Self-Ballasted Mounting System: as indicated on drawings.

E. Photovoltaic Monitoring and Reporting Services: SolarEdge or equal. Contractor shall include a minimum of five (5) years of monitoring service for the entire system. Monitoring service shall generate daily report comparing yield by inverter. System shall automatically send an email to provided recipients if standard deviation of any single inverter exceeds 25%.

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION

A. Install equipment and all required wiring. Provide required conductor terminations to devices for a complete system to function as specified and indicated on Drawings.

B. Terminations shall be in terminal cabinets or on equipment terminals.

C. Conductors shall be installed within conduits, boxes, and terminal cabinets in a totally enclosed installation. Furnish and install conductors required to connect incoming and outgoing circuits.

D. Wiring within equipment and terminal cabinets shall be installed to conform to contract documentation and NFPA 72 standards. Wiring shall be cabled, laced, and securely fastened in place so that no weight is imposed on equipment or terminals.

E. Conductors shall be color-coded per specifications and tagged with code markers at terminal cabinets, and equipment. A wire index shall be typed and installed on terminal cabinet doors.

Index shall be covered with clear plastic adhesive covers. Wiring shall be identified as to building and location of devices.

F. Complete installation shall comply with local building codes, manufacturer's instructions, and applicable industry standards.

G. Do not scale Drawings to determine locations and routing of conduits. Location of the infrastructure and equipment shall conform to architectural features of the building and other Work already in place, and must be ascertained in the field before the start of Work.

H. Drawings generally indicate Work to be provided, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits are to be installed, and furnish and install required fittings.

I. The roof shall be inspected prior to start of any work. Any observed deficiencies shall be brought up to the attention of the Engineer and Architect prior to commencing any work.

J. Prepare framing to receive PV modules in accordance with manufacturer's recommendations and in compliance with accepted shop drawings.

K. Adequate ventilation shall be provided to ensure that all system components are operated within their environmental ratings.

L. Provide warning signs as required by NEC, drawings, specifications and applicable codes.

M. Solar panel connectors and wiring shall be supported.

N. Provide minimum 60 mil (.060) protective slip-sheets (sacrificial membrane) beneath the ballast blocks/trays using "like" material conforming to the current/new roof system. Coordinate exact requirements with roofing contractor.

3.2 LABELING

A. Provide a permanent plaque providing the location of the service disconnecting means and the photovoltaic system disconnecting means at each location. NEC 690.56

B. Each AC disconnect shall be labeled with "PHOTOVOLTAIC SYSTEM AC DISCONNECT".

3.3 TESTING

A. A ten (10) day notice shall be provided to the Owner, Engineer and Commissioning Agent before final testing.

B. Demonstrate in presence of the Engineer and Commissioning Agent that circuit and wiring tests are free of shorts and grounds and that installation performs as specified herein and within manufacturer's guidelines.

C. PV modules shall be factory tested for design performance.

D. Inverters shall be factory tested for performance.

E. Provide commissioning and system startup.

F. Installer is responsible for identifying required tests, coordinating, scheduling, and conducting tests before Substantial Completion. Tests shall include the following:
   1. System response, data logging and transmission, and performance.
   2. System features and components under normal operation.
   3. System shutdown from utility override switches.
   4. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   5. When the system is equipped with optional features, consult the manufacturer manual to determine proper testing procedures.

G. All defects resulting from tests shall be corrected prior to substantial completion.

3.4 SYSTEM START-UP

A. Provide the service of the manufacturer trained certifier who shall visit the site and verify the following:
   1. Verify AC Voltage and that grid AC cables have been installed correctly.
   2. Verify DC conductors terminated correctly to all MPPT inputs.
   3. Apply Grid Voltage. Verify all enclosure doors are closed and locked. Closed AC disconnect switch. Look, listen and smell for signs of defects.
   4. Confirm AC operational parameters. Verify inverter AC limit.
   5. Confirm DC operational parameters. Verify inverter PV settings.
   6. Confirm power tracker configuration operational parameters. Verify inverter power tracker configurations.
   7. Completed commissioning. Save test report to file. Send completed report to inverter manufacturer. Send copy of product registration to inverter manufacturer.
   8. Electrical Inspection and Approval. Using post-installation checklist and maintenance checklist included in the Operation and Maintenance Manual.

3.5 TRAINING: Contractor shall provide full instructions to Owner in the system's operation, maintenance, and programming. Training shall be specifically oriented to installed equipment systems.

A. Provide 8 hours of onsite owner familiarization and training for the installed system. Training shall include system overview, override commands, normal and emergency operation and response, programming features and report generation. District employees attending this training session shall be provided with the following documentation:
   1. System layout point to point connection diagram.
   2. System components cut sheets.
   3. Operations and maintenance data.
   4. Safety rules for the operations and maintenance of PV systems.

3.6 SERVICE MANUALS:

A. Contractor shall deliver to the Owner and Engineer, three (3) copies of the service manuals. Each manual shall include the following:

1. Installation manuals, programming manuals, user manuals, and part numbers if applicable for every major system component. Catalog cut sheets alone are not acceptable.
2. A printed copy of the system configuration, including all system labeling codes, and passwords.
3. Two (2) electronic copies of the system configuration program on USB drive.
4. Final test report.
5. Detailed explanation of the operation of the system.
6. Instructions for routine maintenance.
7. Detailed wiring diagrams and updated shop drawings that include all revisions made in the field via plan changes, RFIs, Field Change Directives, and any other construction change documents including interface details with other systems.
8. Provide a USB drive electronic copy of the updated system As-Built Drawings to the Owner, prepare this copy in the latest version of AutoCAD; along with the electronic copy provide a full-size bond copy. Include one USB drive with the up-dated As-Built Drawings with each of the Service Manuals. USB drive and folded drawings shall be secured and inserted into the Service Manuals via a three-hole punched protective case and protective envelopes for the drawings.
9. All materials and required deliverables shall be submitted to the Owner.

END OF SECTION

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section contains requirements for equipment that is common to multiple sections of Division 27. Additionally, this section contains requirements common to all sections of Division 27.

1.2 RELATED REQUIREMENTS

A. 270526 - Grounding And Bonding For Communications Systems

B. 270528 - Pathway for Communications Systems

C. 270529 - Hangers and Supports for Communications Systems

D. 270533 - Identification for Communications Systems

E. 270536 - Cable Trays for Communications Systems

F. 270543 - Underground Ducts and Raceways for Communications Systems

G. 270544 - Sleeves and Sleeve Seals for Communications Pathways and Cabling

H. 271100 - Communications Equipment Room Fittings

I. 271116 - Communications Cabinets, Racks, Frames, and Enclosures

J. 271323 - Communications Optical Fiber Backbone Cabling

K. 271513 - Communications Copper Horizontal Cabling

1.3 REFERENCE STANDARDS

A. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

B. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

E. NECA/BICSI 607 - Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings; 2011.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

H. NFPA 1225 - Standard for Emergency Services Communications; 2022.

I. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e, with Addendum (2022).

J. TIA-568.1 - Commercial Building Telecommunications Infrastructure Standard; 2020e, with Addendum (2023).

K. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2024e.

L. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.

M. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

N. UL 444 - Communications Cables; Current Edition, Including All Revisions.

O. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; Current Edition, Including All Revisions.

P. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

S. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

T. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work. Submit similar product groups concurrently.

b. Products ordered or installed before receiving reviewed and returned submittals are subject to removal and replacement at the Contractor's expense.
c. Submit product data individually for each specification section under separate cover. Product data submittal shall include all certificates and material listed in the specification section.
    1) Submit cut sheets with part numbers, model numbers, and brief descriptions, including color, size, and other attributes to allow submitted products to be reviewed. Clearly indicate the product on each product data sheet using yellow highlighter.
d. Include a title sheet with the following information:
    1) Contractor name and contact information
    2) Date of submittal
    3) Project name
    4) Project number
    5) Sequential submittal number
    6) Specification section reference
e. Full-line and short-form catalogs are not acceptable.
f. Remove pages without part numbers and basic product descriptions, extraneous pages, blank pages, and repeated information.
g. Keep information pertinent to technical data only and as brief as possible.
h. Submittals will be reviewed for general compliance, not quantities. Individual submittals reviewed more than twice may result in back charges against the Contractor.
i. Resubmittals shall be designated with a revision number beginning with R1 and increasing consecutively. Resubmittals shall include a cover sheet with a written explanation of how each review comment has been addressed.
j. Combined submittals, submittals submitted under the incorrect specification section, submittals with extraneous pages, submittals with incorrect product data, or unapproved substitutions will be rejected.
k. Identify products with long lead times and anticipated ship dates that may affect the project schedule.
l. Work shall not commence before product data submittals have been reviewed and returned.

2. Shop Drawings:
    a. Submit shop drawings in .pdf format, similar to the contract drawings, for review no later than 60 days before beginning work.
    b. Create shop drawings from project Revit backgrounds. Shop drawings created using design team-issued contract drawings will not be accepted.
    c. Shop drawings can be submitted as 1 complete set per discipline.
        1) Include the MDF, each IDF, cable tray pathways, conduit pathways, underground pathways, telecommunications outlet locations with field labeling, rack elevations, and backbone and bonding riser diagrams. Drawings and elevations created with Microsoft Visio are not permitted.

d. Include a title sheet with the following information:
   1) Contractor name and contact information
   2) Date of submittal
   3) Drawing reference
   4) Project name
   5) Project number
   6) Sequential submittal number
e. Submit shop drawings on 30-inch by 42-inch (Architectural size E1) sheets.
f. Scale shop drawings at an appropriate scale, but not smaller than 1/8-inch equals 1 foot.
g. Include sufficient information to describe the work being performed.
h. Shop drawings will be reviewed for general compliance, not dimensions or quantities. Shop drawings reviewed more than twice may result in back charges being levied against the Contractor.
i. Work shall not commence before shop drawings have been reviewed and returned.

B. Informational Submittals:
1. Certificates:
   a. Submit certificates in .pdf format for review no later than 60 days before beginning work.
   b. Submit certificates for each specification section with the associated product data.
      1) BICSI:
         a) RCDD
         b) Technician
         c) Installer 1 or 2
      2) Manufacturer:
         a) Cable and connectivity manufacturer certification for the company, Project Manager, and ICT installers.
         b) ISO 9001 Certification where available.

C. Closeout Submittals:
1. Format:
   a. Submit closeout submittals in .pdf format to the Owner and Consultant for review and approval as soon as they are complete, but no later than 60 days before the date of substantial completion.
      1) Include the following:
         a) Warranty documentation:
            (1) Manufacturer warranty certificate(s)
         b) Record documentation:
            (1) As-builts
         c) Test reports:
            (1) Copper cable test results
            (2) Optical fiber test results
         d) Cable Matrix:

(1) See Section 271513 - Communications Copper Horizontal Cabling, for more information.

2. Warranty Documentation:
   a. Submit authorized manufacturer warranty documentation as specified in other sections.
3. Record Documentation:
   a. As-builts:
      1) Include the MDF, each IDF, cable tray pathways, conduit pathways, underground pathways, and telecommunications outlet locations, including AV and VSS, with field labeling, elevations, and riser diagrams. Remove keynotes and references to project changes.
      2) Submit 1 soft copy set of As-builts to the Owner after the review and approval process is complete. Create As-builts on 24-inch by 36-inch (Architectural size D) sheets.
      3) Create As-builts from project Revit backgrounds. As-builts created from .pdf documents or other means will not be accepted.
      4) Submit As-builts in .pdf and .rvt format.
      5) Submit redlined specification changes in .pdf format.
   b. Record Drawings:
      1) Maintain a complete set of drawings and specifications at the job site to clearly and permanently mark changes made. Transfer changes to As-builts.
      2) Create record drawings from project Revit files. Record drawings created using design team-issued contract drawings will not be accepted.
      3) Submit redlined record drawings in .pdf and .rvt format.
      4) Submit redlined specification changes in .pdf format.
4. Test Reports:
   a. See Section 271323 - Communications Optical Fiber Backbone Cabling, for test report information.
   b. See Section 271513 - Communications Copper Horizontal Cabling, for test report information.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installers:
      a. The project requires certified installers experienced with similar installations in size and complexity.
   2. Certifications:
      a. Division 27 Cabling Contractor:
         1) Minimum 1 current BICSI RCDD on staff as a full-time employee that shall regularly inspect work, stamp shop drawings, and review and stamp test results.
         2) Minimum 1 current BICSI Technician on staff as a full-time employee who shall serve as the Project Manager.

3) Minimum 1 current BICSI Installer 1 or 2 involved with the installation.
4) Current cable manufacturer certification is required for the company, Project Manager, and installers. Clearly indicate which certified employee will be the Project Manager.

3. Project Management:
   a. Assign a Project Manager to the project. Project Manager responsibilities include:
      1) Completing and submitting the required documentation.
      2) Continuously overseeing and directing the work and performance of employees and subcontractors.
      3) Documenting and completing the punch list.
      4) Ensuring completion of the scope of work on time.
      5) Ensuring compliance with the contract documents.
      6) Regularly inspecting work.
      7) Reporting unexpected conditions that may result in delays or additional costs.
      8) Scheduling cutovers or tie-ins.
   b. Maintain the same Project Manager and project team for the duration of the project unless the Architect, Owner, or Consultant request a change.

B. Construction Observation:
   1. The failure of the Consultant or another representative of the Architect or Owner to condemn any defective work or material shall not release the Contractor from the obligation to tear out, remove, repair, or replace upon discovery of non-conforming work or material at any time during the project.

1.6 ABREVIATIONS AND DEFINITIONS

A. Abbreviations and Acronyms:
   1. AHJ – Authority Having Jurisdiction
   2. ANSI – American National Standards Institute
   3. AV – Audio Video
   4. BABA – Build America Buy America
   5. BICSI – Building Industry Consulting Services International
   6. COO – Country of Origin
   7. EPD – Environmental Product Declaration
   8. ESS – Electronic Safety and Security
   9. HPD – Health Product Declaration
   10. IBC – International Building Code
   11. ICT – Information and Communications Technology
   12. IDF – Intermediate Distribution Frame
   13. IFC – International Fire Code
   14. ISO – International Organization for Standardization
   15. LEED – Leadership in Energy and Environmental Design
   16. MDF – Main Distribution Frame
   17. NFPA – National Fire Protection Association
   18. OSHA – Occupational Safety and Health Administration

19. TAA – Trade Agreements Act
20. TDMM – Telecommunications Distribution Methods Manual
21. TIA – Telecommunications Industry Association
22. TR – Telecommunications Room
23. UL – Underwriters Laboratories
24. VSS – Video Surveillance System

B. Definitions:
1. As-built – The documentation of measurements, location, and quantities of material work performed.
2. Basis-of-Design – A device representing the benchmark or minimum requirements in the specifications or drawings for the project. This shall not be interpreted as a sole-source requirement, unless it is stated that substitutions are not permitted.
3. Comply – To conform, submit, or adapt as required or requested.
4. Consultant – A specialist who provides services to the design team headed up by an architect or engineer under contract with a client.
5. Contract – A written document covering the understanding between the customer and the contractor.
6. Contract documents – Plans, specifications, and other documents that together set forth the requirements of the contract and become legally enforceable when the agreement is signed. Executed agreements between the owner and contractor that become part of a contract when the agreement is signed.
7. Coordinate – To bring into a common action, movement, or condition.
8. Deferred Submittal – A building code issue that allows the final design to be submitted after the permit has been issued. Deferred submittals are portions of the design that are not submitted by the design team at the time of building permit application. They are typically performed by a specialty engineer.
9. Delegated Design – A contractual issue between the owner and the contractor. The design professional or architect of record establishes the performance requirements for an element of a building, and a contractor assumes the responsibility of designing that element.
10. Furnish – To supply and deliver to the project site, ready for installation.
11. Install – To place in a position of service or use.
12. Pathway – Any physical method of supporting, enclosing, protecting, or otherwise transporting wiring systems.
13. Provide – To furnish and install, complete and ready for intended use.
14. Punch list – A short list of tasks that are required to be completed in order to close out a work order or project.
15. Raceway – Any enclosed physical pathway designed to protect or shield premises wiring systems.
16. Record drawings – Construction drawings revised to reflect and represent the actual conditions of the project as it was constructed, usually based on marked-up prints, drawings, and other data furnished by the contractor to the architect.
17. Shall – Frequently used in codes and standards publications, the term indicates a mandatory requirement.
18. Shop drawings – Drawings, diagrams, schedules, and other data specially prepared for the work by the Contractor or a subcontractor, sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the work.
19. Should – Indicates a recommendation or that which is advised but not required.

20. Submittal – Information, documentation, or samples that a contractor may be requested to submit to the design team for review and approval before the commencement of work.
21. Substantial completion – A stage of construction or a building project that is sufficiently complete, in accordance with the contract documents, so that the owner may use or occupy the building project.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Examine drawings and specifications for the entire project. Notify the Architect, General Contractor, or Consultant of discrepancies upon discovery.
2. Coordinate shut-downs, cutovers, or tie-ins with the Owner as required. Submit schedule for approval at least 2 weeks in advance.
3. Coordinate work with the Architect, General Contractor, and Subcontractors:
    a. Converged cabling responsibilities:
        1) Division 27 AV Contractor
        2) Division 28 ESS Contractor
    b. Deliverables:
        1) General Contractor
        2) Owner
    c. Inspections:
        1) AHJ
    d. MDF/IDF:
        1) Division 21 Contractor, for sprinkler head locations
        2) Division 23 Contractor, for cooling requirements
        3) Division 26 Contractor, for electrical, lighting, and bonding requirements
        4) Division 27 and 28 Contractors, for equipment locations
        5) General Contractor, for plywood backboard installation requirements
    e. Rough-in, receptacle, conduit, cable tray, and underground pathway requirements:
        1) Division 26 Contractor

B. Pre-installation meetings:
1. Convene pre-installation meetings with the Owner, Architect, Consultant, General Contractor, and other Subcontractors within 30 days before beginning work.
2. Meetings shall consist of construction drawing and specification review, submittal expectations, and project review.

C. Scheduling:
1. Coordinate, plan, and execute work according to the project schedule.
2. Adhere to project milestones and implementation schedule.
3. Within 30 days before beginning work, submit a detailed schedule of installation milestones in the form of a Gantt chart to the design team and General Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Coordinate with the General Contractor for any equipment, products, and materials to be delivered on-site.

B. Storage and Handling Requirements:
   1. Coordinate with the General Contractor for any equipment, products, and materials to be stored on-site.
   2. Store and protect products and materials following manufacturer recommendations.
   3. Provide secure storage for equipment, products, and materials stored on-site.
   4. Follow manufacturer guidelines on proper storage for material.

1.9 WARRANTY

A. Manufacturer Warranty:
   1. The cable manufacturer shall have a minimum of a 20-year warranty on its products. The warranty shall cover the cable and associated components against defects in material and workmanship under normal use.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
   1. See Division 27 specification sections for product and material requirements.
   2. Products shall be new, unused, and in the original packaging.
   3. Products and material specified within this Division shall be listed by UL and bear the appropriate mark. Materials shall comply with the most recent editions of applicable UL standards such asUL 444, UL 497, UL 514A, UL 514B, UL 514C, UL 1863, and UL 2043.
   4. Generic telecommunications cabling shall meet or exceed TIA-568.0.
   5. Telecommunications Infrastructure shall meet or exceed TIA-568.1.
   6. Network cable shall meet or exceed TIA-568.2.
   7. Optical fiber cable shall meet or exceed TIA-568.3.
   8. Grounding and bonding shall meet or exceed TIA-607 or NECA/BICSI 607.
   9. Products and materials used to accomplish project goals shall meet or exceed listed standards.
   10. Products specified are intended to establish a baseline for operational, functional, and performance-based standards that proposed products shall meet or exceed by functionality and quality.
   11. Products listed within Division 27 specifications shall be provided as part of a complete and functional system unless determined otherwise by the Owner, Architect, or Consultant during the submittal process.
   12. Provide incidental items required for a complete installation regardless of whether they are specified.

B. Substitution Limitations:
   1. Specified products and materials establish the overall performance level and provide the physical appearance, part quality, construction quality, and background of proven reliability desired by

the Owner and therefore define the minimum standards of quality required for the project. Certain products are not permitted to be substituted and are listed as "Substitutions: Not permitted." Provide substitution requests for products permitted to be substituted. Substitution requests must contain sufficient information verifying equivalency to specified items or can be procured at a lower price to be considered for an approved substitution and shall be submitted before the bid date. Substitution requests submitted after the bid has been awarded will not be accepted without justification. See Division 1 Substitution Procedures, for pre-or post-bid substitution forms and requirements.

2. Installed products or materials that deviate from specified or submitted make, model, color, or other significant characteristics will be replaced by the Contractor with specified or submitted products at no additional cost and without impact on the construction schedule.

C. Product Options:
   1. Procure material from local distribution sources. Utilize multiple local distribution sources to avoid procuring material from non-local sources.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Perform a site survey before beginning work. Site surveys shall include pathways, raceways, space allocations, installation tolerances, installation hazards, and impediments affecting the installation.
   2. Notify the Contractor of conflicts, discrepancies, or omissions promptly upon discovery. Failure to adequately complete a site survey will not provide a basis for additional compensation.
   3. Commencement of work without providing notification to the Contractor indicates acceptance of conditions.
   4. Errors and omissions in the drawings or specifications do not relieve the Contractor from performing omitted details of the work.
   5. Verify quantities for equipment, cabling, components, and materials before submitting the bid.

3.2 INSTALLATION

A. Systems Integration:
   1. Field measure indicated mounting heights, as shown on the contract drawings. If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide maximum headroom and working clearance.
   2. Furnish labor, materials, tools, equipment, and services for the installation under general provisions of contract documents.
   3. Provide supplementary or miscellaneous items and incidental devices necessary for a complete installation, whether specifically indicated in the contract documents.
   4. Install products, materials, and equipment to facilitate service, repair, or replacement.
   5. Execute work following NFPA 70 (NEC), OSHA, Fire Code NFPA 72 and ICC (IFC), NFPA 1225 and BICSI TDMM standards, manufacturer written instructions or recommendations, and

other applicable codes (i.e., ICC (IBC)). Where modifications are required due to code, regulations, or authorities, such changes shall be made without additional cost.

6. Follow industry standards of good practice for installations.
7. Products and materials shall be installed plumb, level, square, permanently attached, and held firmly in place.
8. Verify conduit, back boxes, junction boxes, pathways, raceways, and electrical requirements meet size and project requirements.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Tests:
      a. Test bonding, optical fiber, and copper cabling as specified in the following sections:
         1) Section 271323 - Communications Optical Fiber Backbone Cabling.
         2) Section 271513 - Communications Copper Horizontal Cabling.
   2. Inspections:
      a. Inspections for appropriate installation practices are the responsibility of the Project Manager.
      b. At the discretion of the Owner, Architect, or Consultant, provide personnel for periodic inspections, including a final inspection, at mutually agreed-upon times at no additional cost.
      c. Scheduled inspections in which the work is deemed incomplete, unfinished, or otherwise not ready for inspection are subject to back charges being levied against the Contractor.

B. Non-Conforming Work:
   1. Work found to be incomplete, of unsatisfactory quality, failing to meet specifications, or unacceptable to the Owner, Architect, or Consultant will be documented as a non-conforming work notice, field observation, or punch list and provided to rectify at no additional cost. Provide written notification with pictures upon completion. Incomplete lists will be rejected.
   2. The non-conforming work notice, field observation, or punch list will be considered complete only after being signed off by the Owner, Architect, or Consultant.

3.4 CLEANING

A. Waste Management:
   1. Remove trash and refuse after each workday. Telecommunications rooms shall be kept clean throughout the entire life of the project.
   2. Coordinate with the General Contractor for disposal of packaging and waste materials created during work to an approved common trash or recycling point or receptacle.
   3. Keep work area neat, tidy, and free from accumulating waste materials.
   4. Remove foreign material, dust, dirt, paint, unneeded labels, and stickers from equipment after completion.

3.5 CLOSEOUT ACTIVITIES

A. See other Division 27 sections for additional closeout activities.

END OF SECTION

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section addresses gounding and bonding requirements for communication systems to includes busbars, bonding clamps, conductors, taps and ground rods.

1.2 RELATED REQUIREMENTS

A. 260526 - Grounding and Bonding for Electrical Systems.

B. 270536 - Cable Trays for Communications Systems.

C. 270553 - Identification for Communications Systems.

D. 271116 - Communications Cabinets, Racks, Frames, and Enclosures.

E. 271119 - Communications Termination Blocks and Patch Panels.

F. 271123 - Communications Cable Management and Ladder Rack.

G. 271323 - Communications Optical Fiber Backbone Cabling.

H. 271513 - Communications Copper Horizontal Cabling.

I. 271543 - Communications Faceplates and Connectors.

1.3 REFERENCE STANDARDS

A. TIA-607-E, Telecommunications Bonding and Grounding (Earthing) for Customer Premises

B. BICSI TDMM (current edition

C. ISO/IEC 30129:2015, Information Technology – Telecommunications bonding networks for buildings and other structures

D. NFPA 70®, National Electrical Code® (NEC) (currently adopted edition)

E. NFPA 70E, Standard for Electrical Safety in the Workplace

F. UL 467, Grounding and Bonding Equipment

G. UL 869, Standard for Reference Standard for Service Equipment

1.4 DEFINITIONS

A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.

B. PBB (TMGB): Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.

C. RBB: Rack bonding busbar, located in equipment cabinets and racks.

D. SBB (TGB): Secondary bonding busbar, located in intermediate distribution frame rooms.

E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.

G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.

H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.5 ABBREVIATIONS

A. AC – Alternating Current

B. ACEG – Alternating Current Equipment Ground

C. AFF – Above Finished Floor

D. AWG – American Wire Gauge

E. BBC – Backbone Bonding Conductor

F. FOP – Fall-of-Potential

G. IDF – Intermediate Distribution Frame

H. MDF – Main Distribution Frame

I. PBB – Primary Bonding Busbar

J. RBB – Rack Bonding Busbar

K. RBC – Rack Bonding Conductor

L. SBB – Secondary Bonding Busbar

M. TBB – Telecommunications Bonding Backbone

N. TBC – Telecommunications Bonding Conductor

O. TEBC – Telecommunications Equipment Bonding Conductor

1.6 SUBMITTALS

A. Action Submittals
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work.
      b. Bonding busbars (submitted by Division 26 Contractor)
      c. Rack bonding busbars (submitted by Division 27 Contractor)
      d. Bonding beam clamp (submitted by Division 27 Contractor)
         1) Compression lugs (submitted by Division 27 Contractor)
         2) Conductors (submitted by Division 27 Contractor)
         3) Taps (submitted by Division 27 Contractor)
         4) Ground rods (submitted by Division 27 Contractor)
   2. Shop Drawings:
      a. Bonding riser diagram, including Telecommunications Room numbers and conductor gauges.
      b. Include plans, elevations, sections, details, and attachments to other work.

B. Informational Submittals:
   1. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
      a. Installing wire connector on conductor.
      b. Recommended torque values.

C. Closeout Submittals:
   1. Field Quality Control Submittals:
      a. Field quality-control reports.
   2. Test Reports:
      a. Provide test reports in Microsoft Excel format.
   3. Record Documentation:
      a. As-builts:
         1) Bonding riser diagram, including Telecommunications Room numbers and conductor gauges.
         2) Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

D. See Section 270500 - Common Work Results for Communications Systems, for additional submission requirements.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installers:
      a. The project requires installers experienced in correct bonding techniques.

1.8 ADMINISTRATIVE REQUIREMENTS

A. IDF – Intermediate Distribution Frame:
   1. Coordinate bonding locations, busbars, and TBC gauges with the Division 26 Contractor.

B. MDF – Main Distribution Frame
   1. Coordinate bonding locations, busbars, and TBC gauges with the Division 26 Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

A. The Division 26 Contractor shall provide the TBC to the electrical panel, building steel, and the permanent connection to the busbar.

B. MDF and IDF copper bonding conductor sheaths shall be green in color and rated for the environment.

C. MDF and IDF bonding conductors shall be stranded copper.

D. Bonding conductors shall remain the same gauge throughout the bonding path.

E. Install bonding conductors in a straight line for as long as possible. Cross obstructions perpendicularly.

F. Bonding conductor bend radius shall be less 90 degrees at any point. Bend radius shall not be smaller than 8 times the outside diameter of the conductor. Sharp bends are not permitted. Use sweeping bends when a change of direction is required.

G. Bond cabinets, racks, cable runway, and other metallic components to the nearest bonding busbar. Bond racks and cabinets using the manufacturer provided bonding lug.

H. Install bolts through each hole of compression lugs and tighten with a lock washer and nut. Secure tightly. Self-tapping screws or similar fasteners are not permitted.

I. Stacking of conductors/lugs under a single bolt is not permitted.

J. One-hole compression lugs are only permitted to be installed onto equipment designed for one-hole lugs, such as network electronics and rack bonding busbars. Two-hole compression lugs are required for metallic components located within the MDF and IDF. Copper conductors shall be visible in the inspection port of each compression lug.

K. Connections for the bonding conductors shall be permanent and made with irreversible connections. Screw-type connections are not permitted.

L. Completely and neatly remove paint or powder coat to expose bare metal and apply antioxidant joint compound before making bonding connections.

M. See Section 270536 - Cable Trays for Communications Systems, for cable tray bonding requirements.

3.2 EXAMINATION

A. Verification of Conditions:
1. Bond the telecommunications bonding system to the nearest effective power grounding system to ensure equal potential between systems. A qualified electrician shall make the connections.
2. Request and review the electrical Three-Point FOP or clamp-on ground resistance tester test results before connecting the communications system bonding electrode system to the power grounding system.
3. Verify the TBC to the PBB and SBB is permanently installed from the AC electrical panel serving the electrical receptacles in the MDF or IDF and to building steel using the same conductor gauge as the AC electrical grounding conductor (minimum of 6 AWG.)

B. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

C. Inspect test results of grounding system measured at point of TBC connection.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.

E. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.3 SELECTION OF COMMUNICATIONS BUSBARS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in 260526 - Grounding and Bonding for Electrical Systems.

B. PBB:
1. Dimensions: 1/4" Thick by 20" Wide .
2. Stand-Off Distance: 4 inch .
3. Insulated standoffs.
4. Hole Pattern: 2-Hole lugs per ANSI/BICSI N3-20 and ANSI/TIA-607.

C. SBB:
1. Dimensions: 1/4" Thick by 12" Wide .
2. Stand-Off Distance: 2 inch .
3. Insulated standoffs.
4. Hole pattern: 2-Hole lugs per ANSI/BICSI N3-20 and ANSI/TIA-607.

D. RBB:
   1. Horizontally oriented.
   2. Rack-Mounted.
   3. Horizontal RBB Dimensions: 3/16"-thick x 3/4"H x 19" W.
      a. Eight #6-32 tapped lug mounting holes on 1" centers and two pairs of 5/16" diameter holes spaced 3/4" apart for attaching jumpers.

3.4 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in 260526 - Grounding and Bonding for Electrical Systems.

B. Communications Busbar Connections:
   1. TBC: Not smaller than 1/0 AWG and no smaller than largest TBB.
   2. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
   3. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
   4. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
   5. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
   6. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.

C. Cable Tray Connections:
   1. Cable Tray Equipment Grounding Conductor: 6 AWG .
   2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 6 AWG and not longer than 12 inch. If jumper is wire, it must be terminated with lug having two holes and long barrel for two crimps. If jumper is flexible braid, it must be terminated with one- or two-hole ferrule . Attach with bonding screw or connector provided by cable tray manufacturer.

D. Underground Connections: Not smaller than 2 AWG . Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.

3.5 INSTALLATION

A. Installation of Busbars:
   1. Primary Bonding Busbar:
      a. Install horizontally in the MDF no higher than 8 feet AFF.
      b. Remove dust, dirt, or other foreign materials and apply antioxidant joint compound before fastening lugs.
      c. Install onto plywood backboard using lag-type bolts through each of the 4 mounting holes located on the mounting bracket.

d. Pre-drilled holes for use with lugs specified.

2. Secondary Bonding Busbar:
   a. Install horizontally in each IDF no higher than 8 feet AFF.
   b. Remove dust, dirt, or other foreign materials and apply antioxidant joint compound before fastening lugs.
   c. Install onto plywood backboard using lag-type bolts through each of the 4 mounting holes located on the mounting bracket.
   d. Pre-drilled holes for use with lugs specified.
3. Rack Bonding Busbar:
   a. Provide an RBB in each cabinet or rack.
   b. Install the RBB in each cabinet or rack using electrically isolating hardware.
   c. Bond the RBB to the PBB or SBB using a minimum 6 AWG conductor and the correctly sized lug.
   d. Remove dust, dirt, or other foreign materials and apply antioxidant joint compound before fastening lugs.
   e. Pre-drilled holes for use with lugs specified.

B. Installation of Bonding conductors:
1. Install and route so that personnel safety is not compromised.
2. No longer than required to achieve their purpose. Do not create service loops with bonding conductors.
3. Attached to surfaces in such a way that they do not become damaged or disconnected.
4. Fastened in such a way that permits associated equipment to be easily serviced.
5. Secured at intervals no greater than 3 feet.
6. Make mechanical connections accessible for inspection.
7. Make crimped connections free of other metals and with the correct tool.
8. Daisy-chaining is not acceptable.
9. Avoid installing within ferrous metallic conduit. When installing bonding conductors within metallic conduit, the conduit shall be terminated on each end with a bonding bushing and bonded to building steel or the nearest busbar.
10. Follow the following TIA chart for sizing bonding conductors:

TBB/BBC Linear Length m (ft)	Conductor Size (AWG)
Less than 4 (13)	6
4 - 6 (14 - 20)	4
6 - 8 (21 - 26)	3
8 - 10 (27 - 33)	2
10 - 13 (34 - 41)	1
13 - 16 (42 - 52)	1/0
16 - 20 (53 - 66)	2/0
20 - 26 (67 - 84)	3/0
26 - 32 (85 - 105)	4/0
32 - 38 (106 - 125)	250 kcmil

38 - 46 (126 - 150)	300 kcmil
46 - 53 (151 - 175)	350 kcmil
53 - 76 (176 - 250)	500 kcmil
76 - 91 (251 - 300)	600 kcmil
Greater than 91 (301)	750 kcmil
This TIA table applies to the bonding conductors that connect SBBs to the PBB and SBBs to each other.	

3.6 FIELD QUALITY CONTROL

A. Inspections:

B. Inspection for the correct installation of the grounding and bonding system conductors and connections is the responsibility of the Project Manager.

END OF SECTION

SECTION 270528 - PATHWAY FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section addresses the pathway requirements including conduits back boxes, and cable trays for the Communication Systems.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. 270500 - Common Work Results for Communications Systems

C. 270526 - Grounding And Bonding For Communications Systems

D. 270533 - Identification for Communications Systems

E. 270536 - Cable Trays for Communications Systems

F. 270543 - Underground Ducts and Raceways for Communications Systems

G. 270544 - Sleeves and Sleeve Seals for Communications Pathways and Cabling

H. 271100 - Communications Equipment Room Fittings

I. 271116 - Communications Cabinets, Racks, Frames, and Enclosures

J. 271119 - Communications Termination Blocks and Patch Panels

K. 271123 - Communications Cable Management and Ladder Rack

L. 271126 - Communications Rack Mounted Power Protection and Power Strips

M. 271323 - Communications Optical Fiber Backbone Cabling

N. 271513 - Communications Copper Horizontal Cabling

O. 271543 - Communications Faceplates and Connectors

P. 271619 - Communications Patch Cords, Station Cords, And Cross Connect Wires

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

E. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

F. NECA 105 - Standard for Installing Metal Cable Tray Systems (ANSI); 2015.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.

H. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling; 2006.

I. NECA/BICSI 607 - Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings; 2011.

J. NEMA 250 - Enclosures for Electrical Equipment; 2020.

K. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

L. NEMA FB 2.10 - Selection and Installation Guidelines for Fittings for Use with Non-Flexible Metallic Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing); 2021.

M. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

N. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

O. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

P. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

Q. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

S. TIA-569-D - Telecommunications Pathways and Spaces Standard; 2015.

T. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

U. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

V. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

W. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

X. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

Y. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

Z. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

AA. UL 651A - High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

BB. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

CC. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

DD. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways; Current Edition, Including All Revisions.

EE. UL 2024A - UL Standard for Safety OUTLINE OF INVESTIGATION FOR CABLE ROUTING ASSEMBLIES; March 25, 2011.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product data for the following:
      a. Surface pathways
      b. Wireways and fittings.
      c. Tele-power poles.
      d. Boxes, enclosures, and cabinets.
      e. Innerducts.
   2. Sustainable Design Submittals:
      a. Product Data: For adhesives and sealants, indicating VOC content.
      b. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
   3. Shop Drawings: For custom enclosures and cabinets and custom underground handholes and boxes. Include plans, elevations, sections, and attachment details.

B. Informational Submittals
   1. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
      a. Structural members in paths of pathway groups with common supports.
      b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

c. Underground ducts, piping, and structures in location of underground enclosures and handholes.

2. Qualification Data: For professional engineer.

3. Seismic Qualification Data: Seismic rating Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
   d. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

4. Source quality-control reports.

1.5 DEFINITIONS

A. ARC - Aluminum Rigid Conduit.

B. GRC - Galvanized Rigid Conduit

C. EMT - Electrical Metallic Tubing.

D. IMC - Intermediate Metallic Conduit.

E. RTRC - Reinforced Thermosetting Resin Conduit.

PART 2 PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. Manufacturers: Subject to compliance with requirements, provide one of the following: Allied Tube & Conduit; Atkore International, O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group, or Southwire Company, LLC

C. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
   2. Comply with TIA-569-D.

D. GRC: Comply with ANSI C80.1 and UL 6.
   1. Rigid metal conduit shall be galvanized steel. Connectors and couplings shall be threaded galvanized malleable iron or steel. Locknuts shall be of the type with sharp edges that bite into

enclosure where connected. Plastic insulating bushings shall be high temperature type. Sealing bushings shall have galvanized malleable iron locking ring with molded neoprene sealing ring with predrilled holes to accommodate each individual conductor, stainless steel screws and washers, PVC-coated pressure discs, and factory-installed lay-in grounding conductor lugs. Hub fittings shall be 2-piece, insulated throat, liquidtight type of steel or malleable construction.

E. EMT: Comply with ANSI C80.3 and UL 797.
1. Electrical metallic tubing shall be galvanized steel. Connectors and couplings shall be malleable iron or steel, galvanized or cadmium-plated, compression type. Connectors shall have insulated throats.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel .
   b. Type: compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

H. Flexible metal conduit shall be galvanized steel. Connectors shall be of the twist-in, insertion or totally enclosed clamp type, galvanized malleable iron or steel, with insulated throats.

I. Liquidtight flexible metal conduit shall be extra flexible type, neoprene-jacketed. Connectors shall be watertight, of the twist-in, insertion type, galvanized malleable iron or steel, with insulated throats.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Allied Tube & Conduit; Atkore International

C. General Requirements for Nonmetallic Conduits and Fittings:
1. Rigid nonmetallic conduit shall be rigid polyvinyl chloride, nonburning, high impact. Couplings and connectors shall be rigid polyvinyl chloride, high impact. Cement for connections of conduit shall be approved by the conduit manufacturer.
2. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D.

D. RNC: Type EPC-40-PVC , complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. Continuous HDPE: Comply with UL 651A.

F. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: MonoSystems, Inc., nVent., Panduit Corp., and Wiremold; Legrand North America, LLC. .

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Non-continuous cable supports shall be available in multiple sizes, styles and materials. Rigid supports shall be equipped with flared edges and pre-configured bend radius controls.

E. Provide drop wire supports and threaded rod assemblies in areas where structural mounting surfaces are non-functional or inaccessible.

F. Sling assemblies/cable straps shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance UTP and optical fiber cables. Support slings shall have a static load limit of 100 lbs.

G. Non-continuous cable supports sized 1 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable.

H. Select approved non-continuous cable supports suitable for specific installation environments and/or air handling (plenum) spaces.

I. Multi-Tier Assembly:
   1. Utilize manufacturer hardware to allow for multiple tiers of cable supports as indicated on the project drawings.
   2. Continuous cable division shall be fully maintained within each open top cable support.

J. Comply withTIA-569-D.

K. Galvanized steel.

L. J shape.

2.4 ADJUSTABLE CABLE SUPPORTS

A. Description:
   1. Non-continuous cable supports designed to manage high-performance data and communication cables. The system shall provide structured support, ensuring proper bend radius and preventing cable damage in overhead or wall-mounted applications.
   2. Large capacity non-continuous pathway support with adjustable fabric/steel construction.

B. Manufacturer: nVent Caddy 425 or equal)

C. Features:
   1. Adjustable strap enables flexible configuration, reducing inventory needs.
   2. Simple locking/unlocking mechanism allows for easy addition of cables post-installation.
   3. Broad base design prevents overbending and kinking of high-performance cables.
   4. Material: Steel and Polyethylene.
   5. Finish: Electrogalvanized.
   6. Diameter: Adjustable, 4" to 6"
   7. Static Load Rating: 100 lb.
   8. Cable Capacity:
      a. Cat 6: ~325 cables
      b. Cat 6A: ~210 cables.

D. Mounting: Utilize appropriate CADDY clips for attachment to beams, threaded rods, or walls.

E. Ensure the cable support is securely locked after cable installation.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Description: Enclosures for communications.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: FSR Inc., Hoffman; brand of nVent Electrical plc., O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group., or Wiremold; Legrand North America, LLC.

C. General Requirements for Boxes, Enclosures, and Cabinets:
   1. Comply with TIA-569-D.
   2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
   3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.NFPA 70.
   4. Device Box Dimensions: 4-11/16" inches square by 2-1/8 inches deep.
   5. Gangable boxes are prohibited.

D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy , Type FD, with gasketed cover.

F. Outlet boxes shall be constructed of code-gauge galvanized steel, unless otherwise specified herein. Where installed in hazardous locations or exposed to corrosive atmosphere, rain or spray, boxes shall be corrosion resistant cast metal with threaded entrances, removable covers, gaskets, and corrosion resistant screws.
   1. Outlet boxes recessed in plaster or gypsum board walls or columns shall be 4" or 4.688" square, 2.125" deep with plaster rings.
   2. Outlet boxes for devices recessed in metal door jambs shall be sheet metal partition boxes sized for the application.
   3. Outlet boxes recessed in masonry walls shall be square cornered masonry boxes or standard 4" square boxes fitted with square cornered tile covers of proper depth for block. Both type boxes shall be 2.125" minimum depth.
   4. Outlet boxes recessed in ceilings shall be 4" octagonal or square, 2.125" depth.
   5. Outlet boxes recessed in concrete shall be UL approved for the application.
   6. Through-wall type outlet boxes are not acceptable.
   7. Where special purpose devices require a larger outlet box than specified herein, provide outlet boxes for each specific device.
   8. Boxes containing low voltage and line voltage devices shall have metal barriers.

G. Metal Floor Boxes:
   1. Material: Cast Metal or Sheet Metal .
   2. Type: Fully adjustable.
   3. Shape: Rectangular.
   4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   5. Floor boxes in slabs above grade shall be 4.688" square, 2.125" deep, constructed of galvanized steel with flush knockouts on sides and bottom. Boxes shall be concrete-tight and fully adjustable. A leveling plate with screws at each corner shall be factory welded to the bottom of each box for rough leveling. Adjusting rings mounted to the top of each box shall provide a 0.5" vertical or angular adjustment of the top after concrete pour and installation of wiring devices.
   6. Floor boxes for slabs on grade shall be zinc-coated cast iron with integral threaded conduit openings. Boxes shall be watertight, fully adjustable, and constructed cast metal or sheet metal to prevent the free entrance of both surface and sub-surface water when the box is embedded in concrete. Boxes shall be provided with a minimum of 2 integral leveling screws for rough leveling. Adjusting rings shall provide a minimum 0.75" vertical or angular adjustment of the top after concrete pour and installation of wiring devices. A cap shall be provided over the top of each box to protect adjusting ring during concrete pour.
   7. Floor plates shall be of aluminum construction, configuration as indicated on the Drawings. Carpet flanges shall be of aluminum construction.

H. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
   1. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
   1. Boxes shall be the type, size and configuration required for its specific use, location, device, and number, size, and arrangement of raceways connecting thereto.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250 Type 1 , with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

2.6 INNERDUCT

A. Fabric Innerduct: Continuous, polyester, multi-pocket fabric innerduct, with internal pull tape.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. MaxCell
2. Indoor Textile Innerduct (Riser-listed): Micro, 2-inch, 3-inch and 4-inch single or multi-cell nylon textile innerduct containing 1250lb polyester flat woven pull tape which meets UL 2024A for flame propagation and smoke density values for general applications.
3. Plenum-Listed Textile Innerduct: Micro, 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77 . Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC .
2. Concealed Conduit, Aboveground: GRC .
3. Underground Conduit: RNC, Type EPC-40-PVC , direct buried.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Pathway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
5. Damp or Wet Locations: GRC .
6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway .
7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway .
8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT .
9. Boxes and Enclosures: NEMA 250 , Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 1 inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10 NEMA FB.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression , steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F .

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
1. NECA 1
2. NECA/BICSI 568
3. TIA-569-D
4. NECA 101
5. NECA 102
6. NECA 105
7. NECA 111

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 270529 - Hangers and Supports for Communications Systems for hangers and supports.

D. Comply with requirements in Section 270544 - Sleeves and Sleeve Seals for Communications Pathways and Cabling for sleeves and sleeve seals for communications.

E. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

F. Complete pathway installation before starting conductor installation.

G. The approximate locations of outlets are indicated on the Drawings. The exact locations shall be determined during construction. The right is reserved to change the exact location of any outlet box in any room before it is permanently installed, without additional cost to the Owner and as approved by the Architect and/or Engineer.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Pathways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
   2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
   3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions or as otherwise directed by structural engineer.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from nonmetallic conduit and fittings to GRC and fittings before rising above floor.

M. Stub-ups to Above Recessed Ceilings:
   1. Use EMT or RMC for pathways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

U. Surface Pathways:
   1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
   2. Install surface pathway with a minimum 2-inch radius control at bend points.
   3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
   1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
   2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
   3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

X. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service pathway enters a building or structure.
   3. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints. Raceways shall be installed parallel or at right angles with building walls.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Hooks and Adjustable Cable Supports:
1. Follow manufacturer’s instructions and recommended industry standards and guidelines.
2. Must be an independent support structure for the voice/data communication system.
3. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
4. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
5. Shall be installed using threaded rods secured to the slab above, manufacturer approved clips/clamps secured to structure or wall mounted to support the telecommunications cable infrastructure parallel to the slab throughout the cable plant, unless site conditions dictate a non-parallel installation.
6. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
7. Space hooks no more than 5 feet o.c.
8. Provide a hook at each change in direction. Must be routed to follow existing corridors, and parallel or 90 degree angles from all walls and/or the cable tray whenever possible.
9. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grid, sprinkler system, electrical supports, air ducts or any other in-ceiling structure may not be used for cable support.
10. Contractor installed supports shall be used to supplement the main cable support system when any cabling leaves the main support system or is unsupported for more than three feet (3’).

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
1. Set outlet boxes for flush-mounted devices to within 0.125" of finished wall.
2. Adjust mounting heights of boxes in masonry walls to minimize cutting and patching of masonry.
3. Install outlet boxes in one vertical line when indicated adjacent on the Drawings but at different mounting heights.
4. Covers on recessed ceiling outlet boxes shall be painted to match the ceiling.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
1. Outlet boxes shall not be installed back-to-back. Maintain minimum 24" separation between outlet boxes on opposite sides of rated walls, and minimum 6" separation in nonrated walls.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits. Install boxes level, plumb, and square to the structure

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

II. Where raceways must pass through structural members, obtain approval from the Architect and/or Engineer regarding location and size of openings prior to drilling. Lateral raceways in masonry shall not exceed 0.75".

JJ. Raceways shall be secured in place and protected to prevent damage to the work during construction. Open ends of raceways shall be taped or capped after installation to prevent entry of dirt and debris during construction prior to pulling wire. Installation of raceways shall be complete and shall be blown-out and swabbed clear of water and trash prior to pulling wire.

KK. Rigid metal conduit shall be installed for applications not otherwise specified herein. Rigid metal conduit shall be secured to metal enclosures using hub fittings. Insulated bushings or fittings shall be installed at connections to cabinets and boxes. Terminate stub-ups not attached to enclosures with an insulated throat grounding bushing. Commercial pipe joint compound shall be applied to the male threads on threaded joints and fittings. Connections shall be wrench-tight, and where subject to ground water, rain or spray shall be watertight.

LL. Service provider raceways shall be installed as indicated on the Drawings and shall be coordinated with the local telephone company or other service provider. Raceways terminated at plywood backboards shall be turned-up out of the floor slab to 12" above the finished floor if routed from below, and turned down and terminated at the top of the backboard if routed from above.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 - Sleeves and Sleeve Seals for Communications Pathways and Cabling.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Inspect fire stopping installation by others between building structure and conduit, wire way, and cable tray to verify integrity of installation.

C. Protect adjacent surfaces from damage during water seal or fire stop installation. Repair any damage.

3.5 INSTALLATION OF INNERDUCT

A. Protect products from the effects of moisture, UV exposure, corrosion and physical damage during construction.

B. Select approved innerduct suitable for specific installation environments and/or air handling (plenum) spaces.

C. Exposed Textile Innerduct Penetrations: Install conduit sleeves or fire barrier sealing systems in all openings where open and exposed textile innerduct passes through fire-rated walls and floors. After installation, install intumescent fire barrier penetration sealing material between textile innerduct and sleeves or fire barrier system.

D. Raceway Penetrations: After textile innerduct installation, install intumescent fire barrier penetration sealing material between textile innerduct and conduit or wire way at all exposed penetration locations.

E. When appropriate, use the following cable ties to secure textile innerduct through previously created incisions:
   1. Plenum areas: plenum-rated plastic or stainless steel
   2. Non plenum areas: Hook and loop style ties (or Velcro)

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section addresses requirements for hangers and supports for communications systems to include beam clamps, grid wire, J-Hooks, single slotted channel, and threaded rod.

1.2 RELATED REQUIREMENTS

A. 270505 - Selective Demolition for Communications Systems.

B. 270526 - Grounding And Bonding For Communications Systems.

C. 270528 - Pathway for Communications Systems.

D. 270533 - Identification for Communications Systems.

E. 270536 - Cable Trays for Communications Systems.

1.3 REFERENCE STANDARDS

A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

G. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

H. NECA 105 - Standard for Installing Metal Cable Tray Systems (ANSI); 2015.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024, with Errata (2025).

K. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e, with Addendum (2022).

L. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

1.4 ABREVIATIONS

A. Abbreviations and Acronyms:
   1. EMI – Electromagnetic Interference
   2. IBC - International Building Code

1.5 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work.
         1) Beam clamps
         2) Grid wire
         3) J-hooks
         4) Slotted channel
         5) Threaded rod
   2. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for communications hangers and support systems.
      a. Trapeze hangers. Include product data for components.
      b. Steel slotted-channel systems.
      c. Aluminum slotted-channel systems.
      d. Nonmetallic slotted-channel systems.
      e. Equipment supports.
      f. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   3. See Section 270500 - Common Work Results for Communications Systems, for submission requirements.

B. Informational Submittals:
   1. Provide Coordination drawings in accordance with Division 1 requirements.
   2. Seismic Qualification Data: Certificates, for hangers and supports for communications equipment and systems, accessories, and components, from manufacturer.
      a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Closeout Submittals (Not Used)

1.6 QUALITY ASSURANCE (NOT USED)

1.7 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate above ceiling pathways with Division 22, 23, 26, and 28 Contractors.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
1. Beam clamps 1 inch: Eaton (530), nVent/Caddy (BC), or Thomas and Betts (502) .
2. Grid wire: Dottie (CWSx) .
3. Single slotted channel: B-Line (B22SH-120HDG), Caddy (A12H1000HD), or Unistrut (CJ32H) .
4. Threaded rod: B-Line (ATR 1/4X120 ZN) or Dottie (ROD14) .

B. Substitutions: Submit for approval per Section 270500 - Common Work Results for Communications Systems.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635 .

2.3 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: CADDY; brand of nVent Electrical plc, Cooper B-line; brand of Eaton, Electrical Sector, or Unistrut; Atkore International
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized Steel, Plain Steel, Stainless Steel Type 304, and Stainless Steel Type 316 .

4. Channel Width: Selected for applicable load criteria 1-5/8 inches, 1-1/4 inches, and 13/16 inches .
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Hilti, Inc., ITW Ramset/Red Head; Illinois Tool Works, Inc., or MKT Fastening, LLC .
2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Cooper B-line; brand of Eaton, Electrical Sector, Hilti, Inc., ITW Ramset/Red Head; Illinois Tool Works, Inc., or MKT Fastening, LLC .
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Hanger Rods: Threaded steel.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify proposed J-hook pathways before installation to confirm the absence of obstructions, EMI sources, or other detriments.

3.2 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
   1. NECA 1.
   2. NECA/BICSI TIA-568.0.
   3. TIA-569.
   4. NECA 101.
   5. NECA 105.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for pathways specified in Section 270528 - Pathway for Communications Systems.

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps, using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.3 INSTALLATION

A. General:
   1. Maintain parallel pathways with walls or other fixed objects along the pathway.
   2. Communications conduit is permitted to share trapeze-style hangers and supports with other disciplines, including electrical systems, provided distances between conduits are met per the NFPA 70 (NEC).

B. Beam clamps:
   1. Install tightly onto building steel making a complete connection.

C. Grid wire and threaded rod:

1. Support by mechanical means to the structure.
2. Use grid wire or threaded rod as support for installing j-hooks when mounting to structure is unavailable.
3. When installing grid wire for J-hook supports, both ends of the grid wire are required to be supported.

D. Slotted channel:
1. Create cable tray trapeze support using slotted channel and threaded rod when not using wire basket clips or wall supports.
2. Paint slotted channel and associated hardware to match adjacent surfaces when installed exposed.

E. Threaded rod:
1. Paint threaded rod and associated hardware to match slotted channel when installed exposed.

3.4 SUPPORT INSTALLATION

A. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Use expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 .
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements .

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.5 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils .

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780.

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Tests: (Not used)
   2. Inspections:
      a. Inspection for correct hanger and support installation practices is the responsibility of the Project Manager.

END OF SECTION

SECTION 270533 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section addresses identification rerquirements for communications systems including labeling and signage.

1.2 RELATED REQUIREMENTS

A. Section 270526 - Grounding And Bonding For Communications Systems

B. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures

C. Section 271323 - Communications Optical Fiber Backbone Cabling

D. Section 271513 - Communications Copper Horizontal Cabling

1.3 REFERENCE STANDARDS

A. ANSI Z535.1 - Standard for Safety Colors; 2022.

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

C. ANSI Z535.3 - American National Standard for Criteria for Safety Symbols; 2022.

D. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. TIA-606-D - Administration Standard for Telecommunications Infrastructure

1.4 ABBREVIATIONS AND ACRONYMS

A. AHJ – Authority Having Jurisdiction

B. AP – Access Point

C. AV – Audio Video

D. BBC – Bonding Backbone Conductor

E. IDF – Intermediate Distribution Frame

F. MDF – Main Distribution Frame

G. TBB – Telecommunications Bonding Backbone

H. TBC – Telecommunications Bonding Conductor

I. UL – Underwriters Laboratories

J. VSS – Video Surveillance System

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate labeling requirements of this specification with the Owner.

1.6 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work.
         1) Label holders
         2) Bonding busbar labels
      b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.
   2. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
   3. Identification Schedule:
      a. Outlets: Scaled drawings indicating location and proposed designation.
      b. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
      c. Racks: Scaled drawings indicating location and proposed designation.
      d. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.
   4. Shop Drawings:
      a. See Section 270500 - Common Work Results for Communications Systems, for shop drawing requirements.

B. Informational Submittals:
   1. See Section 270500 - Common Work Results for Communications Systems for requirements.

C. Closeout Submittals:
   1. See Section 270500 - Common Work Results for Communications Systems for requirements.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 70 NFPA 70.

B. The labeling scheme is intended to comply with TIA-606-D and the owner's standard for labeling and administration of a cable plant. It is the responsibility of the contractor to acquire, understand, and utilize the owner's labeling scheme for all components of the voice data communications system. The final labeling scheme and all other label requirements shall be coordinated and confirmed with the Owner and Engineer.

C. See Section 270500 - Common Work Results for Communications Systems for additional requirements.

PART 2 PRODUCTS

2.1 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Brady, Hellermann Tyton, and Panduit .

B. Self-Adhesive Wraparound Labels: Preprinted , 3-mil- thick, vinyl flexible labels with acrylic pressure-sensitive adhesive.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Brady, Dymo, and Panduit .
   2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
   3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Brady, Dymo, and Panduit .
   2. Minimum Nominal Size:
      a. 1-1/2 by 6 inches for raceway and conductors.
      b. 3-1/2 by 5 inches for equipment.
      c. As required by authorities having jurisdiction.

D. Other Label Requirements:
   1. Characters on labels shall be black text on a white background.
   2. Permanent ink and handwritten labels are not permitted.
   3. Label size shall be appropriate to cable size, outlet faceplate layout, patch panel design, or other related equipment sizes and layouts. Label manufacturer and font shall be consistent throughout the project.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Brady or Ideal Industries .

B. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

C. Color and Printing:
   1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
   2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE" .

D. Tag, Detectable, Reinforced: :
   1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Width: 3 inches.
   3. Overall Thickness: 8 mils.
   4. Foil Core Thickness: 0.35 mil.
   5. Weight: 34 lb/1000 sq. ft..
   6. Tensile according to ASTM D882: 300 lbf and 12,500 psi.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify rooms, walls, telecommunications outlets, patch panels, and ceiling are complete and ready for label installation.

3.2 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.3 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:
   1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
   3. Provide label 6 inches from cable end.

I. Self-Adhesive Wraparound Labels:
   1. Secure tight to surface at a location with high visibility and accessibility.
   2. Provide label 6 inches from cable end.

J. Self-Adhesive Labels:
   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

K. Underground-Line Warning Tape:
   1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at minimum 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
   2. Align tape parallel to and within 3 inches of centerline of duct bank.
   3. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.
   4. Install underground-line warning tape for direct-buried cables and cables in raceways.

3.4 SYSTEM INTEGRATION

A. General labeling:
   1. Telecommunications outlet labeling shall match the patch panels, test results, and the As-builts. Discrepancies shall be corrected immediately at no additional cost.
   2. Clean surfaces before attaching labels.
   3. Install mechanically printed labels firmly, neatly, and level.
   4. Complete labeling no later than 30 days before substantial completion.
   5. Labeling listed within this section shall be completed by the cabling contractor.

B. AP outlet labeling:
   1. Affix AP outlet labeling on the ceiling grid immediately adjacent to the AP in a highly visible area. In areas with no ceiling grid, affix label to AP.

C. AV labeling:
   1. Affix AV outlet labeling immediately adjacent to the device in a highly visible area.

D. Camera outlet labeling:
   1. Affix VSS outlet labeling on the camera housing in a highly visible area.

E. Copper and optical fiber backbone cable labeling:
   1. Label backbone cable within 12 inches of each end.
   2. Minimum tape width is 1/2 inch.
   3. Install label on label holder using cable ties in a highly visible area.

F. Copper patch panel labeling:
   1. Patch panel labeling shall be Room Number.
   2. The first patch panel on the rack shall be designated with the letter “A” and each patch panel shall follow sequentially to the last patch panel. Patch panel letter labels shall be installed on the lefthand side of the panel.
   3. Each patch panel port shall be designated numerically starting with the number “01” and continued sequentially until “48”. Each patch panel port shall be labeled regardless of termination status.
   4. Label copper patch panels with the corresponding telecommunications outlet within the plastic windows. Missing plastic windows are not acceptable.
   5. Minimum character height is 3/8 inch.

G. Firestop sleeve labeling:
   1. Affix adhesive wall label immediately adjacent to penetration/devices to communicate to future installers, the AHJ, and others the manufacturer of the device, installation date, and corresponding UL System number installed.

H. Grounding and bonding labeling:
   1. Label each bonding conductor using label holders. Each label shall show the purpose of each bonding conductor specifically.
   2. Snugly attach label holder using cable ties.
   3. Provide label for each bonding busbar:
      a. IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER.

I. Horizontal cable labeling:

1. Label horizontal cables with a self-laminating label within 4 inches of each end.
2. Minimum tape width is 3/8 inch.

J. Ladder rack:
1. Install signage as follows:
   a. WARNING: DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING.

K. Optical fiber patch panel labeling:
1. MDF patch panel labeling shall indicate the strand count and IDF to where the backbone cable terminates.
2. IDF patch panel labeling shall indicate the strand count and MDF to where the backbone cable terminates.
3. Label optical fiber patch panels on the front of each patch panel.

L. Telecommunications outlet labeling:
1. Telecommunications outlet labeling shall be MDF/IDF–Rack Number–Patch Panel Letter–Port Number.
2. Label outlets with the corresponding copper patch panel port within the plastic window. Missing label windows are not acceptable.
3. Minimum character height is 3/8 inch.

M. Telecommunications racks:
1. Label racks numerically from left to right beginning with the number 1.
2. Adhere label centered on the top horizontal support.
3. Label width shall be minimum 1-inch.

3.5 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:
1. Wiring closet designation.
2. Colon.
3. Faceplate number.

D. Equipment Room Labeling:
1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Refer to project drawings

3. Data Outlets: Unless otherwise noted on project drawings label each outlet with a self-adhesive label indicating the following, in the order listed:
   a. Room number being served.
   b. Colon.
   c. Faceplate number.

E. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

F. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:
   1. Room number.
   2. Colon.
   3. Faceplate number.

G. Grounding Equipment: Refer to Section 270526 - Grounding And Bonding For Communications Systems.

H. Termination Hardware: Refer to Section 271513 - Communications Copper Horizontal Cabling.

I. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

J. Instructional Signs: Self-adhesive labels.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels .
   1. Apply to exterior of door, cover, or other access.

L. Equipment and Raceway Identification Labels:
   1. Indoor Equipment: Self-adhesive label Laminated-acrylic or melamine-plastic sign.
   2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
   3. Equipment to Be Labeled:
      a. Communications cabinets.
      b. Equipment Racks
   4. Raceway to Be Labeled:
      a. Riser conduit
      b. Service entrance conduit

3.6 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Tests: (Not used)
   2. Inspections: Inspection for correct labeling scheme and installation is the responsibility of the Project Manager.

END OF SECTION

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. Section addresses the requirements for cable trays, fittings, supporting hardware, grounding hardware and related materials. This section also addresses installation requirements.

1.2 RELATED REQUIREMENTS

A. Section 270500 - Common Work Results for Communications Systems

B. Section 270526 - Grounding And Bonding For Communications Systems

1.3 REFERENCE STANDARDS

A. ASCE/SEI 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2017.

B. ASTM A1 - Standard Specification for Carbon Steel Tee Rails; 2000 (Reapproved 2026).

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2025.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2025.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

F. ASTM D 769 - Standard Specification for Black Synthetic Iron Oxide; 2025.

G. NECA 105 - Standard for Installing Metal Cable Tray Systems (ANSI); 2015.

H. NEMA VE 1 - Metal Cable Tray Systems; 2017.

I. NEMA VE 1 - Metal Cable Tray Systems; 2017.

J. NEMA VE 2 - Cable Tray Installation Guidelines; 2018.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

M. TIA-569-D - Telecommunications Pathways and Spaces Standard; 2015.

1.4 ABBREVIATIONS AND ACRONYMS

A. EMI – Electromagnetic Interference

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate cable tray pathways with the Owner, Architect, Division 22 Contractor, Division 23 Contractor, Division 26 Contractor, and other Subcontractors with concurrent work.

1.6 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work. Include data sheets for each product (and accessories) indicating dimensions and finishes for each type of cable tray indicated.
   2. Shop Drawings: For each type of cable tray.
      a. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
      b. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
         1) Vertical and horizontal offsets and transitions.
         2) Clearances for access above and to sides of cable trays.
         3) Vertical elevation of cable trays above the floor or bottom of ceiling structure.
         4) Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
      c. Submit shop drawings for review no later than 60 days before beginning work.
   3. See Section 270500 - Common Work Results for Communications Systems, for submission requirements

B. Informational Submittals
   1. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
      b. Vertical and horizontal offsets and transitions.
      c. Clearances for access above and to side of cable trays.

d. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

2. Seismic Qualification Data: Certificates, for cable trays, accessories, and components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Closeout Submittals:
   1. Format:
      a. See Section 270500 - Common Work Results for Communications Systems, for submission requirements.
   2. Warranty Documentation: (Not used)
   3. Record Documentation:
      a. As-builts:
         1) Include wire basket cable tray pathways, including sizes, fill percentage, and elevations

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installers:
      a. The project requires installers experienced in cable tray installations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor: 1.5.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and TIA-569 TIA-569-D TIA-569, and marked for intended location, application, and grounding.
   1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
   1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to .
   2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
   3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 LADDER CABLE TRAY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Cooper B-line; brand of Eaton, Electrical Sector, CPI Chatsworth Products, and Legrand.

B. Ladder cable tray shall form a wireway system for cable management inside communications rooms.

C. Runways shall be classified by UL and rated as an equipment grounding conductor.

D. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1 .

E. Width: Indicated on Drawings.

F. Straight Section Lengths: 10 feet, except where shorter lengths are required to facilitate tray assembly.

G. Rung Spacing: 9 inches o.c.

H. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.

I. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.

J. No portion of the rungs shall protrude below the bottom plane of side rails.

K. Cable Runway Accessories
   1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as ladder cable tray.
   2. Barrier Strips: Same materials and finishes as for ladder cable tray.
   3. Specific Accessory Products: Furnish and install all accessories, including but not limited to radius drops, splice kits, support kits, end closing kits, protective end caps, ground wire supports, elevation kits, and other accessories as indicated on the project drawings, and as required for a complete ladder cable tray system.
   4. Splicing Assemblies: Bolted type using serrated flange locknuts.
   5. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

L. Materials and Finishes:
   1. Steel:

a. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A1011/A1011MSS, Grade 33 or ASTM A1008/A1008M, Grade 33, Type 2.
b. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M , Grade 1008.
d. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

2.4 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

C. Provide all components of the cable tray system (cable tray, turns, splices, supports and other accessories) for a complete and compliant system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Visually verify and plan cable tray pathways before installation for feasibility and to confirm the absence of obstructions, conflicts with other trades, EMI sources, or other detriments.

3.2 CABLE TRAY INSTALLATION

A. Cable tray installation shall conform to NEMA VE 2 and NECA 105 NECA/NEMA 105.

B. Install cable tray level, plumb, and at right angles to the structure.

C. Install cable tray so the cable jackets cannot be damaged during installation of cable. Remove sharp edges and burs from cable tray.

D. Install cable tray so the maximum distance of horizontal cable is no more than 225 feet.

E. Install cable tray to allow the cable bend radius to be followed.

F. Install cable tray in such a manner as to avoid obstructions from other trades after cable tray installation is complete. Other building infrastructure is not permitted to route through or inside cable tray.

G. Maintain clearances of a minimum of 12 inches above, 3 inches below, and 8 inches to one side of the wire basket tray.

H. Cable tray fill shall not exceed 40 percent of available space after cabling is complete.

I. Properly firestop or fill penetrations through fire, smoke, or acoustically rated barriers.

J. Cable tray shall be electrically continuous. Provide bonding jumpers when cable tray breaks between walls or other barriers.

K. No additional bonding is required when the cable tray is installed using a threaded rod attached with galvanized connections to building steel. If cable tray supports are attached to concrete or other nonconductive materials, bond cable tray to building steel every 50 feet.

L. Cable tray sections not electrically connected to the main run shall be bonded to building steel every 50 feet.

M. Use fittings from the cable tray manufacturer to provide all material required to deliver a fully functional cable tray pathway.

N. Provide radius drop fittings where cable exits the cable tray to below.

O. Shop drawings shall be submitted by installing contractor.

P. Complete cable tray installation before installing cables.

Q. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
   1. Provide all components of the cable tray system (cable tray, turns, splices, supports, and accessories) from a single manufacturer.

R. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
   1. Minimum clearance of 12” above the cable tray.
   2. Leave a minimum of 12” in between cable tray and ceiling/building truss structure.
   3. Leave a minimum of 3” in between ladder cable tray and the tops of equipment racks and/or cabinets.
   4. Minimum clearance of 12” in between each tier of cable tray.
   5. When located above an acoustical drop ceiling, leave a minimum of 3” clearance between the top of the drop ceiling tiles and the bottom of the cable tray.
   6. Maintain a 2’ separation between ladder cable tray used for communications cables and pathways for other utilities or building services.

S. Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall.

T. Remove burrs and sharp edges from cable trays.

U. Fasten cable tray supports to building structure and install seismic restraints.

V. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 270528 - Pathway for Communications Systems. Comply with seismic-restraint details according to Section 270548 - Seismic Controls for Communications Systems.

W. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

X. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

Y. Support bus assembly to prevent twisting from eccentric loading.

Z. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

AA. Ladder cable tray:
1. Install all ladder cable tray per the manufacturer's recommended installation instructions, and as indicated in the project drawings.
2. Ladder cable tray shall be installed with side stringers facing down so that the ladder forms an inverted U-shape.
3. Ladder cable tray shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).
4. Ladder cable tray splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.
5. Ladder cable tray support:
    a. Every 5' or less in accordance with TIA-569-D.
    b. Within 2' of every splice and within 2' on both/all sides of every intersection.
    c. Within 2' on both sides of every change in elevation.
    d. Every 2' when attached vertically to a wall.
6. Heavy-duty splices:
    a. Recommended for 18" wide or wider ladder cable tray.
    b. Required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns.
    c. To secure all overhead turns to the overhead horizontal pathway(s).

BB. Support wire-basket cable trays with trapeze hangers and/or wall brackets.
1. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer.
2. Support for wire-basket trays with 1/2-inch diameter threaded rods.

CC. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

DD. Make changes in direction and elevation using manufacturer's recommended fittings.

EE. Make cable tray connections using manufacturer's recommended fittings.

FF. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."

GG. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

HH. Cover the exposed ends of cable tays that do not terminate against a wall, the floor or the ceiling, with end caps or an end closing kit.

II. Install permanent covers, if used, after installing cable. Refer to project drawings for requirements.

3.3 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 - Grounding And Bonding For Communications Systems.

B. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

F. Verify continuity through the bonds at splices and intersections between individual cable tray sections and turns and through the bond to the telecommunications grounding busbar.

3.4 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects, paint or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.
    a. The installer will provide touch-up paint color-matched to the finish on the cable tray and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the cable tray system.

3.6 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
    1. Tests:
        a. Test the bonding as outlined in Section 270526 - Grounding And Bonding For Communications Systems.
    2. Inspections:
        a. Inspection for correct installation and bonding of cable tray is the responsibility of the Project Manager.
        b. If requested by the Owner, Architect, or Consultant, the cable tray manufacturer representative shall perform a site visit to verify the cable tray is correctly installed at no additional cost to the Owner.

END OF SECTION

SECTION 270543 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section addresses metal conduits and fittings, including GRC and PVC-coated GRC, rigid nonmetallic duct, duct accessories, including rigid innerduct and fabric innerduct, precast concrete handholes, fiberglass handholes, and boxes with polymer concrete covers, precast manholes, and utility structure accessories.

1.2 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems

B. Section 260533.16 - Boxes for Electrical Systems

1.3 REFERENCE STANDARDS:

A. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures; 2019.

1.4 ABBREVIATIONS AND ACRONYMS:

A. AFF – Above Finished Floor

B. AWG – American Wire Gauge

C. CCS – Copper Clad Steel

D. IDF – Intermediate Distribution Frame

E. MDF – Main Distribution Frame

F. NECA – National Electrical Contractors Association

G. PVC – Polyvinyl Chloride

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate exterior underground and pull box locations, under slab conduit, and acceptable fittings with the Division 26 Contractor.

B. Pre-installation meetings:
   1. Convene pre-installation meetings with the Division 26 Contractor. Include underground conduit stub-up locations and pull box requirements.

1.6 SUBMITTALS

A. ACTION SUBMITTALS
   1. Product Data:
      a. Submit product data in .pdf format for review no later than 60 days before beginning work.
         1) Fabric mesh innerduct
         2) Tracer wire markers
   2. Shop Drawings:
      a. Provide a site plan indicating the location of underground conduit and pull boxes, including conduit and pull box sizes.
   3. See Section 270500 - Common Work Results for Communications Systems, for submission information.

B. INFORMATIONAL SUBMITTALS (NOT USED)

C. CLOSEOUT SUBMITTALS
   1. Format:
      a. See Section 270500 - Common Work Results for Communications Systems, for additional information.
   2. Warranty Documentation: (Not used)
   3. Record Documentation:
      a. As-builts:
         1) Provide a site plan indicating the location of underground conduit and pull boxes, including conduit and pull box sizes.
   4. Test Reports: (Not used)

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installers:
      a. The project requires installers experienced in installing conduit, underground boxes, tracer wire, and fabric mesh innerduct.

PART 2 PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6 .

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Atkore International (Allied Tube & Conduit), Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions, or Southwire Company .

C. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70 0, by a nationally recognized testing laboratory, and marked for intended location and application.
   2. Comply with TIA-569-C and TIA-758 .

2.2 RIGID NONMETALLIC DUCTS

A. Underground Plastic Utilities Duct: Type EPC-40-PVCRNC or as indicated on project drawings, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Carlon, Dura-Line, or Lamson & Sessions .

C. General Requirements for Nonmetallic Ducts and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
   2. Comply with TIA-569-C 69-C and TIA-758 .

2.3 DUCT ACCESSORIES

A. Fabric Innerduct: Continuous, polyester, multi -pocket fabric innerduct, with internal pull tape and tracer wire.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: MaxCell or approved equal. .
   2. Standard Outdoor Textile Innerduct: Micro, 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250 lb polyester flat woven pull tape.
   3. Each innerduct shall be installed with unique color striping, and with corresponding color-matched pull tapes.
   4. Fabric Innerduct Fittings:
      a. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g.:4-inch plug with nine holes for cables in a 3 pack (9-cell) configuration.
      b. Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit.

B. Duct Spacers: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Atkore International (Allied Tube & Conduits), Cantex, Carlon, or Dura-Line .

C. Underground-Line Warning Tape: Underground-line warning tape specified in Section 270553 "Identification for Communications Systems."

D. Tracer Wire: Use a continuous sheathed solid conductor copper wire line, minimum #12 AWG. Sheathing shall be color coded to match the utility, unless otherwise noted on the Design Drawings.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Monolithically poured, factory-fabricated, reinforced-concrete walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Christy Concrete Products, Oldcastle Precast, and Utility Concrete Products .

C. Comply with ASTM C858 for design and manufacturing processes.

D. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, " COMMUNICATIONS ."

G. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

H. Extensions and Slabs: Designed to mate with bottom of enclosure, and made of same material as enclosure.
1. Extension shall provide increased depth of 12 inches .
2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct and duct banks, plus an additional 6 inches vertically and horizontally to accommodate alignment variations.
1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
3. Knockout panel openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
4. Knockout panels shall be 1-1/2 to 2 inches thick.

K. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
1. Type and size shall match fittings to duct or conduit to be terminated.
2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

L. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 UTILITY STRUCTURE ACCESSORIES

A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Christy Concrete Products, Oldcastle Precast, or Quazite; Hubbell Incorporated, Power Systems .

C. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.
1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

D. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.

E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to a minimum of 1-1/4 inches at base.
1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Ground Rod Sleeve: 3-inch, PVC duct sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.

H. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of nine holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

I. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic duct, metallic duct, duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012 , and traceable to NIST standards.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Communications: Type EPC-40-PVC RNC, shall be installed in a direct-buried duct bank unless otherwise indicated.

B. Underground Duct Crossing Driveways Roadways and Railroads: Type EPC-40-PVC RNC, shall be encased in reinforced concrete or GRC.

C. Stub-Ups for Communications: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for Communications:
   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 or Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-5 Precast concrete, AASHTO HB 17, H-10 or Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: structurally tested according to SCTE 77 with 3000-lbf vertical loading.
   5. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
   1. Determine exact location of existing underground utilities before excavation.
   2. Excavation shall be no longer or deeper than necessary. Backfill material shall be free from rocks and debris.
   3. Compact backfill as the excavation is filled.

B. Restoration: Replace area immediately after backfilling is completed or after construction in immediate area is complete.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

E. Cut and patch existing pavement in the path of underground duct, duct bank, and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

3.5 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct and duct bank according to NEMA TC 2 and TIA-758 .

C. Slope: Pitch duct and duct bank a minimum slope of 1:100 down toward manholes and handholes and away from buildings and equipment. Slope duct and duct bank from a high point in runs between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5 feet , both horizontally and vertically, at other locations unless otherwise indicated.
   1. Duct and duct banks shall have maximum of two 90-degree bends, or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings, and make watertight according to manufacturer's written instructions. Stagger couplings, so those of adjacent ducts do not lie in same plane.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct or duct banks are installed parallel to underground steam lines, perform calculations showing the duct or duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct or duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. End-Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct slope and without forming a trap in the line.
   2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight-line direct-buried duct and duct banks, with calculated expansion of more than 3/4 inch.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to terminator spacing 10 feet from the terminator without reducing duct slope and without forming a trap in the line.
   2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight-line duct or duct bank, with calculated expansion of more than 3/4 inch.

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct slope away from the building or forming a trap in the duct.

Use fittings manufactured for RNC duct-to-GRC conduit transition. Install GRC penetrations of building walls as specified in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

J. Sealing: Provide temporary closure at terminations of duct that has cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

K. Innerduct: Install immediately after mandreling duct. Size and type as indicated on Drawings.

L. Pulling Cord: Install 200-lbf- test nylon cord in empty duct and innerduct.

M. Concrete-Encased Duct and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct or duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 12 inches wider than duct or duct bank on each side.
3. Width: Excavate trench 3 inches wider than duct or duct bank on each side.
4. Depth: Install top of duct and duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support duct and duct bank on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Minimum Space Between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around duct or duct bank.
8. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
9. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
    a. Couple GRC to duct with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-Ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be finished floor and minimum 3 inches from conduit side to edge of slab
    c. Stub-Ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.

1) Stub-ups shall be minimum 4 inches abovefinished floor and no less than 3 inches from conduit side to edge of wall

10. Reinforcement: Reinforce concrete-encased duct and duct bank where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use trench walls to form side walls of duct and duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between ducts, and 4 inches between power and communications duct.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between ducts and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto duct. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

N. Direct-Buried Duct and Duct Banks:
1. Excavate trench bottom to provide firm and uniform support for duct and duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for duct less than 6 inches in nominal diameter.
2. Install duct with a minimum of 3 inches between duct for like services and 6 inches between power and signal duct.
3. Width: Excavate trench 12 inches wider than duct or duct bank on each side.
4. Width: Excavate trench 3 inches wider than duct or duct bank on each side.
5. Depth: Install top of duct or duct bank at least 36 inches below finished grade unless otherwise indicated.
6. Set elevation of bottom of duct or duct bank below frost line.
7. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
8. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around duct or duct bank.
9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances through floor, and at changes of direction in duct unless otherwise indicated. Encase elbows for stub-ups throughout length of elbow. Extend encasement minimum of 36 inches beyond elbow joints.

10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
    a. Couple GRC to duct with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor bases, extend GRC horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving duct at end of run free to move with expansion and contraction, as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around duct to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
    a. Place minimum of 3 inches of sand as a bed for duct and duct bank. Place sand to a minimum of 6 inches above top level of duct and duct bank.
    b. Place minimum of 6 inches of engineered fill above concrete encasement of duct bank.

O. Underground-Line Warning Tape: Bury conducting underground-line warning tape specified in Section 270553 "Identification for Communication Systems" no less than 12 inches above all concrete-encased duct and duct bank and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below frost line.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

E. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After duct has been connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for field-installed anchor bolts installed. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF INNERDUCT

A. General:
1. Protect products from the effects of moisture, UV exposure, corrosion and physical damage during construction.
2. Select approved innerduct suitable for specific installation environments.

B. Textile Innerduct Installation:
1. Provide in conduit and wire ways using continuous unspliced lengths between maintenance holes, pull boxes, and/or termination points as indicated on the drawings.
2. Provide suitable textile innerduct slack in the maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.
3. Textile Innerduct Mountings, Hangers and Attachments: When exposed indoors or in maintenance holes, hold firmly in place using independent support.
    a. Design & install hangers and other similar fittings adequate to support loads and so as to not damage innerduct.
    b. Do not fasten textile innerduct to steam, water, or other piping, ductwork, mechanical equipment, electrical equipment, electrical raceways, or wires.
    c. Secure textile innerduct using UV-resistant plastic cable ties.
4. Maintenance Hole and Hand Hole Installation:
    a. At locations where textile innerduct will be continuous through a manhole or hand hole, allow sufficient slack so that the innerduct may be secured to the side of the vault maintaining the minimum bend radius.
    b. At maintenance holes serving as the junction location, pull the exposed end of the innerduct to the far end of the vault, install termination bag, and secure to the vault.

C. Penetrations:
   1. Seal all conduit and textile innerduct entering structures at the first box or outlet to prevent gases, liquids or vermin from entering the structure.

3.8 GROUNDING

A. Ground underground duct, duct bank, and utility structures according to Section 270526 - Grounding And Bonding For Communications Systems.

3.9 SYSTEMS INTEGRATION:

A. Underground conduit stubbing into the MDF or IDF should be no taller than 3 inches AFF and no further away than 3 inches from the backboard.

B. Division 26 Contractor shall install detectable warning tape at a minimum of 6 inches above buried exterior underground conduit.

C. Division 27 Contractor shall install minimum 14 AWG CCS orange tracer wire in buried exterior underground conduit. Leave 3 feet of wire exposed on IDF end. Securely fasten tracer to orange Rhino HideOut™ using 1 inch conduit.

D. Division 26 Contractor shall install Muletape® (WP1800P/3000FT) within each underground conduit.

E. See contract drawings for conduit sizes.

F. Provide rated lids and boxes. Provide lids with a minimum of 2 bolts.

G. Provide 2 inches of number 2 gravel to entirely cover the ground inside of the box.

H. Pull box lids shall be labeled, “COMMUNICATIONS”.

I. Install pull boxes for underground conduit runs over 400 feet.

J. Install fabric mesh innerduct with a swivel.

3.10 EXAMINATION

A. Verification of Conditions:
   1. Verify conduit has been installed as shown on the contract drawings.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 270526 "Grounding and Bonding for Communications Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.12 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
1. Tests: (Not used)
2. Inspections:
a. Inspections for appropriate installation of underground conduit, fittings, pull boxes, and fabric mesh innerduct are the responsibility of the Project Manager.

3.13 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris.

B. Clean internal surfaces of manholes, including sump.
1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Round sleeves.
   2. Firestopping
   3. Firestopped Sleeve Assemblies

B. Related Requirements:
   1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:
   1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

2.2 FIRESTOPPING

A. Where applicable, refer to section 078413, "Penetration Firestopping."

B. Description: 1. Firestops shall consist of an asbestos-free fill material, forming/backing/damming materials, and accessories needed to complete a UL classified through-penetration firestopping system. Fill material shall not slump or sag and shall be the required thickness in the fully cured state.

C. Firestops shall be designed to seal through-penetrations against flame, heat, smoke, and water in compliance with ASTM E84-2016, ASTM E119-2016a, ASTM E814-2013a, UL 1479 and UL 723-2008.

D. Firestops shall be specifically designed and rated for the individual application, including movement, materials, moisture, penetrating item material, and fire and smoke ratings of the penetrated construction.

2.3 FIRESTOPPED SLEEVE ASSEMBLIES

A. Description: An enclosed fire rated cable management device where cable bundles penetrate rated partitions.
   1. The cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated.
   2. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.

B. The firestop system assembly shall be able accessible and re-installed from one side of the wall.

C. UL classified for use in wall and floor systems rated for up to 3 hours

D. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Specified Technologies, Inc. - EZ-Path
   2. Legrand – FlameStopper
   3. Hilti Speed Sleeve
   4. Abesco Fire Ltd. - Cable Transit System

2.4 SMOKE & ACOUSTICAL SLEEVE ASSEMBLIES

A. Description: An enclosed smoke & acoustic rates cable management device where cable bundles penetrate partitions.
   1. The cable management device shall contain integrated materials to stop smoke transfer and maintain STC rating of the penetrated barrier or partition.
   2. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.

B. The sleeve assembly shall be accessible and re-installed from one side of the wall.

C. UL classified for use in wall and floor systems.

D. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Specified Technologies, Inc.
   2. Legrand
   3. Hilti
   4. 3M™

2.5 FIRE RATED PUTTY PADS

A. Description: Moldable firestop putties for use around boxes and gaps.

B. Putty pads shall be made of intumescent material.

C. UL classified.

D. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Specified Technologies, Inc.
   2. Hilti
   3. 3M™

PART 3 EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
      b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors a minimum of 2 inches above finished floor level unless otherwise noted on project drawings. Install sleeves during erection of floors.
   6. Wall sleeves shall extend 4" from each side of the walls.
   7. Openings through slabs for communications risers shall be finished with a 4" wide by 2" high curb around the opening.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for wall assemblies.
   3. Wall sleeves shall extend 4" from each side of the walls.

D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:
   1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
   2. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

C. Install in accordance with the manufacturer's published instructions to achieve ratings and classifications specified herein. A copy of these instructions shall be maintained and available on site.

D. Install sleeve-seal fittings in new walls and slabs as they are constructed.
   1. Provide where cables pass through walls or elevated floor slabs within communications rooms.
   2. Provide where cable trays pass through rated walls or elevated floor slabs. Install 4 sleeves at each penetration, minimum.
   3. Install associated rating information decal on both sides of sleeve. Sign and date the decal.
   4. Install sleeve systems with flanges and fire-rated caulk as recommended by the manufacturer.

E. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

3.3 INSTALLATION OF FIRESTOP SYSTEMS

A. Close and firestop abandoned penetrations and penetrations through fire- and smoke-rated construction. Materials used to seal these penetrations shall continue the construction’s fire and smoke resistance ratings uninterrupted and shall maintain an effective barrier against the spread of flame, smoke, water and hot gases.

B. Install after installation of raceways and cable trays.

3.4 INSTALLATION OF SLEEVE ASSEMBLIES

A. Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

B. Comply with manufacturer’s instructions for installation of firestopping products.

END OF SECTION

SECTION 270548 - SEISMIC CONTROLS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Elastomeric isolation pads.
2. Neoprene Isolation Washers and Grommets
3. Restraints - rigid type.
4. Restraints - cable type.
5. Restraint accessories.
6. Post-installed concrete anchors.
7. Concrete inserts.

B. Related Requirements:
1. Section 270529 "Hangers and Supports for Communications Systems" for commonly used communications system supports and installation requirements.

1.3 DEFINITIONS

A. Designated Seismic System: A communications system component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated load capacity for each seismic - and wind-load-restraint device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic - and wind-load-restraint component used.
3. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by an agency acceptable to authorities having jurisdiction.
4. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic and wind-load bracing for communications components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Consequential Damage: Provide additional seismic and wind-load restraints for suspended communications components or anchorage of floor-, roof-, or wall-mounted communications components as indicated in ASCE/SEI 7-10 so that failure of a non-essential or essential communications component will not cause failure of any other essential architectural, mechanical, or communications building component.

B. Fire/Smoke Resistance: Seismic - and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

C. Component Supports:
1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-10 Section 13.6.

2.2 RESTRAINTS - RIGID TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CADDY; nVent.
2. Gripple Inc.
3. International Seismic Application Technology (ISAT).
4. Kinetics Noise Control, Inc.
5. Mason Industries, Inc.
6. Vibration Eliminator Co., Inc.
7. Vibration Mountings & Controls, Inc.
8. Vibro-Acoustics.

B. Description: Shop- or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; nVent.
   2. Gripple Inc.
   3. International Seismic Application Technology (ISAT).
   4. Kinetics Noise Control, Inc.
   5. Mason Industries, Inc.
   6. Vibration Eliminator Co., Inc.
   7. Vibration Mountings & Controls, Inc.
   8. Vibro-Acoustics.

B. Seismic - and Wind-Load-Restraint Cables: ASTM A1023 galvanized or ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.

C. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.4 RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; nVent.
   2. Gripple Inc.
   3. International Seismic Application Technology (ISAT).
   4. Kinetics Noise Control, Inc.
   5. Mason Industries, Inc.
   6. Vibration Eliminator Co., Inc.
   7. Vibration Mounting & Controls, Inc.
   8. Vibro-Acoustics.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Non-metallic stiffeners are unacceptable.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. DeWALT.
      b. Hilti, Inc.
      c. Simpson Strong-Tie Co., Inc.
   2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

B. Adhesive Anchor Bolts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. DeWALT.
      b. Hilti, Inc.
      c. Simpson Strong-Tie Co., Inc.
   2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

C. Provide post-installed concrete anchors which have been prequalified for use in seismic applications. Post-installed concrete anchors must conform to all requirements of ASCE/SEI 7-10, Ch. 13.
   1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
   2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

D. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.
   1. Undercut expansion anchors are permitted.

2.6 CONCRETE INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. DeWALT.
   2. Gripple Inc.
   3. Hilti, Inc.
   4. International Seismic Application Technology (ISAT).
   5. Simpson Strong-Tie Co., Inc.

B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.

C. Comply with MSS SP-58.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static , wind-load, and seismic loads within specified loading limits.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

END OF SECTION

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Backboards.
   2. Boxes, enclosures, and cabinets.
   3. Power strips.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. RCDD: Registered communications distribution designer.

D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

E. TGB: Telecommunications grounding bus bar.

F. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD .
2. Installation Supervision: Installation shall be under direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches, AC grade void-free.

B. Backboard Paint: Light-colored fire-retardant paint . Paint plywood face and all sides with two coats of paint, do not paint over fire rated stamp.

C. Mounting: Anchor with 3/8" toggle bolts or concrete expansion anchors, where applicable, and 2" washers on each corner and 4' on center as required on all walls and above door frame of each communications room/space. Install at 6" AFF to 8' 6" AFF with fire rating stamp facing outwards and visible.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Comply with requirements in Section 271116 "Communications Racks, Frames, and Enclosures."

2.4 POWER STRIPS

A. Comply with requirements in Section 271116 "Communications Racks, Frames, and Enclosures."

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with the latest edition of BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with the latest edition of BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.
   1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.

4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:
1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint , leaving fire rating stamp visible.
a. If the stamp is painted-over, the contractor shall be required to replace and properly repaint the plywood.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

3.5 CLEANING

A. Remove dust, dirt, rust, stains, and temporary covers.

B. Foreign matter shall be blown, vacuumed, or cleaned out of and from new equipment, devices, switches, controls, and panels.

C. Clean and polish identification plates.

D. In equipment rooms, clean equipment, conduit and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

E. Remove all excess material from the Project site.

END OF SECTION

SECTION 271116 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. 19-inch equipment racks.
2. 19-inch freestanding equipment cabinets.
3. Power strips.
4. Grounding.
5. Labeling.

B. Related Requirements:
1. Section 271110 "Communications Equipment Room Fittings" for backboards and accessories.
2. Section 270526 "Grounding and Bonding for Telecommunications Equipment" for TMGBs and TGBs.
3. Section 270536 "Cable Trays for Communications Systems" for cable trays and cable tray accessories.
4. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
5. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. TGB: Telecommunications grounding bus bar.

G. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
   2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
   3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
   2. Installation Supervision: Installation shall be under direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. UL listed.

C. RoHS compliant.

D. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 BACKBOARDS

A. Backboards: Plywood, void-free, AC grade or better,fire-retardant treated, 3/4"D x 48"W x 96"H inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

B. Comply with requirements in Section 271100 "Communications Equipment Room Fittings."

2.3 19-INCH EQUIPMENT RACKS

A. Description: Two- and four- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.

B. Manufacturers: Subject to compliance with requirements, undefined:
   1. CPI Chatsworth Products.
   2. Great Lakes Case and Cabinet.
   3. Leviton Manufacturing Co., Inc.
   4. Middle Atlantic Products; Legrand North America, LLC.
   5. nVent (Hoffman).
   6. Ortronics, Inc.
   7. Panduit Corp.
   8. Siemon Co. (The).

C. General Requirements:
   1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Material: Extruded steel.
   3. Finish: Manufacturer's standard, baked-polyester powder coat.
   4. Color: Black .

D. Floor-Mounted Racks:
   1. Overall Height: As indicated on Drawings .

2. Upright Depth: 3 inches.
3. Two-Post Load Rating: 400 lb.
4. Four-Post Load Rating: 2000 lb.
5. Number of Rack Units per Rack: 51.
   a. Numbering: Every rack units, on interior of rack.
6. Threads: 12-24.
7. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
8. Base shall have a minimum of four mounting holes for permanent attachment to floor.
9. Top shall have provisions for attaching to cable tray or ceiling.
10. Self-leveling.

E. Cable Management:
1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 UNINTERUPPTIBLE POWER SUPPLY (UPS)

A. System shall be a self contained unit designed for the support of IT equipment.

B. Provide one UPS for each active rack indicated on drawings.

C. Batteries: lead-acid type.

D. Integral lightning and surge protection complying with IEEE C62.41.1-2002 (R2008), IEEE C62.41.2-2002 (COR 1-2012), and UL 1449-2014.

E. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Schneider Electric (APC)
2. Vertiv
3. Eaton

F. RackUPS
1. Architecture: Line-Intera
2. Load: 5kVA.
3. Input Voltage: 208v.
4. Input Plug: NEMA L6-30P
5. Output Voltage: 120V & 208V
6. Output Receptacles: 2 NEMA L6-20R
7. Output Receptacles: NEMA 5-20R
8. Output Receptacles: 1 NEMA L6-30R
9. Runtime at Full Load: 9 minutes.
10. Form Factor: Rack-Mount.

11. Network Management Card
12. Environmental Monitoring Card
13. Rack-Mount Step Down Transformer.

2.5 POWER STRIPS

A. Power Strips: Comply with UL 1363.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Rack mounting.
   3. LED indicator lights for power and protection status.
   4. LED indicator lights for reverse polarity and open outlet ground.
   5. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Chatsworth Products, Inc. (CPI)
      b. Eaton.
      c. Schneider Electric (APC)
   6. Vertical Surge-Protected Power Strips
      a. Input Plug: NEMA 5-20P
      b. Input Cord Length: 10
      c. Output: 10 NEMA 5-15R
      d. Metered: LED Display indicating Voltage and Amps.
      e. Provide two vertical power strips for each active rack as indicated on drawings.
      f. Provide all mounting hardware and standoff brackets as required.

2.6 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-D. Predrilling shall be with holes for use with lugs specified in this Section.
   1. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

2.7 LABELING

A. Comply with TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 270533 "Identification for Communications Systems."

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
   1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
   4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Furnish and install a horizontal cable manager below each patch panel in the Rack. Refer to Project Drawings for size of Wire Managers. Horizontal cable managers are not required below angled patch panels.

H. Outdoor enclosures to be provided with ventilation according to equipment manufacturer's recommendations.

3.2 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.
   1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-D. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Comply with requirements in Section 270553 "Identification for Communications Systems."

END OF SECTION

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. 9/125 micrometer single-mode, indoor-outdoor optical fiber cable (OS2).
   2. Optical fiber cable connecting hardware, patch panels, and cross-connects.
   3. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:
   a. Telecommunications rooms plans and elevations.
   b. Telecommunications pathways.
   c. Telecommunications system access points.
   d. Telecommunications grounding system.
   e. Cross-connects.
   f. Patch panels.
   g. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Optical fiber cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

B. Contractor to submit all cable test results and any test documentation required prior to acceptance by the Owner.

C. Subsequent to the installation, and prior to acceptance of the work, the contractor shall prepare and issue record (as-built) drawings, in Adobe PDF and BIM format, that reflect the lengths of cables installed, the actual manner and conditions of installation, including all deletions from, additions to or departures from the contract documents. These documents are to include the information outlet station numbers and cable routing where it varies from the original plan.

D. Provide cable termination schedules for all cables installed under the Work. Schedules shall be in printed form and on CD in Microsoft Excel format.

E. Provide Operation and Maintenance Manuals including wiring diagrams, parts list, shop drawings and manufacturers' information on all equipment and cables provided under this Work. Provide manuals within fifteen days of systems acceptance.

F. Upon completion of the work, the contractor shall coordinate with the manufacturer the issuance of a full warranty on the entire copper and fiber optic cable plant including the horizontal cabling for both parts and labor. The cabling contractor at his sole expense will correct any deficiencies determined by the manufacturer.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings , Cabling Administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.
   3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set .
   2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-E.

2.2 9/125 MICROMETER, SINGLE-MODE, INDOOR-OUTDOOR OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, stranded loose tube, optical fiber cable. Number of strands as indicated on project drawings.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Berk-Tek Leviton.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable; General Cable Corporation.
5. Optical Cable Corporation.
6. Superior Essex.

C. Standards:
1. Comply with TIA-492CAAB for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-104-696 for mechanical properties.

D. Maximum Attenuation: 0.4 dB/km at 1310 nm; 0.3 dB/km at 1550 nm.

E. Jacket:
1. Jacket Color: Black.
2. Type: Dielectric Armored.
3. Armor Material: Aluminum.
4. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
5. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

F. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
1. Plenum Rated, Armored (Conductive): Type OFCP installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2.3 9/125 MICROMETER, SINGLE-MODE, ARMORED, INSIDE PLANT OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, tight buffered, optical fiber cable. Number of strands as indicated on project drawings.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Berk-Tek Leviton.
   2. CommScope, Inc.
   3. Corning Cable Systems.
   4. General Cable; General Cable Corporation.
   5. Optical Cable Corporation.
   6. Superior Essex.

C. Standards:
   1. Comply with TIA-492CAAA for detailed specifications.
   2. Comply with TIA-568-C.3 for performance specifications.
   3. Comply with ICEA S-83-596 for mechanical properties.

D. Conductive cable shall be aluminum armored type.

E. Maximum Attenuation: 0.4 dB/km at 1310 nm; 0.3 dB/km at 1550 nm.

F. Jacket:
   1. Jacket Color: Yellow.
   2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
   3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
   1. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.

2.4 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Berk-Tek, a Leviton Company.
   2. CommScope, Inc.
   3. Corning Optical Communications; Corning Incorporated.
   4. Optical Cable Corporation (OCC).
   5. Panduit Corporation.

B. Standards:
   1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
   2. Comply with TIA-568-C.3.

C. Fiber Optic Enclosure
   1. Shall provide cross connect, interconnect, and splicing capabilities and contain troughs for supporting and routing of the fiber cables and jumpers.
   2. Shall consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of fibers.
   3. Shall have a window section to insert connector panels for mounting of connectorized fibers.

4. Shall provide capacity to accommodate quantity of terminations as indicated on the project drawings, plus 25% spare capacity for future growth.
5. Refer to Project Drawings for Wall-Mount and Rack-Mount requirements.

D. Fiber Connector Panels
1. Modular, quick-fastening steel plate, powder-coated to match the fiber enclosure finish.
2. Shall have a pre-installed array of fiber adapters of a specific connector type, available in low- or high-density versions.
3. Pre-installed, push-pull type quick-release fasteners for quick snap-in installation.
4. Suitable for mounting either vertically or horizontally.
5. Panels with SC or LC adapters shall have precision phosphor-bronze alignment sleeves that are suitable for either singlemode or multimode transmission. SC/APC adapters shall have precision ceramic alignment sleeves.
6. All fiber panels shall have dust caps installed.

E. Fiber Optic Connectors
1. Field Polish Connectors
   a. LC small form factor (SFF) field polish connectors with rear pivot latch are TIA-604 FOCIS-10 compatible. LC simplex and duplex connectors are field terminable. The fibers shall terminate in 1.25mm ceramic ferrules with non-optical disconnect functionality and an average insertion loss of 0.1dB per mated pair for multimode and singlemode fiber.
   b. SC field polish connectors are TIA-604 FOCIS-3 compliant. SC simplex and duplex connectors are field terminable. The fibers shall terminate in 2.5mm ceramic ferrules with non-optical disconnect functionality and an average insertion loss of .1dB (multimode) and .15dB (singlemode) per mated pair.
2. Connector Pigtails
   a. Optical fiber pigtails shall be constructed with a fiber connector, factory terminated onto a cut length of 900 micron buffered fiber cable of specific color.
   b. Connector pigtail terminations shall be heat-cured epoxy type with a machine polish, inspected 100% for polish quality and mated-pair insertion loss.
   c. Epoxy volume within each connector shall be sufficient to properly surround and strain relieve the buffer layer at the buffer/fiber transition inside the connector body.
   d. Pigtails shall be available in standard lengths of 3 meters.
   e. Connector shall be LC-Style complying with TIA-604-10-B.
   f. Factory terminated connectors shall comply with the applicable ANSI/TIA-604 Intermateability standard.

F. Splices and Closures
1. The fiber splice module shall be utilized for all outside plant terminations. The link shall consist of the fiber cable, the splice, the splice tray holder/closure, the fiber panel/coupler, a pre-manufactured fiber pigtail with pre-polished fiber connector, and a fiber jumper to connect the pigtail-coupled link to the appropriate electronic switch. The fiber splice module shall meet the following specifications:
   a. Fusion: Optical fiber splices shall not exceed a maximum optical attenuation of 0.3 dB when measured in accordance with ANSI/TIA-455-34, Method A (factory testing) or

ANSI/TIA-455-59 (field testing). Optical fiber splices shall have a minimum return loss of 20 dB for multimode, 26 dB for single mode, when measured in accordance with ANSI/TIA-455-107. The minimum single mode return loss for broadband analog video (CATV) applications is 55 dB.

b. All fusion splices shall be mounted in protective trays within the closure.
c. Joins single mode or multi-mode fibers.
d. Establishes a permanent fusion splice.
e. May be used in OSP and/or premises applications.
f. Accept 250 and 900 micron fibers.
g. Re-enterable, portable and reusable.
h. Require no polishing.
i. Require no adhesives.
j. No loose parts.
k. Unlimited shelf life.

G. Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Adapter Panel: Twelve for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

H. Patch Cords: Factory-made, duplex cables in lengths as requested by Owner or indicated on project drawings unless specified otherwise.
1. Patch cord manufacturer shall match the selected fiber system solution and maintain the selected manufacturer's warranty.
2. Patch Cord Lengths: As indicated on the project drawings.
3. Quantities: Provide one fiber patch cord for 50% of strands installed.
4. The fiber optic patch cords shall be consistent with termination type and fiber optic cable type. (i.e. singlemode or multimode).
5. Field terminated patch cords are not acceptable.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-E.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 270553 "Identification for Communication Systems."

2.7 SOURCE QUALITY CONTROL

A. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

B. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:
   1. Comply with TIA-568-C.1 and TIA-568-C.3.
   2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
   3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   4. Ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities.
   5. Install plenum rated cables where cables are not installed in conduits or enclosed wireways.
   6. Install cables designed for the installation environment.
      a. For each cable distribution application, install fiber optic cables UL listed for the application.
      b. For cable distribution applications including enclosures or raceways underground or in slabs on grade, install fiber optic cables designed for use in wet locations.
   7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   9. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, provide a 10-foot- long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
14. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
15. Place fiber-optic cable so as to maintain the minimum cable bend radius limits specified by the selected manufacturer.
16. Place fiber-optic cables transitioning between the cable trays and cabinets or racks in a neat and orderly manner per NEC 318.11(b) requirements and pathway requirements of TIA 569-A. Velcro transitioning bundles.
17. Secure the cables in the Communication Rooms with velcro cable ties or straps as needed to prevent cables from sagging or becoming disorderly.
18. Follow selected manufacturer’s installation instructions for connector installation.
19. Bring fiber optic cables into patch panels or cabinets at one location. Secure cables inside patch panels or cabinets at entrance points by securing fiber jackets. Break out individual fiber cables inside of panel or cabinet.
20. Fusion splices shall be located in attached splice trays.
21. Follow guidance of ANSI/TIA-568-C.3 regarding polarity management of fiber elements in the permanent link. Mate terminated fiber-optic cables on adapter panel housings, in standard color code order.
22. Use connector manufacturer’s recommended tools.
23. Fiber-optic connecting hardware and material including patch panels, connectors, cross-connect cables, patch cords, and other components used to connect fiber-optic cable shall be sourced from the same manufacturer.
24. Unarmored Fiber cables shall be installed in innerducts rated for the installation environment.

C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.5 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607-E and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-D. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
   1. Administration Class: Class 3.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-D.

C. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
   4. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar

jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-D, for the following:
   1. Flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Optical Fiber Cable Tests:
      a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
      b. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated by the manufacturer within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request.
      c. Test equipment and modules shall be within the calibration period recommended by the manufacturer of the test equipment in order to achieve the manufacturer-specified measurement accuracy, and shall be within 1 year of the test date.
      d. Link End-to-End Attenuation Tests:
         1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
         2) Single-mode backbone links shall be tested bidirectionally at both 1310 nm and 1550 nm in accordance with TIA 526-7A-2015, Method A.1, One Reference Jumper. Single-mode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm.
         3) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.
      e. Cable test results with negative loss values shall be deemed invalid. Fiber terminations shall be cleaned, evaluated, and retested until the results contain no negative loss values at no additional cost to the Owner. Verify that the cable test results are valid.
   4. Optical Time Domain Reflectometer (OTDR) Tests:
      a. Perform OTDR testing on outside-plant fiber.

b. OTDR testing shall meet the following requirements for both single-mode and multimode fiber cabling:
   1) Reflective events (connections) shall not exceed 0.5 dB.
   2) Non-reflective events (splices) shall not exceed 0.15 dB.
   3) Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.
   4) Each fiber link and channel shall be tested in both directions.
      a) Multimode: 850 nm and 1300 nm.
      b) Single-mode: 1310 nm and 1550 nm.
   5) A launch cable shall be installed between the OTDR and the first link in the channel.
   6) A receive cable shall be installed between the last link connection.
   7) The length if each fiber shall be recorded.

C. Data for each measurement shall be documented.
   1. The test results/measurements shall be submitted in both the test equipment manufacturer's raw data file and searchable PDF format files.
   2. The database for the complete project shall be stored and delivered in digital format prior to Owner acceptance of the building. This digital format shall include the software tools required to view, inspect, and print any selection of the test reports.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. A representative of the Owner may elect to test 5% of the installed cables. The test results will be compared with the submitted results. In the event that more than 2% of the compared results differ from the submitted results, the Owner may contract with a third-party testing firm to retest 100% of the installation and the cost shall be borne by the Contractor.

G. Prepare test and inspection reports.

END OF SECTION

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Category 6 twisted pair cable.
   2. Category 6a twisted pair cable.
   3. Twisted pair cable hardware, including plugs and jacks.
   4. Cabling identification products.
   5. Grounding provisions for twisted pair cable.
   6. Source quality control requirements for twisted pair cable.

1.2 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
   1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

A. General Requirements for submittals:
   1. Within 14 days after notice to proceed, submit an anticipated Project Schedule, and a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Architect and/or Engineer will advise of any conflicts in reviewing submittals that the proposed schedule presents.
   2. Submittals shall be prepared in a line-by-line format corresponding to these Specifications and shall indicate compliance with each requirement specified herein and indicated in the Drawings.
   3. Submittals shall be prepared with a table of contents and hyperlinks to the headers of each submitted item.
   4. Resubmittals that are required to address review comments shall include a cover transmittal with a written explanation of how each review comment has been addressed.
   5. Submittal data for each Specification Section shall be submitted as a single package.
   6. Submittals not specifically required, or not complying with the format requirements, will be returned unreviewed.
   7. All submittals shall be submitted electronically in PDF format unless stated otherwise.
   8. Submittals are required before installation begins. Equipment shall not be ordered, and pay requests will not be approved prior to receipt and approval of submittals.

B. Product Data: For each type of product.
   1. Product submittals shall include all equipment, materials and cables being utilized on the project.
   2. Data sheets shall clearly indicate the specific model or part number being submitted for review including sizes, color, finishes, and other attributes to adequately allow submitted product to be reviewed.

3. All related system components shall be submitted as part of the same submission (i.e. patch panels, jacks, faceplates, cable, etc.).
4. Indicate manufacturer's installation instructions, where applicable, including any deviations required due to project conditions.
5. Furnish sample products as required for review by Engineer and/or Architect including any assembly mockups.

C. Shop Drawings: Reviewed and stamped by RCDD.
1. Reproductions or electronic versions of design drawings shall not be used in the preparation of shop drawings.
2. Wiring diagrams indicating proposed connections of equipment, equipment types, model numbers, and designations for cables and termination points.
3. Floor plans indicating equipment locations including equipment identification and references to wiring details.
4. Major, coordinated conduit and cable tray pathways.
5. Shop drawings of fabricated or modified units, if any.
6. Seismic and wind restraint devices, including calculations, restraint selection, installation details and written confirmation that a licensed engineer prepared the calculations.
7. System Labeling Schedules:
   a. Electronic copy of labeling schedules, in software and format selected by Owner.
8. Cabling administration Drawings and printouts.
9. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
   a. Telecommunications rooms plans and elevations.
   b. Telecommunications pathways.
   c. Telecommunications system access points.
   d. Telecommunications grounding system.
   e. Telecommunications conductor drop locations.
   f. Typical telecommunications details.
   g. Mechanical, electrical, and plumbing systems.

D. Twisted pair cable testing plan.

E. Samples: For telecommunications jacks and plugs, in specified finish, one for each type and configuration and cover plates for color selection and evaluation of technical features.

F. Field Quality-Control Submittals:
1. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Contractor shall submit all cable test results and any test documentation required prior to acceptance by owner.

C. Subsequent to the installation, and prior to acceptance of the work, the contractor shall prepare and issue record (as-built) drawings, in Adobe PDF and BIM format, that reflect the lengths of cables installed, the actual manner and conditions of installation, including all deletions from, additions to or departures from the contract documents. These documents are to include the information outlet station numbers and cable routing where it varies from the original plan.

D. Provide cable termination schedules for all cables installed under the Work. Schedules shall be in printed form and on CD in Microsoft Excel format.

E. Provide Operation and Maintenance Manuals including wiring diagrams, parts list, shop drawings and manufacturers' information on all equipment and cables provided under this Work. Provide manuals within fifteen days of systems acceptance.

F. Upon completion of the work, the contractor shall coordinate with the manufacturer the issuance of a full warranty on the entire copper and fiber optic cable plant including the horizontal cabling for both parts and labor. The cabling contractor at his sole expense will correct any deficiencies determined by the manufacturer.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Cover Plates: One of each type.
   2. Jacks: Ten of each type.
   3. Multiuser Telecommunications Outlet Assemblies: One of each type.
   4. Patch-Panel Units: One of each type.
   5. Plugs: Ten of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings , cabling administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.
   3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-E.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
   1. Communications, Plenum Rated:
      a. Type CMP complying with UL 1685 or Type CMP in listed cable routing assembly.
   2. Communications, Non-Plenum Rated:
      a. Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

D. Cable Construction
   1. Listed CMP cable: Solid copper conductors with fluorinated ethylene propylene (FEP)/polyolefin insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.
   2. Indoor/Outdoor CMP cable: Rated for wet locations with solid copper conductors covered in fluorinated ethylene propylene (FEP)/polyolefin insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.

3. OSP outdoor cable rated for wet locations: Solid copper conductors with polyolefin insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket.

E. Minimum compliant cables are not acceptable.

F. Copper Clad Aluminum cables are not acceptable.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden Inc.
2. Berk-Tek, a Leviton Company.
3. General Cable; Prysmian Group North America.
4. Hitachi Cable America Inc.
5. Mohawk; a division of Belden Networking, Inc.
6. Siemon Co.
7. Superior Essex Inc.; subsidiary of LS Corp.

C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP) .

F. Cable Rating: Plenum.

G. Jacket: Color shall be as indicated on project drawings; thermoplastic.

2.4 CATEGORY 6A TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden Inc.
2. Berk-Tek, a Leviton Company.
3. General Cable; Prysmian Group North America.
4. Hitachi Cable America Inc.
5. Mohawk; a division of Belden Networking, Inc.
6. Panduit Corp.
7. Siemon Co.
8. Superior Essex Inc.; subsidiary of LS Corp.

C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP) .

F. Cable Rating: Plenum.

G. Jacket: Color shall be as indicated on project drawings; thermoplastic.

2.5 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Leviton Manufacturing Co., Inc.
2. Ortronics, Inc.
3. Panduit Corp.
4. Siemon Co. (The).

C. General Requirements for Twisted Pair Cable Hardware:
1. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
2. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

E. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
   a. Style: Flat
   b. Modular type panels utilizing insertable jacks.
      1) Provide additional insertable jacks, as needed, to populate all ports on modular panels.
   c. Universal T568A and T568B wiring labels.
   d. Labeling areas adjacent to conductors.
   e. Replaceable connectors.
   f. 24 or 48 ports as indicated on the project drawings.
   g. Rear strain-relief bar.
2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.

F. Patch Cords: Factory-made, four-pair cables in lengths, quantities and colors as indicated on the project drawings; terminated with an eight-position modular plug at each end.
1. Patch cords shall have color-coded boots for circuit identification.
2. Modular data patch cords shall meet channel performance requirements specified herein, and shall be 28 AWG, stranded conductors insulated with solid polyolefin, tightly twisted into individual pairs and jacketed with flame retardant PVC.
3. Patch cords shall have latch guards to protect against snagging.
4. Field terminated patch cords are not acceptable.

5. Patch cords shall be provided as part of the warranted channel solution.
6. Patch cables shall be made of stranded cable and shall meet TIA/EIA 568B.2 requirements for patch cords. Cable used for the construction of patch cables shall be UL or ETL verified to meet the channel Category for voice, data and A/V requirements and the cable jacket shall be labeled to indicate verification. Patch cables shall be boot-less.

G. Modular Plug Terminated Link (MPTL) (Direct Connect)
1. Standard: Conform to TIA-568.2-D, Annex F
2. Uses: Termination at end device including Wireless Access Points, CCTV Cameras, TV Displays, Projectors, and other devices as indicated on the project drawings.
3. Use only where specifically indicated on the Project Drawings.

H. Jacks and Jack Assemblies:
1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.
5. Refer to project drawings for exact quantities and configurations.
6. Keystone-Style jacks shall be provided in floor boxes, poke-thru's, modular furniture adapter plates, etc. where required on project drawings.

I. Industrial / Ruggedized Components
1. Specifier: For Hazardous Locations with specific Class X, Division Y classifications, additional specification edits are required.
2. Shall be used in areas containing dust, moisture, vibration, and chemicals as indicated on the project drawings.
3. IP66/IP67 rated.
4. Components include information outlets, Plugs, Patch Cords, Surface Mount Boxes, Stainless Steel faceplates, and other components as required.
5. Install dust caps on all unused ports.

J. Faceplates / Cover Plates:
1. Four port, vertical single gang cover plates designed to mount to single gang wall boxes or as indicated on project drawings.
2. Plastic Cover Plate: High-impact plastic. Coordinate color with Section 260533 "Raceway and Boxes for Electrical Systems" and with Architect.
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
4. Faceplates shall be designed with flush port openings to accept jacks and other configurations indicated on the Drawings.
5. Faceplates shall not extend more that 0.25" from face of wall.
6. Faceplates shall have an integrated label holder with clear plastic cover. Single gang faceplates shall have 2 integrated label holders with clear plastic covers; one shall be above the jacks and one shall be below the jacks. Double gang faceplates shall have 4 integrated label holders with clear plastic covers; two shall be above the jacks and two shall be below the jacks.

K. Modular Furniture Adapter Faceplates
1. Faceplates shall be designed for use within modular furniture.

2. Faceplates shall have an integrated label holder with clear plastic cover.
3. Confirm dimension of furniture knockout with proposed modular furniture adapter to ensure compatibility.
4. Color: black for dark furniture; ivory for light colored furniture; as directed by architect.

L. Floor Box / Poke-Thru Adapter Plates
1. Coordinate with requirements of Division 26 as applicable.
2. Adapter Plates shall accept 8P8C Jack assemblies, A/V Inserts/Connectors and other connectivity as required by project documents.

M. Surface Mount Boxes
1. 1-Port and 2-Port surface mount boxes as indicated on the project drawings.
2. Plenum rated as required.
3. Shall accept jacks from the same manufacturer as other components used throughout the project.

N. Legend:
1. Snap-in, clear-label covers and machine-printed paper inserts.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA-568-C.1.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 WIRING METHODS

A. Routing:
1. Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
   a. Install plenum cable in environmental air spaces, including plenum ceilings.
   b. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use

lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."

B. Comply with Section 270528 "Pathways for Communications Systems."

C. Comply with Section 270529 "Hangers and Supports for Communications Systems."

D. Comply with Section 270536 "Cable Trays for Communications Systems."

E. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. 8P8C Jack assemblies shall be wired per the pin/pair assignments indicated in ANSI/TIA-568.1D-2015 designated T568B configuration.

C. General Requirements for Cabling:
   1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
   2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
   3. Horizontal cables shall be installed in a star topology from each communications outlet to the Telecommunications room serving that area.
   4. The length of each horizontal cable from the Telecommunications room to the communications outlet shall not exceed 295'. Coordinate with the conduit and cable tray installation and modify as necessary to ensure distance requirements are not exceeded.
   5. Install 110-style IDC termination hardware unless otherwise indicated.
   6. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
   7. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   8. MUTOA shall not be used as a cross-connect point.
   9. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   10. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
   11. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.

12. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
13. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
14. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
15. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
16. Observe and comply with manufacturer recommended bending radius and pulling strength requirements of the cables during handling and installation.
17. Provide clutch or shear pin protection for cables during cable pulling to ensure cable pulling tension is not exceeded.
18. Conceal horizontal cables within ceilings and walls.
19. Cables, when not installed in conduit or cable tray, shall be bundled in groups of no more than 48 cables for Category 5e and 6, and no more than 24 cables for Category-6A. Cable bundle quantities exceeding these limits may cause deformation of the bottom cables within the bundle and degrade cable performance. Cable raceways shall not be filled greater than the ANSI TIA-569-A maximum fill for the particular raceway type or 40%.
20. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
21. Provide temporary protection of cables before termination. Cables shall not be left lying on the floor. Bundle and use Velcro or hook and loop tape to provide protection.
22. Provide a 3’ service loop at the entrance of conduits that terminate at communications wall outlets.
23. Provide a 10' service loop at the entrance of conduits that terminate at poke-thru's and floor boxes.
24. Provide a 20' service loop above accessible ceiling at all Wireless Access Point locations.

D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Complete work actions requiring above ceiling access prior to ceiling tile installation.
3. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
4. Cabling routed above ceilings shall be supported with the following methods:
    a. In cable tray above accessible ceiling, where indicated on drawings.
    b. In conduit where indicated on drawings. A pull cord (Polyolefin; minimum 210lb Tensile Strength) shall be installed alongside all cables in enclosed raceways, conduits and areas where access is limited.
    c. On J-hooks and/or Cable Slings, unless otherwise indicated on the Drawings. Cables shall be supported at a maximum of 48 inch intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
    d. Cables shall not be attached to ceiling grid, lighting fixture wires or any other MEP system supports.

5. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Communications Outlets
1. Communications outlets shall be formed from an assembly of faceplates and jacks as indicated on the Drawings.
2. Communications outlets installed in walls shall be installed in a double-gang box, with a single-gang or double-gang plaster ring (see project drawings), terminating cables from the Telecommunications room as indicated on project drawings.
3. Install outlets straight and perpendicular to walls and ceilings.
4. Secure faceplates with machine screws provided with the faceplate.
5. Label appropriately and cover each label with the clear plastic cover provided with the faceplate.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607 and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-D. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
   1. Administration Class: Class 3.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-D.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
   3. Cables labeled within the bundle, where label is obscured from view shall not be accepted.
   4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
      a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-D requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform Tests and Inspections:
1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection, Channel Performance Tests will not be accepted.
   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for permenant link test configuration.
   b. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated by the manufacturer within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request.

B. Data for each measurement shall be documented.
1. The test results/measurements shall be submitted in both the test equipment manufacturer’s raw data file and searchable PDF format files.
2. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered in digital format prior to Owner acceptance of the building. This digital format shall include the software tools required to view, inspect, and print any selection of the test reports.
3. Testing of transmission performance of horizontal cabling includes the following:
   a. Insertion Loss
   b. Near End Crosstalk (NEXT)
   c. PowerSum Near End Crosstalk (PSNEXT)
   d. Attenuation-to-Crosstalk Ration Near End (ACRN)
   e. PowerSum Attenuation-to-Crosstalk Ratio Near End (PSACRN)
   f. Attenuation-to Crosstalk Ratio Far End (ACRF)
   g. PowerSum Attenuation-to-Crosstalk Ratio Far End (PSACRF)

h. Return Loss
i. Transverse Conversion Loss (TCL)
j. Equal Level Transverse Conversion Loss Transfer Loss (ELTCLTL)
k. Length
l. Propagation Delay
m. Delay Skew
n. Additional Category 6A requirements
    1) PowerSum Alien Near End Crosstalk
    2) PowerSum Alien Attenuation-to-Crosstalk Ratio Far

C. Nonconforming Work:
1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
3. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner

D. Collect, assemble, and submit test and inspection reports.

E. A representative of the Owner may elect to test 5% of the installed cables. The test results will be compared with the submitted results. In the event that more than 2% of the compared results differ from the submitted results, the Owner may contract with a third-party testing firm to retest 100% of the installation and the cost shall be borne by the Contractor.

F. Prepare test and inspection reports. Contractor shall furnish test reports in both PDF and source data files.

END OF SECTION

SECTION 274010 - AUDIO-VISUAL GENERAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The General Provisions herein are applicable to the following Specification Sections:
   1. 274105 - AUDIO-VISUAL EQUIPMENT ENCLOSURES AND TECHNICAL FURNITURE
   2. 274106 - AUDIO-VISUAL POWER DISTRIBUTION AND MANAGEMENT EQUIPMENT
   3. 274110 - MICROPHONES, CONFERENCING SYSTEMS, AND AUDIO SOURCE EQUIPMENT
   4. 274111 - MIXING, PROCESSING, AND AMPLIFICATION EQUIPMENT
   5. 274113 - LOUDSPEAKERS AND RELATED EQUIPMENT
   6. 274115 - PRODUCTION COMMUNICATION SYSTEMS
   7. 274116 - ACCESSIBILITY SYSTEMS
   8. 274121 - VIDEO CAMERA, SOURCE, AND RECORDING EQUIPMENT
   9. 274122 - VIDEO TRANSPORT, SWITCHING, AND PROCESSING EQUIPMENT
   10. 274123 - VIDEO DISPLAY EQUIPMENT
   11. 274125 - ELECTRONIC SIGNAGE AND WAYFINDING EQUIPMENT
   12. 274126 - PROJECTION SCREENS
   13. 274131 - AUDIO-VISUAL CONTROL SYSTEMS AND PROGRAMMING
   14. 274132 - AUDIO-VISUAL NETWORK EQUIPMENT
   15. 274140 - AUDIO-VISUAL CABLING AND CONNECTORS

B. The Audio-Visual Installation Contractor shall be responsible for providing all equipment, accessories, parts, and supplies as necessary to deliver complete and working systems as defined herein. Any equipment list or bill of materials included in the Contract Documents is for reference only and is not necessarily an exhaustive list of all components required to make the systems complete and operational. The Audio-Visual Installation Contractor shall be required to amend any such document or provide their own equipment list or bill of materials. Any equipment list or bill of materials provided by the Audio-Visual Installation Contractor shall not constitute a complete list of all equipment and supplies the Audio-Visual Installation Contractor intends to provide. Such a document shall not alleviate the Audio-Visual Installation Contractor from providing any and all necessary equipment and supplies beyond that which is on said equipment list or bill of materials to make the systems described herein and on the Drawings complete and operational.

C. The Audio-Visual Installation Contractor shall be responsible for interfacing power and grounding provisions with work covered under these Sections.

D. Anywhere this or any of the Sections listed above directs an entity to contact the Court, the primary contact person shall be the Contracting Officer of record. The Contracting Officer shall have the right to delegate this reponsibilty to any other person on a permanent or case-by-case basis.

E. All notices, subimttals, RFIs, requests, information, emails, and any other documentation or communications described herein or in any of the above sections shall be delivered to the Architect, unless otherwise directed in this or any other Specification Section, or the Drawings.
   1. The same entity will prepare all responses, unless another person or entity is specifically identified herein, in any of the above Sections, or on the Drawings.

1.2 RELATED REQUIREMENTS

A. Raceway and boxes for the Audio-Visual Systems are provided by others.

B. Audio-Visual power distribution equipment is covered in Section 274106, Audio-Visual Power Distribution and Management Equipment.

C. Provide additional power provisions, raceways, and boxes, beyond those indicated in the above referenced Drawings, as required to accommodate the system configuration.

D. Performance Verification responsibilities and obligations related to these Systems are specified herein and in the sections listed above.

1.3 REFERENCE STANDARDS

A. ANSI/INFOCOMM (AVIXA) 10:2013, Audio-Visual Systems Performance Verification.

B. ANSI/INFOCOMM (AVIXA) 2012, Audio-Visual Implementation Handbook.

C. Additional standards as identified in other Specification Sections included herein.

D. ISO 9001-2015.

E. NFPA 70-2017

1.4 DEFINITIONS

A. “Audio-Visual Installation Contractor,” "AVIC," or simply, “Contractor” – The organization charged with installation and configuration of the Systems described herein.

B. "Owner-Furnished Equipment" - A device that is currently in the posession of the Owner, but shall be incorporated into the design described herein by the Audio-Visual Installation Contractor.

C. "Owner-Furnished-Owner-Installed Equipment," - a device that is currently in the posession of the Owner, but will be connected to the systems described herein by the Owner.

D. “Basis of Design,” – A device representing the benchmark or minimum requirements in the Specifications or Drawings for this Project. This shall not be interpreted as a sole-source requirement.

1.5 FUNCTIONAL DESCRIPTIONS

A. General
   1. These descriptions shall be informational only. Where a discrepancy or conflict exists between this paragraph and another requirement in the Specifications or on the Drawings, the other requirement shall govern.

B. Conference Room

1. Video: Each conference room will be equipped with a non-interactive display screen. A USB-C input will be provided at the conference table, located inside an in-table A/V box that will also contain electrical receptacles and data jacks as needed. A camera at the display will provide BYOD conferencing to users via the USB-C connection at the table.
2. Audio: Audio will be provided through the display's built-in speakers.
3. Control: The receiver in each conference room will have signal sense capability which will allow the display to turn on or off depending on sensing signal, or when a device is plugged in/out.

C. Music Classroom
1. Audio: Full range speaker system for listening, simple fixed stereo recording to computer, playback from connected computer, auxiliary connection or Bluetooth.

D. Cafeteria
1. Video: A wall-mount motorized projection screen and projector in a wall niche will display shared content. An HDMI input plate on the wall and wireless presentation capabilities will allow users to share content from their device.
2. Audio: Wireless microphones will be provided to amplifier presenters' voices. The system will accept an audio input from the campus-wide paging system. Pendant speakers will reproduce all audio.
3. Control: A touch panel on the wall will allow users to adjust audio volume, select video source, and turn the system on/off.

E. Gym
1. Video: Wall-mount motorized projection screens and projector on motorized scissor-lift will display shared content. A/V inputs and wireless streaming will be provided.
2. Audio: High-power speakers attached to the ceiling structural beams will provide sound coverage throughout the gym. PA announcements will be broadcast over the same speakers. Both Wireless microphone capability and wired microphone inputs will be provided. An Assistive Listening system will be provided with receiver units in compliance with ADA requirements.
3. Control: A wall-mount Control Panel will be provided to allow control of the audio inputs and volume control. The headend A/V equipment will be located in a rack in a Storage Room adjacent to the gymnasium.

F. Black Box
1. Video: A motorized rear projection screen will be provided and supported from the pipe grid above the platform. A projector will be attached to the pipe grid behind the projection screen and will display shared content.. A/V inputs and wireless streaming will be provided. Wall-mount PTZ cameras will provide video for live and recorded events.
2. Audio: Full range performance speakers will provide stereo sound coverage throughout the space. Both Wireless microphone capability and wired microphone inputs will be provided. An Assisted Listening system will be provided with receiver units in compliance with ADA requirements. A basic wireless production communications system will be provided.
3. Control: Control of the audio and video systems will be located in a small control room adjacent to the platform. Operaters will be able to route video and mix audio on production equipment. A control panel will provide system preset operations for typical events.

1.6 QUALITY ASSURANCE

A. This paragraph contains general quality assurance requirements. Additional quality assurance requirements are identified in the Specification Sections listed in PART 1 of this Section.

B. Conform to the reference standards indicated herein and in other Sections covered by this Section.

C. Provision of manufactured components, installation, wiring, and testing shall be the responsibility of a single Contractor.

D. Supply only new equipment, parts, and material currently manufactured at the time of submittal and operate only for testing as part of the installation procedures.

E. Conduit sizes specified herein or indicated on the Drawings refer to the standard trade sizes, are for identification purposes only, and are not actual dimensions.

F. Codes, standards, and regulations referred to are minimum standards. Where the requirements of these Specifications or the Drawings exceed those of the codes, standards, and regulations, the Drawings or Specifications govern.

G. Codes, standards, and regulations specified herein include the edition date. Revisions and addenda to these codes, standards, and regulations shall be part of the Specifications. Provisions of referenced codes, standards, and regulations do not create duty or responsibility by the Owner, unless otherwise specified herein. The Audio-Visual Installation Contractor shall be responsible for modifying the Systems described herein and on the Drawings to comply with such revisions and addenda.

H. Adhesives and Sealants:
   1. Adhesives, sealants, and sealant primers used inside the building (defined as inside the weatherproofing envelope and applied on site) shall comply with SCAQMD Rule1168-2017 for volatile organic compound content limits.
   2. Aerosol adhesives shall comply with GS 36-2013 for volatile organic compound content limits.

I. Paints and Coatings:
   1. Anticorrosive and antirust paints applied to interior ferrous metal shall not exceed a volatile organic compound content limit of 250 g/L per GS 11-2015.

J. Audio-Visual Installation Contractor qualifications at the time of bid:
   1. All technical personnel assigned to this project shall have a current AVIXA CTS certification.
   2. The person(s) charged with managing the Audio-Visual Installation Contractor’s overall effort shall have either a Professional Engineer’s license (PE), a PMP certification, or one of the advanced AVIXA certifications (CTS-D or CTS-I).
   3. The person(s) charged with managing the Audio-Visual Installation Contractor’s design effort shall have a current AVIXA CTS-D certification.
   4. The person(s) charged with managing the Audio-Visual Installation Contractor’s physical installation and/or fabrication effort shall have a current AVIXA CTS-I certification.

1.7 SUBMITTALS

A. General

1. This paragraph contains general submittal requirements that apply to all Sections and all equipment and supplies in this Project. Additional submittal requirements are identified in PART 1 of the Specification Sections listed in PART 1 of this Section.
2. Submittals are required before installation or fabrication begins. The Audio-Visual Installation Contractor shall not procure any equipment or perform any fabrication on any portion of this scope that has not received approval as defined herein. The Audio-Visual Installation Contractor shall be responsible for any costs related to returning, replacing, or not using any component of this scope that is ordered, fabricated, or installed prior to receiving such approval. Pay requests will not be approved for any work performed without approved submittals.
3. Partial Submittals may be acceptable. The Audio-Visual Installation Contractor shall submit a written request in the form of an RFI to request approval to submit partial Submittals.
4. Any approval granted on a partial Submittal is only applicable to the submitted section or other portion(s) of the required submittals listed in the request. This approval is provisional based on the receipt and review of the remainder of the required Submittals and may be modified or rescinded based thereupon.

B. Pre-Installation Submittal (Shop Submittal) Requirements:
1. Submittals shall be prepared in a line-by-line format corresponding to these Specifications and the Drawings, and shall indicate compliance with each requirement specified herein and indicated in the Drawings:
   a. Indicate manufacturer's installation instructions.
   b. Indicate deviations, if any, including any from the manufacturer's installation instructions.
   c. Reproductions or electronic versions of Design Drawings shall not be used in the preparation of Submittals. Submittals containing such Drawings may be rejected.
   d. Resubmittals that are required to address review comments shall include a cover transmittal with a written explanation of how each review comment has been addressed.
   e. Submittals not specifically required, or not complying the format requirements, will be returned unreviewed.
   f. All electronic documents shall be provided in PDF format. PDF files containing multiple drawings or components shall include an index of the file contents and electronic bookmarks.
2. Submittals shall include the following:
   a. Wiring diagrams (functional diagrams) indicating:
      1) Equipment to be used, marked with make and model numbers.
      2) Proposed connections of equipment at device inputs and outputs. Unused connections shall be marked unused in a consistent fashion.
      3) Cable designations meeting the cable labeling requirements of Section 274140, Audio-Visual Cable and Connectors.
   b. Floor plans and reflected ceiling plans indicating equipment locations, including identification and references to wiring details. Other Specification Sections listed earlier in this Section contain additional requirements for floor plans. Floor plan requirements from multiple Sections may be combined on one or more floor plans as long as the document(s) remain clear and legible.
   c. Product data sheets on all equipment, materials, and cables to be used in this Project. Data sheets shall be combined into a single PDF file and arranged by Specification

Section number. The PDF file shall be indexed or bookmarked by Specification Section and each individual product. Bookmarks or indexes shall be renamed as necessary so that each manufacturer and model is shown in the index. The index or bookmarks shall provide a clickable link to the corresponding data sheet(s).

d. A table indicating the color of all pieces of equipment that will be mounted, installed, or used in any generally accessible area of the spaces included herein. Unless otherwise noted, this requirement does not apply to equipment permanently installed in equipment rooms, telecommunications rooms, or other closets that are generally accessible only by the Owner's staff or their designees.

e. A table indicating the proposed network configuration information. This shall include, at a minimum, proposed VLANs or physically isolated networks, IP addresses as needed, and necessary switch and router configuration information.

1) If it is necessary for the Audio-Visual Installation Contractor to obtain network information (i.e., IP address ranges, subnet masks, gateways, etc.) in order to properly configure the Systems included herein, such request shall be made prior to submission of the table described in this paragraph.

2) Submit in writing all requests for Audio-Visual Installation Contractor remote access to the Owner's network for configuration and maintenance of audio-visual equipment.

f. Dimensioned shop drawings of all fabricated, custom, or modified hardware and software equipment, components, or devices. Provide a finish sample for all connector plates furniture, consoles, carts, and stands.

g. Schematic drawings of all custom electronic components, assemblies, and circuitry.

h. A table containing all usernames and passwords assigned by the Audio-Visual Installation Contractor and the devices to which they are assigned.

i. Where applicable, seismic and wind restraint devices, including calculations, restraint selection, installation details, and written confirmation that a licensed engineer prepared the calculations.

j. Required raceways and power outlets, including quantity, locations, and capacity characteristics.

k. Environmental requirements, including heat release.

l. The Audio-Visual Installation Contractor's Test Plan, as defined herein.

C. Installation Submittal: No later than the time of the Substantial Completion Inspection, the following shall be submitted:

1. A list of test equipment, giving make and model numbers to be used for all testing in spreadsheet format.
2. A draft version of as-built drawings for every item depicting the current state of the systems to be tested.
3. A draft version of the simplified one (1) page instructions to be provided with final documentation.
4. A spreadsheet containing all network configuration and settings of equipment in this scope and the Owner's LAN.

5. A spreadsheet containing all Audio-Visual Installation Contractor-assigned usernames and passwords for devices that require them.
6. Test reports as defined herein indicating all Category cable signal paths pass the Category cable testing requirements."
7. A draft version of the Technical and User Manuals as defined in PART 3 herein.

D. Final Acceptance Submittal: Within thirty (30) days after Substantial Completion is achieved, and/or prior to Final System Acceptance, submittals (whichever is earlier) shall be provided and shall include the following:
1. Equipment manufacturer's operation and maintenance manuals for each piece of equipment.
2. Corrected as-built drawings for every item depicting the state of the system at the time of system acceptance.
3. One printed copy of the final version of the Technical and User Manuals.
4. A list of all fixed or static IP addresses and telephone numbers used for devices such as video codecs, telephone hybrids, and control system devices.
5. One (1) copy of all control software programming including control screens and all uncompiled source code. The source codes for the integration of all control system programming shall be delivered to the Owner with unlimited but not exclusive rights at the completion of the installation. This shall include software setup and configuration files for all configurable equipment, including control system processors, custom source code, compiled programs, software-controlled screens, computer workstation controllers, software-configured signal switchers, mixers, DSP units, or other signal processors. The contractor shall provide all installation programs and drivers necessary to transfer the software settings or programs to each respective piece of equipment. In addition, the contractor shall provide complete documentation of the software in the Maintenance Manual.
6. The Final version of the Operation and Maintenance Documentation package as defined in PART 3 of this Section.
7. The systems described herein shall not be deemed "finally accepted" until the final version of the Operation and Maintenance Documentation package has been delivered. The Audio-Visual Installation Contractor shall obtain a receipt stating that the Operation and Maintenance Documentation package has been received.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Systems or equipment installed in environmentally controlled areas shall meet performance requirements specified herein in the following conditions:
1. Temperature: 40°F to 95°F.
2. Humidity: 20% to 80% RH.
3. Air purity: systems shall be capable of continuous operation in an environment where the level of dust, lint, paper fiber, and other airborne particles is equal to that found in a standard office.

B. Systems or equipment installed in indoor environmentally uncontrolled areas shall meet performance requirements specified herein in the following conditions:
1. Temperature: 0°F to 120°F.
2. Humidity: 5% to 95% RH.

C. Systems or equipment installed in outdoor areas shall meet performance requirements specified herein in the following conditions:

1. Wind-driven dust, dirt, sand, and snow for 6 hours.
2. Rain at a maximum rate of 4.0"/hour.
3. Ice loads up to 2.0" measured radially to exposed surfaces.
4. Wind: 85 mph, maximum.
5. Sleet with wind: 55 mph, maximum.
6. Snow cover: 2.0' maximum, measured vertically.
7. Humidity: 0% to 100% RH.
8. Temperature: -30°F to 150°F.

1.9 SPACE CONDITIONS

A. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of equipment and components. Changes in the location and offsets of the same, which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made during the production of shop drawings and prior to initial installation, without additional cost to the Owner.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Control the handling and installation of hardware and equipment items that are not immediately replaceable so that completion of the work will not be delayed by hardware or equipment losses, both before and after installation. Coordinate storage with the Architect.

B. Prior to installation, protect exposed surfaces with material that is easily removed without marring finishes.

1.11 PERFORMANCE VERIFICATION

A. Performance Verification is an ongoing process and shall be performed throughout the installation process. Performance Verification verifies that systems are operating in a manner consistent with the Construction Documents.

B. Performance Verification shall include but shall not be limited to identification of Audio-Visual System devices, cabling, equipment, cleaning, start-up, check-out, testing and adjusting of systems, preparation of equipment and systems documentation and of maintenance and operation manuals, Ownertraining, and preparation of Record Drawings.

C. Performance Verification shall conclude with the completion of required testing, training, and system documentation as specified herein and shall be required to demonstrate the proper operation of the Audio-Visual Systems.

D. Provide an Audio-Visual Systems Performance Verification Supervisor for the Audio-Visual Systems. The Audio-Visual Systems Performance Verification Supervisor shall have a current AVIXA CTS-I certification and 10 years' experience in audio-visual systems contracting. The Audio-Visual Systems Performance Verification Supervisor shall become familiar with the Owner's Project requirements and the requirements of the Performance Verification process as defined in this Section and if applicable, the commissioning process defined in Division 29. The Audio-Visual Systems

Performance Verification Supervisor shall coordinate and execute the required Performance Verification activities. for that subcontractor's scope of work.

E. The Audio-Visual Systems Performance Verification Supervisor shall review submittal data for conformance with the requirements of the Project, shall monitor compliance with the requirements specified herein for storage and protection of equipment during construction, shall oversee testing, and shall document that the scheduled and specified performance requirements of each system have been accomplished.

F. Conform to all codes and standards listed in PART 1, as well as all other applicable federal, state, and local regulations.

G. Comply with AVIXA Standard 10:2013 Audio-Visual Systems Performance Verification.

H. Refer to ASHRAE Guideline 0.2-2015, The Commissioning Process for Existing Systems and Assemblies, and ASHRAE Guideline 4-2008 (RA 2013), Preparation of Operating and Maintenance Documentation for Building Systems.

1.12 WARRANTY

A. Equipment shall be free of faulty workmanship and defects for a period of 1 year from date of Substantial Completion and as specified in the General Conditions.

B. To maintain certain manufacturers' warranties, all equipment must be installed, aligned, and serviced by those installers authorized by each manufacturer to perform those duties. If the Audio-Visual Installation Contractor is not authorized by said manufacturer, it is the Audio-Visual Installation Contractor’s sole responsibility to make the appropriate arrangements and bear all cost and consequences thereof.

C. Replace defective materials and repair faulty workmanship within 2 days of notification at no cost to the Owner during warranty period.

D. In addition to warranty service, provide maintenance service for the warranty period, including at least 2 semi-annual visits to site for checking and adjustment of equipment. During this period, answer service calls within 24 hours. During this period, maintenance calls shall be completed within 3 days of notification and at no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise specified herein or in the Sections identified in PART 1 of this Section, quantities of equipment are indicated on the Drawings.

B. Unless specifically indicated otherwise on the Drawings, all equipment and material shall be new. Refurbished products are not permitted.

C. Performance Criteria listed in this or related Sections shall indicate the minimum performance allowed, unless otherwise noted.

D. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.

E. All equipment, whether stock manufactured or custom built, shall be supported by complete and detailed schematic drawings and replacement parts lists. No "black boxes" or unidentified components shall be acceptable.

F. All equipment, except portable equipment, shall be held in place. This shall include equipment, enclosures, components, and cables. Fastenings and supports shall support their loads with a safety factor of at least 3 unless otherwise specified herein. Equipment cabinets shall be square and plumb.

G. Owner-Furnished Equipment:
   1. The Audio-Visual Installation Contractor is not responsible for providing, but is responsible for installing, configuring, and accepting all Owner-Furnished Equipment after testing the equipment.
   2. The Audio-Visual Installation Contractor shall inspect, test, and perform a general cleaning of all Owner-Furnished Equipment.
   3. If any of the equipment needs repair, the Audio-Visual Installation Contractor shall submit written notification that includes a detailed description of the needed repairs and an estimate of the cost of repair.
   4. Specific devices that are Owner-Furnished Equipment are so indicated on the Drawings.

H. Where equipment is specified by a brand name or manufacturer’s make and model number it is intended to be descriptive, but not restrictive, and to indicate the quality and performance characteristics of the article described.

I. Where multiple manufacturers are listed, a selection shall be made from one or more of those manufacturers. Where only one manufacturer is listed, substitutions shall not be allowed without written authorization.

J. Color of all equipment mounted, installed, or used in any generally accessible area of the spaces included herein shall be coordinated with and/or approved as necessary by the Architect.

K. All equipment substitutions and discrepancies identified after award shall be submitted in writing for approval using the same process described herein for requests for information. The substitution request shall include a narrative describing the reason for the substitution, product data sheet(s), functional sketch demonstrating that the proposed substitution will perform in a manner consistent with the design intent.

L. If, at any point after award, a newer model has superseded a manufacturer’s product specified herein, the newest model shall be furnished, provided the new model retains or exceeds all the characteristics of the superseded item specified herein. Submit immediate notification If there is no new or replacement model.

2.2 SEISMIC AND WIND RESTRAINTS

A. Seismic information is contained herein.

B. Seismic force design shall be determined in accordance with the following seismic design criteria:
   1. Seismic Design Category: B.
   2. Risk Category: III.
   3. Component Importance Factor, Ip: 1.25.

C. Provide restraint devices as required for vibration isolated and non-vibration isolated systems and equipment components. Provide calculations to determine restraint loadings for specific equipment to be installed resulting from seismic forces on equipment. Seismic restraint calculations shall be signed by a licensed engineer in the employ of the seismic restraint device manufacturer.

D. For roof-mounted equipment and components both the seismic acceleration and wind loads shall be calculated, and the highest load shall be utilized for the design of the seismic restraints and vibration isolators.

E. Exceptions for components listed within the applicable Project building code may be utilized. However, use of exceptions shall be noted with submitted seismic restraint calculations.

F. Seismic restraints and vibration isolators provided with integral seismic restraint capacity shall have Anchorage Preapproval "R" Number from OSHPD in the State of California listing minimum certified horizontal and vertical load ratings.

G. Floor-Mounted Restraints:
   1. Restraints for neoprene vibrations isolators shall consist of Type DN isolators with the addition of welded steel housings to resist seismic forces.
   2. Manufacturer: Kinetics Noise Control, Mason Industries, VMC Group, Vibration Eliminator, or Vibro-Acoustics.

H. Suspended Restraints:
   1. Restraints for vibration isolated suspended systems or equipment shall consist of galvanized or stainless-steel aircraft cables with end connection fittings designed to swivel to ensure proper cable alignment and avoid bending of cable.
   2. Restraints for non-vibration isolated suspended equipment or raceways shall consist of steel angle or Unistrut with anchor bolts and end connection fittings designed to swivel to the final installation angle.
   3. Manufacturer: International Seismic Application Technology, Kinetics Noise Control, Mason Industries, Tolco, VMC Group, Vibration Eliminator, or Vibro-Acoustics.

2.3 TEST EQUIPMENT

A. Standard testing equipment required to perform start-up, initial check-out, and required functional testing shall be provided by the Audio-Visual Installation Contractor for the equipment or system being tested.

B. Specific test equipment and devices and additional testing requirements are identified in each of the Sections listed in PART 1 of this section.

C. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request. Accuracy of other sensors shall be at least twice that of the instrumentation being tested.

2.4 OPERATION AND MAINTENANCE DOCUMENTATION PACKAGE

A. Each manual shall contain printed operation instructions for all system functions whose format has been compiled specifically for each system. Providing standard factory equipment operating instructions alone is not acceptable .

B. Operation and Maintenance Documentation shall be provided in hardback 3-ring binders, except printed full size drawings, which shall be provided as stapled sets. All documents shall also be provided on USB drive or delivered via an electronic document service such as Dropbox, Google Drive, or MIcrosoft SharePoint. Electronic transfer of digital files is permitted if a write-protected electronic copy is delivered in addition to the electronically transferred files.

1. The “Maintenance Manuals” shall include:
    a. Contact information, to include regular service and emergency service (if different), for the Audio-Visual Installation Contractor.
    b. Copies of software configuration files and/or programming files, as applicable, on CDs or other write-protected media, for every system component for which software was used in the configuration. This includes, but is not limited to uncompiled control code files, audio matrix mixer configuration files, and video matrix switch configuration files.
    c. Emergency Information:
        1) Information for technical and nontechnical personnel about actions recommended during emergency situations to protect property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:
            a) Power failure.
            b) Heating failure.
            c) Cooling failure.
            d) Control system failure.
            e) TCP/IP network failure.
    d. Manufacturer’s literature, to include descriptive literature and performance specifications, operating manuals, and servicing information.
    e. Schedule of nominal control settings for proper system operation.
    f. A restatement of the terms and conditions of the warranty system and warranty service including any extended Original Equipment Manufacturer (OEM) warranties beyond the standard one-year warranty required herein.
    g. Inventory Listing Reports.
    h. Complete documentation of installed software.
    i. Recommended list of spare parts, part numbers, and the place(s) from which they can be obtained if the Audio-Visual Installation Contractor is not able to provide them.
    j. Test Reports and Certifications:

1) Certification of seismic and wind restraints.
2) Reports from performance tests as outlined in Section 274010, Audio-Visual General and other Sections identified in PART 1 of this Section.

k. Construction Documents:
1) Record Documents, including but not limited to:
a) Detailed functional block diagrams which illustrate as-built conditions identifying each equipment item by manufacturer and model number, labeling alpha-numerically all contractor furnished controls, relays, patch panel jacks, and other similar devices and referencing these designations on fabrication drawings, patch panel details and other related instruments.
b) Final rack elevation drawings.
c) Detailed as-built drawings of all contractor fabrications illustrating the mechanical and electrical construction with manufacturer's part numbers and values for all components. Also included shall be floor and reflected ceiling plans indicating device layouts and locations throughout the spaces included in the contract.
2) Record Drawings.
3) Approved Submittals.
4) Warranty certificates.
5) Inspection certificates.
6) Performance Verification report.

l. A restatement of the terms and conditions of the warranty system and warranty service including any extended Original Equipment Manufacturer (OEM) warranties beyond the standard one-year warranty required herein.

m. All financial documentation related to the Project, including but not limited to proposals, contracts, purchase orders, and receipts.

2. The "Operation Manuals" shall include:
a. Systems operating instructions for each system specifically describing the functions, operation, and maintenance of the system installed. The instructions shall be written in full detail for comprehension by non-technical persons. This includes, but is not limited to:
1) System and/or equipment specifications.
2) Operating routines and procedures.
3) User programming instructions.
4) Special procedures.
5) Basic troubleshooting.
6) Administrative user IDs and passwords for all equipment provided that includes such a feature.

b. Schedule of nominal control settings for proper system operation.

c. Troubleshooting guide for system operators, listing the procedures to follow in the event of an apparent equipment failure, written in logical outline form.

d. Simplified as-built block diagrams deleting alpha-numeric references to controls, relays, patch panel jacks and other similar devices

PART 3 EXECUTION

3.1 GENERAL

A. This paragraph contains general execution, testing, performance verification support, and warranty requirements. Additional execution requirements are identified in PART 3 of the Specification Sections listed in PART 1 of this Section.

B. Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.

C. Provide all necessary incidental equipment or devices to deliver a complete and operable system.

D. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.

E. Equipment shall be installed in accordance with the manufacturer's instructions.

F. Furnish special installation equipment or tools necessary to properly complete the system, including but not limited to, tools for terminating, testing, and splicing fiber optic and shielded Category cables.

G. Equipment, except portable equipment, shall be held in place. This shall include equipment, enclosures, components, and cables. Fastenings and supports shall support their loads with a safety factor of at least 3 unless otherwise specified herein.

H. Prevent and guard against electromagnetic and electrostatic hum and install the equipment to provide safety for the operator.

I. Repair or replace any equipment or materials damaged during the construction or installation period.

J. Provide firestopping for all new penetrations made in support of the installation. Repair or replace any firestopping that is damaged or removed during installation. Firestopping shall adhere to all applicable codes and building standards that may be in force.

K. Provide power connections from existing panels and/or to equipment included in this Scope as indicated on the Drawings.

3.2 SPACE CONDITIONS

A. General:

1. Verify dimensions of equipment, equipment arrangements, space availability (including any millwork or cabinetry provided by others), and provide systems that work within the constraints of the space available. Submit written notification of any situation where space constraints are a problem, prior to the ordering or purchase of equipment. The Audio-Visual Installation Contractor shall bear the expense of providing alternate equipment which will work within the available space if space availability problems are discovered after equipment is ordered.

2. Provide access to equipment and components requiring operation, service, or maintenance for the life of the system.
3. Coordinate layout and installation of all equipment in this scope, including, but not limited to, projection screens, mounted displays, and speakers with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

B. EQUIPMENT AND EQUIPMENT ROOMS
1. Protect any equipment stored or installed on-site covered by this Scope from extreme temperatures, corrosive agents, dust, water, or other debris until the spaces included herein are considered climate controlled and dust free. Re-protect any equipment as required when building modifications are required after the building is considered climate controlled and dust free.
2. Remove dust, dirt, rust, stains, and temporary covers.
3. Foreign matter shall be blown, vacuumed, or cleaned out of and from new equipment, devices, switches, controls, and panels.
    a. In equipment rooms, clean equipment conduit and room surfaces from dust and dirt and maintain in a clean condition from date of Substantial Completion until final completion of work and corrective work.

3.3 IDENTIFICATION

A. General:
1. Identification shall consist of UPPER-CASE LETTERS.
2. Where identification is applied to surfaces which require a finish, identification shall be installed after the surface has been finished.
3. Cables:
    a. Cables, regardless of length, shall be marked with preprinted, wrap-around number or letter cable markers at both ends. Markers shall be permanently affixed with heat-shrink tubing. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall be indicated on the Record Drawings.
    b. See Section 274140, Audio-Visual Cabling and Connectors for additional requirements.
4. Equipment:
    a. Provide and install laser labels for each piece of rack-mounted equipment. Labels shall be white text on black background or black text on white background, as appropriate to make the text as visible as possible.
    b. Minimum labeling shall include a device identifier consistent with the as-built drawings and network or control identification (address) for each device.
    c. Except where otherwise specified herein, label switches, controls, and receptacles. Labeling material shall be laser labels. Labels shall be placed on cover plates or directly adjacent to switches, controls, and receptacles to facilitate service and replacement.
    d. Signs shall not cause interference with operation and maintenance of equipment. Attach signs with rustproof screws.
    e. All equipment, including cables, shall have externally visible labels tha tindicated the equipment's serial number or cable connection points.

3.4 PERFORMANCE VERIFICATION PROCEDURES

A. General
   1. The Audio-Visual Systems Performance Verification Supervisor shall be responsible for scheduling, supervising, coordinating, and executing the testing and Performance Verification activities as specified herein.
   2. Specific Audio-Visual performance verification procedures required at various milestones of the installation are described below.
   3. Submit additional documentation as required to support the Performance Verification process. This additional submittal documentation shall include, at a minimum, the proposed functional testing plan, and functional testing checklists.
   4. Change factory default usernames and passwords on all devices requiring log in. Record passwords in a table and include with Submittals as required above.

B. The Audio-Visual Installation Contractor's Test Plan shall include:
   1. Provide documentation of installed systems and equipment and develop functional testing procedures, prior to normal operation and maintenance manual submittals. This documentation shall include detailed manufacturer installation, operating, troubleshooting and maintenance procedures; full factory testing reports, if any; and full warranty information, including responsibilities of the Owner to keep the warranty in force. In addition, the installation materials that are actually shipped inside the equipment, and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted.
   2. Develop and submit for review and comment, prior to system functional testing, a complete functional testing plan using manufacturer's testing procedures and functional testing checklists for the performance of the equipment to be verified.
   3. Assist in clarifying the proposed operation and control of equipment in areas where the Specifications, Drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
   4. Reference shall be made to all applicable standards for test methods, equipment, and reporting values, or to best industry practices when test requirements are not addressed by specific standards.
   5. Review the proposed functional test procedures to ensure feasibility, safety, and equipment protection. Obtain approval from the Architect for proposed functional test procedures.
   6. Prepare a preliminary schedule for Performance Verification activities, including equipment testing and adjusting from start to completion, and update the schedule during the construction period, as appropriate. Submit immediate notification when the verification activities not yet performed, or not yet scheduled, will delay construction.
   7. Provide functional testing for equipment and execute the Audio-Visual Systems-related portions of the functional checklists for the verification of the performance of all the equipment during the testing process.

C. Construction Phase Procedures:
   1. During the construction phase of the Project, transmit a status update report upon request. The status update report shall include digital photographs of areas where significant progress has been made. Digital photographs shall be minimum 10 MP in resolution. Both the detail in the report and the detail in the photographs shall be sufficient for the Engineer to assess the progress made to date . Periods of inactivity will require only a retransmission of the most recent form (via e-mail), updated to reflect the new date, and that no significant progress has

been made since the last status report was submitted. Status reports will be required not more than once every two weeks..

2. Perform and document functional tests results, and sumibt a copy of said results.
3. Correct noncompliance items before beginning acceptance testing. Discrepancies and problems shall be remedied before acceptance testing.

D. Construction Phase Testing:
   1. Functional testing shall be performed as required to ensure that the equipment and systems are properly installed and ready for operation, so that acceptance testing may proceed without delay. Follow the approved functional testing procedures. Sampling strategies shall not be used for functional testing unless explicit direction to do so is given in this or another Section. The functional testing for equipment and subsystems of a given system shall be successfully completed and documented prior to acceptance testing of a system.
   2. Specific test equipment and devices and additional testing requirements are identified in each of the Sections listed in PART 1 of this Section.
   3. Functional testing plan: develop the detailed functional testing plans for equipment and systems for which the performance is to be verified, as specified herein. Review the proposed procedures and functional testing documentation to ensure that there is written documentation the each of the manufacturer-recommended procedures has been completed.
   4. The functional testing plan shall include the manufacturer's standard written check-out procedures copied from the installation manuals and manufacturer's normally used field check-out sheets. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the tests recommended by the equipment manufacturer, and as specified herein. Each checklist shall include a summary statement with a signature block at the end of the plan.
   5. Interior finishes and furnishings shall be in place for all testing where finishes and furnishings could have an impact on the testing outcome(s).
   6. Documentation of performance tests shall be maintained for reference during the system acceptance tests.
   7. Tests may include subjective listening and/or viewing at various positions under various operating conditions, using live or recorded material.
   8. Grounding Tests:
      a. Measure the ground conductor impedance from the ground of each receptacle serving systems in this scope to the project ground electrode.
      b. Measure the impedance of the connection from each enclosure or enclosure group to the project ground electrode.
      c. In each case, the impedance shall be less than 5.0 Ω.
      d. Record results.

E. Acceptance Phase Procedures:
   1. Place equipment and systems into operation and continue their operation during each working day of the acceptance testing and verification activities, as required.
   2. Provide skilled technicians to execute acceptance testing of each system. Technicians shall be available and present during the agreed upon scheduled acceptance tests and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
   3. Perform acceptance testing for specified systems and equipment as directed by the Architect and interpret the test data as necessary.

4. Correct deficiencies (differences between specified and observed performance) as identified and interpreted by the Architect and retest the equipment as required to demonstrate proper operation and performance.
5. Prepare operation and maintenance manuals as specified, including clarifying and updating the original sequences of operation to as-built conditions.
6. Maintain marked-up record drawings and produce final record drawings of Project Drawings and Contractor-generated coordination drawings.
7. Provide specified training of the Owner operating personnel.
8. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

F. Acceptance Phase Testing:
1. Before obtaining permission to schedule the acceptance tests, provide written certification that each system has been calibrated, tested, and is ready to begin the 14-day burn-in period and acceptance testing.
2. Conduct Final Acceptance test after a period of not less than 14 consecutive normal working days of trouble- free operation.
3. During this burn-in period, each system shall operate continuously for 24 hours per day. During the acceptance test, demonstrate the correct operation of features and capabilities specified herein.
4. The Architect reserves the right to witness the acceptance tests. Submit notification with at least 10 days prior to the date scheduled for the tests.
5. The Contractor's manufacturer-certified control systems programmer shall be available and on site to assist in the testing of the Systems and to perform control code, configuration, and GUI modifications as required during testing.

G. Retesting of Equipment and/or Systems
1. Provide labor and materials required for retesting of any functional test found to be deficient.
2. Prior to retesting, submit required data indicating that the deficient items have been completed and/or corrected for approval and rescheduling of the functional test. If during the retesting it becomes apparent that the deficient items have not been completed and/or corrected as indicated in the data provided by the Contractor, the retesting shall be stopped. Costs for the Design Team to further supervise the retesting of a functional test shall be the responsibility of the Contractor.

H. Testing Documentation, Nonconformance, and Approvals
1. Submit a list of outstanding items of the functional testing procedures that were not completed successfully within 48 hours of test completion. The Architect will then review the Contractor's functional testing reports and submit either a noncompliance report or an approval form to the Audio-Visual Installation Contractor. Retest deficiencies or uncompleted items. Correct items that are deficient or incomplete in the checklists and tests in a timely manner and indicate as soon as outstanding items have been corrected. Resubmit an updated report and a statement of correction on the original noncompliance report.
2. When requirements are completed, the Architect will recommend approval of the functional testing of each system and schedule the acceptance testing of the equipment or system
3. As acceptance testing progresses and deficiencies are identified, work with the Architect to resolve the deficiencies found.

I. Warranty Period:

1. Correct deficiencies and make necessary adjustments to operations and maintenance manuals, and as-built drawings system or equipment modifications made during the warranty period.

3.5 RECORD DRAWINGS

A. Refer to Section 01.

B. A record of field and as-installed conditions shall be maintained at the site, shall be kept current throughout the Project, and shall be used in preparation of the final Record Drawings. Field and as-installed conditions shall be recorded on Design Drawings and shall be marked to include addenda, change orders, field changes, and selections made during construction.

C. Concurrent with Substantial Completion, submit 2 sets of prints indicating field and as-installed conditions of raceways and equipment, and incorporating changes made during construction.

D. Upon completion of the Project, submit marked-up drawings indicating field and as-installed conditions, and shop drawings incorporating changes made during construction for raceways and equipment. This shall include two sets of bound prints and full-size PDFs delivered electronically using a mutually agreed-upon method.

3.6 MAINTENANCE

A. Equipment operated prior to the date of theSubstantial Completion shall be maintained in accordance with manufacturer’s recommendations.

B. Provide replacement fuses, lamps, batteries, and other necessary consumable supplies in sufficient quantities to last one (1) year under normal use conditions.

3.7 INSTRUCTION OF OPERATING PERSONNEL

A. General
   1. Conduct formal instruction sessions for operating personnel for all systems described herein and/or on the Drawings. This shall include separate types of sessions for “operating/user personnel” and “technical support personnel.” Each type of session shall be specifically geared toward the appropriate group, with the training for technical support personnel containing more information and detail than that of the operating/user personnel.
   2. In the event the Contractor does not have qualified instructors on staff for any given device, a manufacturer's representative capable of such instruction shall be provided by the Contractor at no additional cost to the Owner. All training shall take place after the Owner takes possession of the system, at a time convenient to the Owner.
   3. Coordinate the schedule of the training sessions with the Owner. Provide up to two occurrences of the same training session if required.
   4. Obtain a receipt signed by the Owner that all training has been completed. If the Owner declines any of the above training, the receipt shall so indicate.
   5. For each session, prepare and make available to each participant an outline indicating the components or major items to be reviewed.

B. Operational ("Operator/User") Training Sessions
   1. The total duration of all “operator/user personnel training” sessions shall be at least two hours and distributed amongst the system types as directed by the Owner.
   2. The content of these sessions shall include:
      a. General familiarization and operating procedures.
      b. All end-user functionality.
      c. User level trouble shooting and identification of common user errors.

C. Technician training shall include the following:
   1. The total duration of all “technical support personnel training” sessions shall be at least four hours and distributed amongst the system types as directed by the Owner.
   2. The content of these sessions shall include:
      a. All content presented (or to be presented) at the Operator/User training sessions.
      b. Routine maintenance procedures for equipment and systems.
      c. User level programming of programmable systems.
      d. Technician level troubleshooting, including resetting systems and equipment diagnostics.

D. All training sessions shall be video recorded. These shall be encoded in a common video format, such as MPEG-4, and delivered to the Owner via a mutually acceptable digital media storage device and/or electronically (cloud or file sharing service).

END OF SECTION

SECTION 274105 - AUDIO-VISUAL EQUIPMENT ENCLOSURES AND TECHNICAL FURNITURE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor-mounted equipment cabinets.

B. Surface raceway systems.

C. Flip-top recessed connector boxes.

D. Enclosure accessories.

E. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. 274010 - AUDIO-VISUAL GENERAL.

B. Section 274106, Audio-Visual Power Distribution and Management Equipment.

C. Section 270526, Grounding and Bonding for Communications Systems.

D. Additional requirements as shown on the Drawings.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

B. AVIXA F502.01:2018, Rack Building for Audio-Visual Systems

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010 - AUDIO-VISUAL GENERAL. In addition to those requirements, submittals for this Section shall include the following:
   1. Elevations of console or rack-mounted equipment including equipment locations. This shall include any accessories mounted to the sides, top, bottom, frame, or to the outside of the rack.
   2. General cabling routing paths into, out of, and through each equipment rack.
   3. Detailed drawings showing dimensions of all millwork elements and any other custom manufactured enclosures. This shall include, at a minimum, top view, bottom views, a view from each side, panels removed as required to show racks or other equipment locations on the

interior and cut outs for connector plates or recessed flip top boxes. It shall also include a parts list.

4. Drawings of existing furniture and millwork showing the location(s) where grommet holes and/or cut outs for flip top boxes will be drilled or cut.
5. A sample of all finish materials, including but not limited to stains, paints, and laminates for enclosures placed in view of general building occupants. Samples shall be no smaller than 12" H x 12" W and shall be prepared on the same material specified for the enclosure it represents. This paragraph explicitly excludes enclosures placed in rooms accessible only to system technical support staff.
6. Plans and elevations showing all surface mount raceway, dimensioned, and annotated with part numbers for all required components.

PART 2 PRODUCTS

2.1 GENERAL

A. Enclosures shall be rated and certified to seismic applications based on seismic information shown on the Drawings and specified in Section 274010, Audio-Visual General.

B. All products listed in this Section may have additional requirements shown on the Drawings.

C. Equipment racks shall have sufficient racking height or rack units (RUs) to accommodate the equipment as shown on the Drawings.

D. Unless otherwise noted, all equipment racks shall be configured for standard 19" rack panels.

E. All equipment racks with locking doors shall be keyed alike.

F. Provide lacing bars, fixed shelves, straps, side mounting rails, and any accessories as shown on the Drawings.

G. All equipment racks shall be black unless otherwise noted.

2.2 FLOOR-MOUNTED EQUIPMENT CABINETS

A. Minimum 16-gauge steel construction.

B. Gangable where shown immediately adjacent to another rack on the Drawings.

C. Ventilation to accommodate manufacturer's cooling recommendation(s) for equipment housed in the rack.

D. Provide side panels, doors, fan tops, and caster bases as indicated on the Drawings.

E. Minimum depth shall be 24", unless otherwise noted.

F. Manufacturer: Middle Atlantic, Lowell, Atlas, Panduit.

2.3 SURFACE RACEWAY SYSTEMS

A. Raceway that includes power distribution shall have UL-rated partitions to isolate the line voltage from the low voltage signal cable.

B. Over-The-Floor Raceway:
   1. ADA-compliant.
   2. Base constructed of extruded aluminum.
   3. Cover constructed of steel.
   4. Dimensions, channels, breakout boxes, and connectivity as shown on the Drawings.
   5. Transition pieces as shown on the Drawings.
   6. Color: Black, unless otherwise indicated on the Drawings.
   7. Manufacturer: Wiremold/Legrand, Extron, Connectrac.

C. Wall-Mounted Raceway:
   1. Dimensions, channels, breakout boxes, and connectivity as shown on the Drawings.
   2. Transition pieces as shown on the Drawings.
   3. Construction: Aluminum.
   4. Manufacturer: Wiremold/Legrand, Hubbell, Cables 2 Go, Panduit.

2.4 FLIP TOP RECESSED CONNECTOR BOXES

A. Aluminum construction.

B. Quantity as shown on the Drawings.

C. Dimensions as shown on the Drawings.

D. Connectivity and power as shown on the Drawings.

E. Manufacturer: Extron, Crestron, FSR.

2.5 RACK ACCESSORIES

A. Manufacturer: Middle Atlantic, Atlas, Lowell, Odyssey, Gator.

B. Rack Drawers:
   1. Steel construction.
   2. Key lockable.
   3. Compatible with standard 19” wide equipment racks.
   4. Depth: 14.25”.
   5. Height: 4 RU.

C. Rack Shelves:
   1. Steel construction.
   2. Pre-drilled as required to mount equipment as shown on the Drawings.

PART 3 EXECUTION

3.1 EQUIPMENT ENCLOSURES

A. See the Drawings for equipment rack layout and additional requirements.

B. For wall-mounted racks, prior to installation:
   1. Verify that blocking has been installed to support the rack in the position shown.
   2. Verify that raceway and box locations, and rack mount location, will allow rack to swing open to allow access to the rear of equipment and rack mounting pan.

C. Equipment enclosure assembly, loading, and dressing shall be in accordance with AVIXA F502.01:2018.

D. Secure enclosures in place with insulating hardware.

E. Enclosures shall be completely insulated from the raceway system, floor ducts, building structure, ductwork, and piping.

F. Adjacent enclosures shall be separated to prevent contact with each other.

G. Provide and install plastic laser-printed labels for each item of rack-mounted equipment.

H. Provide ventilation according to equipment manufacturer’s recommendations.

I. Where controls or equipment are specified herein or indicated on the Drawings for future installation, space shall be provided in the enclosures as necessary to accommodate that equipment.

J. Provide unused equipment enclosure panel space with blank or ventilating panels.

3.2 SURFACE RACEWAY SYSTEMS

A. Install power cables in separate channel from low-voltage cable.

B. Cut raceway to length as required and provide necessary coupling hardware.

C. Secure in place per manufacturer’s instructions.

D. Provide incidental parts, including but not limited to couplers, trim rings, mounting brackets, elbows, junctions, and other parts not specifically identified to provide the pathway(s) and continuity shown on the drawings.

3.3 FLIP TOP RECESSED CONNECTOR BOXES

A. Cut and/or route furniture as necessary to install recessed flip top boxes per manufacturer’s instructions at locations as shown on the Drawings. Coordinate locations with Architect.

B. Install recessed flip top boxes in cut-outs in furniture. Cut-outs are fabricated by others.

3.4 EQUIPMENT ENCLOSURE AND TECHNICAL FURNITURE PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

END OF SECTION

SECTION 274106 - AUDIO-VISUAL POWER DISTRIBUTION AND MANAGEMENT EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution equipment.

B. Uninterruptible power supplies.

C. Equipment rack grounding bus bars for audio-visual equipment racks..

D. Grounding requirements.

E. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

B. Section 270526, “Grounding And Bonding for Communications Systems.”

C. Section 274105, “Audio-Visual Equipment Enclosures and Technical Furniture.”

D. Additional requirements as shown on the Drawings.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Single line diagrams of all power connections showing receptacles to which equipment included in this Project will connect.
   2. A detail showing sequence of power on and off operations when appropriate.
   3. Power cable routing paths into, out of, and through each equipment rack.
   4. Mounting of power equipment in equipment enclosures, furniture, and other surfaces (i.e. a surge suppressor mounted behind a speaker or display).
   5. A schedule of anticipated electrical loads to be coordinated with the Electrical Contractor as necessary.

PART 2 PRODUCTS

2.1 GENERAL

A. All products listed in this Section may have additional requirements shown on the Drawings.

B. Coordinate equipment covered by this Section with enclosures and furniture specified in Section 274105, Audio-Visual Enclosures and Technical Furniture.

C. Unless otherwise noted, all electrified components described in this section shall support or be rated for:
   1. Voltage: 120 V AC.
   2. Amperage: 20 A.

2.2 AC POWER DISTRIBUTION AND MANAGEMENT

A. General:
   1. Except as otherwise specified herein , grounding conductors shall be insulated. Insulation shall be rated 600 V. Conductors shall be continuous from connector to connector with no splices. Grounding connectors shall be solid bronze, compression type, and designed for the intended use.
   2. Power wiring for the extension of power circuits provided by others shall be #12 AWG THWN/THHN or XHHN, 600 V, rated at 194°F.
   3. AC power equipment shall have LED or lamp status devices to provide indication that the systems are on.
   4. Power configuration, unless otherwise noted: standard ground.
   5. All power and distribution devices shall be UL-rated.
   6. Voltage, unless otherwise noted: 120 V AC.
   7. Control protocol, unless otherwise noted: TCP/IP.
   8. Manufacturer: Middle Atlantic, Surge-X, APC, Furman.

B. Vertical AC Power Distribution and Management:
   1. Chassis configuration: fixed.
   2. Total maximum current draw, per circuit: 20 A.
   3. Lighted master power switch.
   4. Outlet control: individual.
   5. Mains power connection type: hardwire for connection to junction box.
   6. Unit shall have integral two-stage transient surge suppression:
      a. Unit shall be accordance with IEEE C62.41.1-2002 (R2008), IEEE C62.41.2-2002 (COR 1-2012), and UL 1449-2014 (R2018).
      b. Peak Impulse Current, 8/20 microseconds waveform, minimum: 30,000 A, one time, 19,500 A two times in 5 minutes.
      c. Maximum response time: 1 ns.

C. Rack-Mountable AC Power Distribution and Management:
   1. Outlets, minimum: 8 switched.

2. Total maximum current draw: 20 A.
3. Lighted master power switch.
4. Individual Outlet control.
5. Unit shall have integral two-stage transient surge suppression:
   a. Unit shall be accordance with IEEE C62.41.1-2002 (R2008), IEEE C62.41.2-2002 (COR 1-2012), and UL 1449-2014 (R2018).
   b. Peak Impulse Current, 8/20 ms waveform, minimum: 30,000 A, one time, 19,500 A two times in 5 minutes.
   c. Maximum response time: 1 nanosecond.

D. Stand-Alone AC Power Distribution and Management:
1. Chassis with brackets to allow surface or direct to device mounting.
2. Individually switched outlets, minimum: 2.
3. Voltage: 120 V AC.
4. Total maximum current draw: 20 A.
5. Unit shall have integral two-stage transient surge suppression:
   a. Unit shall be accordance with IEEE C62.41.1-2002 (R2008), IEEE C62.41.2-2002 (COR 1-2012), and UL 1449-2014 (R2018).
   b. Peak Impulse Current, 8/20µS waveform, minimum: 30,000 A, one time, 19,500 A two times in 5 minutes.
   c. Maximum response time: 1.0 ns.
6. Lighted master power switch.

2.3 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. Capacity: 1000 VA.

B. Voltage, unless otherwise noted: 120 V AC.

C. Maximum transfer time: 0 ms.

D. Protection of AC power and network circuits.

E. Integral lightning and surge protection complying with IEEE C62.41.1-2002 (R2008), IEEE C62.41.2-2002 (COR 1-2012), and UL 1449-2014 (R2018).

F. Integral automatic current and overvoltage protection.

G. Batteries: Hot-swappable 12 V (9 AH) minimum, sized to sustain the rated full and half loads for the times indicated on the Drawings.

H. Rack-mountable.

I. Network controllable and manageable via software.

J. Manufacturer: Middle Atlantic, APC, Liebert, Eaton.

2.4 EQUIPMENT RACK GROUNDING BUS BARS (RBB)

A. See “RBB,” Section 270526, Grounding And Bonding for Communications Systems.

2.5 SECONDARY BONDING BUSBARS

A. See “SBB (TGB),” Section 270526, Grounding And Bonding for Communications Systems.

PART 3 EXECUTION

3.1 GENERAL

A. Provide power connections from electrical panels to equipment in this scope.

B. When the scope of work requires installing equipment into existing equipment racks, coordinate as required prior to procuring equipment to ensure that sufficient space exists to properly house equipment per this design and manufacturer recommendations.

3.2 EQUIPMENT ENCLOSURES

A. Mount an AC enclosure wiring diagram in each enclosure with the following information:
   1. The number of AC power circuits within the enclosure.
   2. A schematic diagram showing the incoming AC circuits and the location and quantity of outlets fed by each circuit.
   3. The current capacity of each circuit.
   4. The location of the breaker panel and the number of various breakers.

3.3 AC POWER

A. Provide master AC power switching capability for each circuit entering each enclosure.

B. Where multiple AC power circuits serve one system, each circuit shall have at least one power conditioner with AC power switching capability.

C. Provide sufficient receptacles via vertical and/or horizontal power strips for the equipment housed in the rack plus 20% overage.

3.4 GROUNDING

A. See Section 270526, “Grounding And Bonding for Communications Systems.”

B. The Contractor shall ensure that all power circuits are on the same electrical phase and that all ground cables are only connected to one point at the power breaker panel.

C. Equipment shall be grounded in accordance with the equipment supplier's recommendations.

D. Bus bars shall be electrically isolated from the mounting surface.

E. Size grounding conductors as follows:
   1. See Section 270526, “Grounding And Bonding for Communications Systems.”

F. A single primary specialty system ground shall be established for the specialty systems in each enclosure as indicated on the Drawings and as follows:
   1. Unless otherwise indicated on the Drawings, an “enclosure” shall be defined as a non-moveable free-standing or wall-mounted metallic equipment enclosure, or multi-post rack designed to house multiple devices. Such devices shall be either in a rack (RU) configuration or accessory device attachment panels or shelves.
   2. In each enclosure install a copper bus bar mounted to the enclosure on insulated support blocks to act as the ground unipoint for the connection of ground conductors used within that enclosure. Terminate insulated ground conductors to the bus bar with torqued machine screws. Bars shall be bounded to enclosures in accordance with the grounding conductor sizing requirements.
   3. Ladder rack and cable tray shall be bonded per NEC and isolated from the equipment enclosure.
   4. Conduit shall be isolated from enclosures with insulated fittings.

G. Surge Suppression Equipment Grounding:
   1. Connect each suppressor to the local ground bus in the terminal cabinet with wiring sized as recommended by the manufacturer. Where M-block-type terminations/suppressors are used, bond the ground rail to the local ground bar with wiring as recommended by the manufacturer.
   2. Coordinate to ensure that the 120 V AC power source/supply suppressor is also grounded to the same local ground bus as suppressors provided in this Section for the same system.

3.5 PERFORMANCE VERIFICATION.

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

END OF SECTION

SECTION 274110 - MICROPHONES, CONFERENCING SYSTEMS, AND AUDIO SOURCE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wired handheld and stand-mounted microphones.

B. Wired gooseneck microphones.

C. Performance wireless microphones.

D. Microphone mounts and other accessories.

E. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plan showing locations of all permanently installed equipment, including but not limited to microphones, wireless microphone transmitters, conferencing units, and wireless microphone antennae. “Permanently installed” includes microphones that are typically left in place, whether they are physically affixed or attached to a surface or not.
   2. Floor plan showing coverage lobes of digitally steerable microphones.
   3. Report of a frequency spectrum analysis performed at the project site showing available frequencies and the frequencies to be used by the wireless microphones in this Project.

PART 2 PRODUCTS

2.1 GENERAL

A. See Drawings for additional requirements.

B. Quantities of devices herein are indicated herein.

C. Performance criteria or physical characteristics specified herein represent minimum acceptable values unless noted otherwise.

D. Microphones of the same type shall be from a single manufacturer.

E. Microphones shall be black unless otherwise noted or the microphone is only available in a single color.

F. Outputs of microphones shall be 150 Ω nominal, balanced with respect to ground.

2.2 WIRED HANDHELD AND STAND-MOUNTED MICROPHONES

A. Provide microphone stand clip adapter and soft or hard storage case for each handheld microphone.

B. Element type, pick-up pattern, frequency response, and other properties as indicated on the Drawings.

C. Functionally designed for handheld vocal and/or instrument applications.

D. Multi-position frequency roll of switch and on/off switch when indicated on the Drawings.

E. Shock-isolated element.

F. Integral windscreen and pop filter.

G. Male 3-pin XLR connector.

H. Manufacturer: AKG Acoustics, Audio-Technica, Beyerdynamic, DPA, Electro-Voice, Neumann, Sennheiser, Shure.

2.3 WIRED GOOSENECK MICROPHONES

A. Functionally designed for podium or desk applications.

B. Form factor: manufactured as a single unit or modular (interchangeable capsules, goosenecks, base types, etc.) as shown on the Drawings.

C. Desktop or shock mount as indicated on the Drawings.

D. Length as indicated on the Drawings.

E. Polar pattern: Cardioid.

F. Removeable foam windscreen.

G. Switch, unless otherwise noted: membrane type with selectable mute, push to mute, and push to talk modes.

H. Status indicator: Multicolor LED element on the base.

I. Immune to RF interference.

J. Remote controllable via contact closure where shown on the Drawings.

K. Manufacturer: AKG Acoustics, Audio-Technica, Clock Audio, Beyerdynamic, Sennheiser, Shure.

2.4 PERFORMANCE WIRELESS MICROHPONE SYSTEMS

A. General:
1. Operating RF frequency range: selected from the manufacturer's standard bands available in the area the wireless microphones will be used, as determined by a frequency scan performed by the Audio-Visual Contractor.
2. Line-of-sight working range, minimum: 328.0'.
3. Up to 64 MHz tuning range.
4. Tuning step: 25 kHz.
5. 48 kHz / 24-bit digital audio encoding.
6. AES 256-bit encryption.
7. Latency: <2.9 ms.
8. Ethernet-controllable.
9. Digital modulation.
10. Minimum battery life: 8.0 hours.
11. Transmitters shall have gain adjustment.
12. Provide a soft or hard storage case for each transmitter.
13. Compliant with FCC Part 15, Subpart AC, 2018, and FCC Part 90, Subpart C, 2018.
14. Manufacturer: Shure, Sennheiser, Lectrosonics.

B. Receivers:
1. Outputs: as shown on the Drawings.
2. Predictive RF switching diversity.
3. Front panel LCD showing frequency and channel/group settings.
4. Audio, RF, and battery life LED meters.
5. Rack-mountable with remote-mountable antennae.
6. Multiple receivers in a single chassis sharing one pair of antennae where shown on the Drawings.
7. Antennae cascading ports where shown on the Drawings.
8. Automatic frequency scanning and infrared syncing with transmitters.

C. Handheld Transmitters:
1. Metallic construction with external solid antenna.
2. Provide a microphone stand clip adapter for all handheld transmitters.
3. Element: dynamic.
4. Polar Pattern: cardioid.

D. Bodypack Transmitters:

1. Metallic construction with external flexible antenna.
2. Metallic clip to secure pack to body or clothing of user.
3. Maximum dimensions: 3.4” H x 2.6” W x 0.9” D.
4. Microphone type: earworn.
5. Microphone Element: condenser.
6. One microphone element and one instrument cable for each bodypack.
7. Microphone element manufacturer: Countryman Associates.

E. Desktop Gooseneck Transmitters:
1. Functionally designed for use on a work surface.
2. Interchangeable goosenecks and microphone elements.
3. Gooseneck Length: 5.0”.
4. Polar Pattern: cardioid.
5. Multifunction button providing on/off toggle, push-to-mute, and push-to-talk functionality.
6. Molded plastic housing.
7. Internal antenna.
8. Battery life: 9.0 hours.

F. Boundary Microphone Transmitters:
1. Polar Pattern: cardioid.
2. Multifunction button providing on/off toggle, push-to-mute, and push-to-talk functionality.
3. Molded plastic housing.
4. Internal antenna.
5. Battery life: 9.0 hours.

G. Antennae and Related Equipment:
1. Powered Antennae and Power Distributors:
   a. Compatible with the system frequency range(s).
   b. Dual antenna channels.
   c. Functionally designed to distribute RF signal and power to the receivers as shown on the Drawings.
   d. Internal RF amplifiers.
   e. Cascading functionality to allow multiple distributors to use the same antennae.
   f. Rack-mountable.
2. Passive Antenna Splitters:
   a. Functionally designed to allow two receivers to use one pair of antennae.
   b. Impedance 50 Ω.
   c. Isolation: 20 dB.
   d. Insertion Loss: 2.0 dB.
3. RF In-Line Amplifiers:
   a. Remote-mountable.
   b. Powered through the receiver’s antenna output port or distribution amplifier.
   c. RF/Power overload indicator.
   d. Switchable gain: +6.0 dB and +12 dB.
4. Passive Remote-Mountable Antennae:
   a. Omnidirectional.

b. Half wave.
c. Hardened, impact resistant.
d. Mouting thread.

5. Active Directional Antennae:
   a. Integral amplifier powered by voltage from receiver or distribution amplifier.
   b. Beam Width: 70° @ 3.0 dB.
   c. Integrated thread adapter.
   d. Four-position gain adjustment switch: -6.0 dB, 0 dB, +6.0 dB, +12 dB.
   e. RF overload indicator.

H. Wireless System Accessories:
1. One rechargeable battery for each transmitter plus 20% as spare stock.
2. Charging station(s) with network connectivity to accommodate all batteries in this scope.

2.5 PHANTOM POWER SUPPLIES

A. Channels as shown on the Drawings.

B. Frequency response: 10 Hz to 25 kHz.

C. Output phantom power: 48 V DC, +/- 2.0 V DC.

D. Output noise: -115 dBV.

E. Manufacturer: ART, Audio-Technica, RDL.

2.6 MICROPHONE MOUNTS AND STANDS

A. Floor Stands:
1. Base: 10.0” round iron.
2. Three-piece removeable telescopic boom adapter with 18” to 30” extension.
3. Height: adjustable from 26” to 63”.
4. Counterweight.
5. Color: Black.
6. Manufacturer: Atlas Sound, Konig & Meyer, Whirlwind.
7. Quantity: one per handheld microphone.

B. Desk Stands:
1. Height: adjustable from 8.0” to 13”.
2. Low profile design with round or square base.
3. Color: Black.
4. Manufacturer: Atlas Sound, Konig & Meyer, Whirlwind.
5. Quantity: one per handheld microphone.

PART 3 EXECUTION

3.1 GENERAL

A. Provide matching transformers, buffer amplifiers or fixed attenuation pads as required to meet the signal levels specified herein.

B. See Section 274140, Audio-Visual Cabling and Connectors for additional requirements related to cables, connectors, and terminations.

3.2 WIRED MICROPHONES

A. Size microphone cabling based on cable run distance so that microphones that require receive +48 V phantom power with sufficient current the manufacturer's specifications. Provide local phantom power supplies when the supplying component and/or the cabling is unable to deliver this voltage and/or current.

3.3 WIRELESS MICROPHONES

A. Wireless microphone antennae shall be located to provide drop-out free performance over the entire area being served.

B. Mount receivers in the equipment racks where shown on the Drawings.

C. Provide RF amplifiers as required per manufacturer's antenna cable length distance recommendations and/or limitations.

D. Perform frequency scan to identify available frequencies. Coordinate final frequency selection(s) with the Architect.

E. Label transmitters with laser labels indicating room names or numbers where there are multiple spaces with dedicated wireless microphone systems.

F. Position permanently installed microphones to provide the best pickup of the intended source(s).

3.4 MICROPHONES, CONFERENCING SYSTEMS, AND AUDIO SOURCE EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Tests may include subjective listening at various positions under various operation conditions.

D. Microphone Tests and Adjustments:

1. Adjust positioning of permanently installed microphones to ensure that they are at the optimum position for picking up their intended source(s).
2. Adjust and document internal microphone preamplifier gain trim controls.
3. Test and verify switching and LED tally functions.

END OF SECTION

SECTION 274111 - MIXING, PROCESSING, AND AMPLIFICATION EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Automatic matrix mixers and related peripherals.

B. Mixing consoles, interface boxes, and related equipment.

C. Single and multi-channel distribution and line amplifiers

D. Headphone distribution amplifiers.

E. Power amplifiers.

F. Audio embedders and de-embedders.

G. Accessories related to the above devices.

H. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Section 274110, Microphones, Conferencing Systems, and Audio Source Equipment.

B. Section 274113, Loudspeakers and Related Equipment.

C. Section 274116, Accessibility Systems.

D. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

E. Additional requirements as shown on the Drawings.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Proposed software signal flow diagrams within the mixing system.
   2. Audio mixing system network topology, if applicable.

3. Floor plan showing location of mixing system components not located in an equipment rack.
4. Power amplifier channel assignments showing the connected zone, output type, and power.
   a. For constant voltage systems, show 70 V or 100 V and power used / power available.
   b. For variable impedance systems, show wattage and impedance load.

PART 2 PRODUCTS

2.1 GENERAL

A. Inputs, outputs, and audio network topology as shown herein.

B. Capacity of a matrix described by this Section shall be defined by the quantity of the inputs and outputs (inputs x outputs).

C. Manufacturer: QSC, Biamp, BSS/Harman.

2.2 DIGITAL AUTOMATIC MATRIX MIXERS

A. General:
   1. Primary TCP/IP audio protocol: DANTE.
   2. Acoustic echo cancelling (AEC) available on all inputs.
   3. All components of the mixing system shall be from the same manufacturer, except as noted herein or on the Drawings and the network switch connecting the components.
   4. System control and configuration via Ethernet.
   5. Primary audio network minimum channel matrix capacity: 256 x 256.
   6. System shall supply +48 V DC phantom power to each microphone input individually.
   7. Analog inputs and outputs shall be balanced.
   8. Sampling rate: 24-bit @ 96 kHz.
   9. Digital signal processing integral to video matrix and presentation switchers is covered in Section 274122, Video Transport and Switching Equipment.

B. Fixed I/O Digital Automatic Matrix Mixers:
   1. Minimum DANTE matrix capacity: 32 x 32.
   2. Minimum AVB matrix capacity: 128 x 128.
   3. USB audio channels: 8.
   4. Minimum VoIP instances: 2.
   5. Minimum two network ports assignable to audio network, control network, and VoIP connections.
   6. Rack-mountable.
   7. Single RU chassis.

C. Expansion Card Frames:
   1. Available card slots as shown on the Drawings.
   2. Card types as shown on the Drawings.
   3. Connection to audio network.
   4. Rack-mountable.

2.3 AUDIO NETWORK PERIPHERALS

A. Manufacturer: Same as digital audio matrix mixers.

B. Expansion Modules:
   1. Fixed inputs, outputs, and control ports as shown on the Drawings.
   2. Power via POE, POE+, or local power.
   3. Chassis designed to be mounted to a surface or rack mounted.
   4. Minimum 8 discreet audio network channels converted to USB, where USB is shown on the Drawings.
   5. Audio and control network connection(s): Dual.

C. Remote-mount Audio Network PoE Amplifiers:
   1. Fixed inputs, outputs, and control ports as shown on the Drawings.
   2. Power via POE, POE+, or local power.
   3. Chassis designed to be mounted to a wall or ceiling.
   4. Manufacturer: same as audio matrix mixer manufacturer.

D. Audio Network Peripheral Hubs:
   1. Ports as shown on the Drawings.
   2. Support for the specified audio network topology.
   3. Supports PoE+ power for audio network peripherals.
   4. Manufacturer: Same as audio matrix mixer.

E. Audio Network USB Encoder/Decoders:
   1. Functionally designed to convert audio from the automatic matrix mixer to USB over the audio network for use as recording inputs and/or outputs.
   2. Channels: minimum 8, configurable as outputs or inputs.
   3. PoE, PoE+, or UPoE powered.
   4. Distance limitation 330’.
   5. Manufacturer: Same as audio matrix mixer.

F. Network Switches:
   1. See Section 274132, Audio-Visual Network Equipment.

2.4 DIGITAL MIXING CONSOLE SYSTEMS

A. General:
   1. All components shall be from the same manufacturer unless otherwise noted herein or on the Drawings.
   2. Primary system protocol and network topology as shown on the Drawings.
   3. Minimum system sample rate: 96 kHz / 24-bit, unless otherwise stated on the Drawings.
   4. Main system processing computer shall be housed in the console.
   5. Minimum software matrix buss capacity: 4.
   6. Support for Dante audio network formats.
   7. Support for primary and redundant audio network connections on all devices.
   8. Expansion card slots for additional inputs/outputs, alternate digital audio networks, control ports, and effects processing with cards as shown on the Drawings.

9. Remote control via computer or mobile device software through the audio system control network.
10. Remote control via portable or fixed hardware units as shown on the Drawings.
11. Integral automixing functionality.
12. Parametric equalizers shall have minimum four band fully parametric equalization with amplitude, frequency, and bandwidth controls.
13. Graphic equalizers shall have a minimum of 31 band controls.
14. On-board digital signal processing on inputs shall include, at a minimum, per channel: high pass, low pass, parametric equalizer, compressor, gate, delay, individual output routing, mute, and solo.
15. On-board digital signal processing on outputs shall include, at a minimum, graphic equalizer, parametric equalizer, compressor, and delay.
16. Full system matrix, allowing for any physical input or output to be patched via software to any physical fader.
17. Motorized 100 mm faders.
18. Support for multiple consoles on the digital mixing system network.
19. Manufacturer: Allen & Heath, Avid, Soundcraft, Yamaha, Digico, Midas.

B. Consoles:
1. On-board monitors shall be touch screens.
2. Number of physical faders as shown on the Drawings.
3. On-board local inputs and outputs as shown on the Drawings.
4. Digital labeling of input and output channels.

C. Accessories:
1. Dust cover.
2. ATA-approved transport case, with steel corners, steel latches, and casters.
3. Racks for rack-mount input/output chasses not shown in a fixed equipment rack shall be ATA-approved with metal corners, metal latches, and a caster base.
4. Metallic folding console stand that facilitates tilting the console from a vertical (storage/transport) to a horizontal (in use) position.

2.5 AUDIO NETWORK INTERFACES

A. Form factor and connectivity as shown on the Drawings.

B. Microphone inputs shall provide +48 V DC phantom power to each channel.

C. Microphone inputs shall provide selectable input gain.

D. Line inputs, where shared with a microphone input, shall be balanced.

E. Line-level only inputs shall be balanced or unbalanced.

F. Software-controllable output gain with mute.

G. Bluetooth shall provide duplex pairing at a minimum range of 30’.

H. PoE powered.

I. Manufacturer: same as digital audio matrix mixer.

2.6 DISTRIBUTION AMPLIFIERS

A. Inputs and outputs as shown on the Drawings.

B. Gain: 0 dB unbalanced; +6.0 dB balanced.

C. Rack-mountable or Surface mountable as shown on the Drawings.

D. Manufacturer: RDL, Extron, Rane, Audio Technologies, Drawmer, Whirlwind.

2.7 HEADPHONE AMPLIFIERS

A. Supported impedances: from 32 Ω to 600 Ω.

B. Active balanced or unbalanced inputs up to +20 dBu.

C. Individual (isolated) inputs per channel plus a stereo “mix” input feeding all channels.

D. Quantity of channels per amplifier as indicated on the Drawings.

E. LED metering for each channel.

F. Rack mountable when shown in an equipment rack. Modular (mountable in a gang box) when shown downstream of a field connection.

G. Manufacturer: Behringer, Presonus, RDL, Rane.

2.8 LINE COMBINERS

A. Functionally designed to combine two unbalanced line-level signals to one balanced line-level signal.

B. Input level: -10 dBV nominal -22 dBV minimum.

C. Input impedance: 10 kΩ.

D. Adjustable gain: unity to +14 dB nominal.

E. Output: 150 Ω balanced, +4 dBu to drive low or high impedance, balanced, or unbalanced lines.

F. Manufacturer: Quantum Technologies, RDL, Extron, Whirlwind.

2.9 AUDIO EMBEDDERS AND DE-EMBEDDERS.

A. Refer to Section 274121, Video Source, Recording, and Signal Processing Equipment.

B. Inputs and outputs as shown on the Drawings.

C. Line level input(s) and output(s) shall be balanced.

D. Support for computer and video resolutions up to and including 4K.

E. Support for HDMI data rates up to 10.2 Gbps, 12-bit deep color, and CEC pass through.

F. HCDP compliant.

G. Manufacturer: Extron, Kramer, Crestron, Atlona.

2.10 SMALL FRAME POWER AMPLIFIERS

A. Applies to smaller chassis power amplifiers designed to be mounted to a surface or within a rack with a rack-mounting accessory.

B. Power amplifiers contained in a video matrix or presentation switcher are covered in Section 274122, Video Transport and Switching Equipment.

C. Surface Induction Speaker Amplifiers:
   1. Applies to amplifiers by the surface induction speaker manufacturer.
   2. Refer to Section 274113, Reinforcement and Program Loudspeaker Systems, paragraph 2.07.

D. Output type: 70 V, 100 V, or variable impedance as shown on the Drawings.

E. Channels and inputs as shown on the Drawings.

F. Network controllable where shown on the Drawings.

G. Amplifier type: Class D.

H. Plenum-rated where shown on the Drawings as being installed above an accessible ceiling in a plenum airspace.

I. Watts per channel:
   1. Constant voltage systems: sufficient power to drive the loudspeakers as shown on the Drawings at the performance level indicated in Section 274113, Reinforcement and Program Loudspeaker Systems, up to 80% of available power.
   2. Variable impedance systems: wattage ratings matching specified loudspeaker's continuous power rating and to match the performance level indicated in Section 274113, Reinforcement and Program Loudspeaker Systems.

J. Manufacturer: RDL, Stewart, Extron, Atterotech.

2.11 MULTI-CHANNEL RACK-MOUNT POWER AMPLIFIERS

A. Applies to power amplifiers of two or more channels that have built-in rack mounting hardware and are designed to be mounted only in an equipment rack.

B. Applies only to power amplifiers that feed 70 V or 100 V loudspeaker circuits.

C. Channels and inputs as shown on the Drawings.

D. Ethernet and software controllable.

E. Channels bridgeable in pairs or groups of four.

F. Watts per channel:
   1. Constant voltage systems: sufficient power to drive the loudspeakers as shown on the Drawings at the performance level indicated in Section 274113, Reinforcement and Program Loudspeaker Systems.
   2. Variable impedance systems: wattage ratings matching specified loudspeaker's continuous power rating and to match the performance level indicated in Section 274113, Reinforcement and Program Loudspeaker Systems.

G. Dynamic power sharing across all channels.

H. Local analog inputs routable throughout audio network.

I. On-board dynamics processing, including equalization, compression, limiting, and filtering.

J. Stable under 2.0 Ω loads per channel.

K. Channel volume controls on front panel.

L. Channel output metering LEDs, including signal present and limit or overload.

M. Amplifier and load protection, including short circuit, open circuit, over current, over voltage, thermal, RF, DC fault shutdown, active inrush limiting, and on/off muting.

N. Channels independently switchable between constant voltage and variable impedance modes.

O. Manufacturer: Fulcrum Acoustic, Powersoft, Lab Gruppen, Crown, QSC,.

PART 3 EXECUTION

3.1 GENERAL

A. Configure audio mixing system as required to meet performance requirements in this and other Specification Sections pertaining to the audio system(s).

B. Configure network equipment as required to support the mixing system. Coordinate configuration with the Architect.

C. See Section 274140, Audio-Visual Cabling and Connectors for additional requirements related to cables, connectors, and terminations.

3.2 AUTOMATIC MATRIX MIXERS AND RELATED EQUIPMENT

A. Provide audio, control, and VoIP network topology as shown on the Drawings. Coordinate final topology with the Architect. Provide accessories, including but not limited to SFP modules, stacking cables, and license keys as required.

B. Card order on the Drawings shows design intent only. Install cards in card frame automatic mixers according to manufacturer's instructions.

C. Configure digital signal processing and routing as shown on the Drawings and in conjunction with the requirements shown in Section 274131, Audio-Visual Control Systems and Programming.

D. Any direction given herein or on the Drawings pertaining to digital signal processor programming shall be considered a starting point. Final routing and processing shall be coordinated with the Architect.

E. Configure matrix routing so that the system operates as a true mix minus system to the extent allowed by the loudspeaker zoning shown on the Drawings.

F. Auto-mixers with digital signal processors shall be gating auto-mixers.

G. Terminate all unused inputs and outputs on patch panels or other custom connector plates on the back of the equipment rack(s).

H. Follow manufacturer's recommendations regarding maximum network switch hops.

I. Configure audio matrix mixing system notification feature(s) that notify the user of network or audio signal faults on the system.

3.3 DIGITAL MIXING SYSTEMS

A. Observe manufacturer's distance limitations between the console and input chasses.

B. Configure audio mixing system as required to meet performance requirements in this and other specifications with related equipment.

C. Network and other digital connections between components shall be made in a way that minimizes audio latency.

D. Configure default routing preset configurations for the system based on typical use case scenario(s) identified by the Architect.

3.4 POWER AMPLIFIERS

A. Observe manufacturer's racking recommendations relative to thermal management.

B. Configure power amplifier internal DSP, power allocation, and other settings as required to meet the performance requirements in this and other Specification Sections pertaining to this audio system.

3.5 MIXING, PROCESSING, AND AMPLIFICATION EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment, including, but not limited to:
   1. Section 274110, Microphones, Conferencing Systems, and Audio Source Equipment.
   2. Section 274113, Loudspeakers and Related Equipment.
   3. Section 274116, Accessibility Systems.

C. Perform audio network failover testing for each audio network device as follows:
   1. Where redundant paths are specified, disconnect the primary path, and verify that the audio network equipment provides an uninterrupted switch over to the secondary (redundant) path.
   2. Where a redundant path is not specified, disconnect, and reconnect the primary path to verify that the audio network device recovers and returns to a fully connected state.
   3. Test notification features of the audio network that notify the user of a failure.

END OF SECTION

SECTION 274113 - LOUDSPEAKERS AND RELATED EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ceiling-recessed speakers and subwoofers.

B. Pendant speakers and subwoofers.

C. Surface-mounted program audio speakers and subwoofers, passive.

D. Control room monitors.

E. Volume controls, analog.

F. Headphones.

G. Performance loudspeakers, subwoofers, and rigging hardware.

H. Foldback (monitor) loudspeaker systems.

I. Loudspeaker mounting equipment.

J. Loudspeaker accessories.

K. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 DEFINITIONS

A. “Reinforcement and Program Loudspeakers” shall mean ceiling and pendant speakers, wall-mount speakers, columnar speakers, desktop speakers, and similar used for speech, program audio, or light musical reinforcement of acoustic instruments.

B. “Performance Loudspeakers” shall mean loudspeakers, either as single enclosures or as an array, that are used for live performance, higher volume or ensemble musical reinforcement.

1.3 RELATED REQUIREMENTS

A. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

B. Section 274110 - Microphones, Conferencing Systems, and Audio Source Equipment.

C. Section 274111 - Mixing, Processing, and Amplification Equipment.

D. Additional requirements as shown on the Drawings.

1.4 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

B. Conform to AVIXA A102-01-2017, Audio Coverage Uniformity.

1.5 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plan showing locations of speakers placed in any location other than in or above the ceiling.
   2. Reflected ceiling plan showing locations of speakers in or above the finished ceiling.
   3. Wall-mounted speakers shall be shown in an elevation showing height and spatial relationships to adjacent equipment or architectural elements that are on or in the wall where the speakers will be mounted.
   4. For performance loudspeakers, and any arrays, elevations of the speaker(s) or array(s) showing:
      a. The height and spatial relationships to adjacent equipment or architectural elements that are on or in the wall(s) adjacent to the speaker or array.
      b. Loudspeaker mounting or rigging systems, specifically identifying by make and model all components thereof.
      c. Dimensions of the speaker(s)/array(s), including height AFF and BFC.
      d. Dimensions of each individual loudspeaker component of the array.
      e. Total weight of the speaker(s)/array(s).
      f. Details depicting the method by which the speaker(s)/array(s) will be suspended.
      g. Vertical and horizontal tilt and pan angles for the speaker(s)/array(s).
      h. For arrays: vertical and horizontal splay angles between cabinets within the array.
      i. For any array or individual speaker cabinet weighing 100 lbs. or more: Certification from a licensed structural engineer that the structure will support the load.
      j. Contact information for the loudspeaker manufacturer's representative that was involved in the design of the proposed loudspeaker solution, if any.
   5. Wiring diagrams showing:
      a. Loudspeaker connections to other devices.
      b. Connections between loudspeakers within an array.
      c. Proposed loudspeaker zoning and circuiting, including voltage and proposed tap settings.
      d. Details showing speakers mounted in or on walls or hard ceilings.
      e. Processor settings for all loudspeakers with active internal signal processing.
   6. Loudspeaker modeling reports including coverage map indicating dB SPL and % ALCONS over the entire coverage area.
   7. Finish or color samples of any custom finished or colored component covered by this Section.

PART 2 PRODUCTS

2.1 GENERAL

A. Loudspeakers of the same type (i.e., ceiling speakers, pendant speakers) shall be from the same manufacturer unless otherwise noted.

B. Loudspeakers shall be governed by requirements herein and additional requirements on the Drawings.

C. Exterior-rated or wet-rated where shown on the Drawings on a schedule, with a symbol annotation tag, or placed on a plan in an exterior or wet location. “Exterior-rated” or “wet-rated” shall be defined as IP-65 as it relates to products covered by this Section.

D. Finish color, all exposed components, unless otherwise noted: Coordinate with Architect.

E. Provide manufacturer’s recommended mounting hardware, safety hardware, and seismic restraints (i.e., tile bridges, beam clamps, wall-mounts) as required.

F. Power ratings as shown on the Drawings.

G. Bi-amplified, tri-amplified, or powered (integral amplifiers) as shown on the Drawings.

H. Driver size and quantity as shown on the Drawings.

I. Any loudspeaker or array (or component thereof) shown suspended on the Drawings shall be rated for overhead suspension and have integral fly points.

J. Connectors:
   1. Speaker level signals: Neutrik SpeakON™ or terminal block connectors.
   2. Analog and digital line level audio: latching XLR connectors.
   3. Communication and network-audio: RJ-45 connectors. Cable-mounted connectors with latching metallic barrel shield (i.e., Neutrik EtherCON™) shall be used when connectors on the loudspeaker accept such a connector.
   4. AC Power: Neutrik PowerCON™ or latching connector.

2.2 CEILING SPEAKERS AND SUBWOOFERS

A. Loudspeaker, transformer, and enclosure shall be manufactured and sold as a single unit unless otherwise indicated on the Drawings.

B. Adjustable tap settings with transformer bypass. Tap adjustment shall be accessible without removing speaker assembly from its installed location unless otherwise noted.

C. Cylindrical enclosure unless otherwise indicated on the Drawings.

D. Dimensions as shown on the Drawings.

E. Driver component size(s) as shown on the Drawings.

F. Metallic enclosures shall have a rust-preventative coating.

G. Frequency response and power handling as shown on the Drawings.

H. Grilles as indicated on the Drawings.

I. Manufacturer: QSC, Electro-Voice, JBL, Tannoy

2.3 PENDANT SPEAKERS AND SUBWOOFERS

A. Adjustable tap settings with transformer bypass. Tap adjustment shall be accessible without removing speaker assembly from its installed location, unless otherwise noted.

B. Cylindrical enclosure unless otherwise indicated on the Drawings.

C. Dimensions as shown on the Drawings.

D. Suspension height as shown on the Drawings.

E. Metallic enclosures shall have a rust-preventative coating.

F. Frequency response and power handling as shown on the Drawings.

G. Manufacturer: QSC, Electro-Voice, JBL, Tannoy.

2.4 SURFACE MOUNTED PROGRAM AUDIO SPEAKERS AND SUBWOOFERS, PASSIVE

A. Adjustable tap settings with transformer bypass. Tap adjustment shall be accessible without removing speaker assembly from its installed location.

B. Dimensions as shown on the Drawings.

C. Frequency response and power handling as shown on the Drawings.

D. Mounting hardware and/or attachment points with tamper-resistant to allow multiple mounting positions.

E. Manufacturer: QSC, Electro-Voice, JBL, Tannoy.

2.5 CONTROL ROOM MONITORS

A. Active:
1. Bi-amplified configuration.
2. High frequency driver: (1) 1.0” Ø soft dome tweeter.
3. Low frequency driver: (1) 5.0” Ø woofer.
4. Frequency response: 47 Hz to 20 kHz, ±3.0 dB.
5. Power handling capacity: HF: 250 W, LF: 250 W.
6. Inputs as shown on the Drawings.
7. Selectable HF trim control.

8. Selectable boundary equalization.

B. Wall-mountable where shown on Drawings.

C. Manufacturer: Genelec, JBL, IK Multimedia.

2.6 VOLUME CONTROLS, ANALOG

A. For use with 70 V lines.

B. 10-step attenuation.

C. Control: integral paging override circuit/relay where shown on the Drawings.

D. Single-gang plate mounting.

E. Manufacturer: Atlas Sound, Lowell, Quam.

2.7 HEADPHONES

A. Pair, complete with headband, cord, and connector compatible with equipment headphone jacks.

B. Power handling capacity: 200 mW.

C. Impedance per headphone: 600 Ω.

D. Frequency response: ±3.0 dB, 20 Hz to 20 kHz.

E. Closed earmuff.

F. Manufacturer: AKG Acoustics, Beyer, Sennheiser, Shure, Sony.

2.8 PERFORMANCE POINT SOURCE LOUDSPEAKER ARRAY CABINETS

A. Passive:
1. Internal crossover where Drawings show signal feeding drivers supporting multiple frequency ranges.

B. Active:
1. Integral digital signal processing (DSP), including, at a minimum, limiting and equalization.
2. Network controllable.

C. Cabinet construction as shown on the Drawings.

D. Integral flying/hanging points intended for overhead suspension for all speakers shown as suspended on the Drawings.

E. Rotatable horn.

F. Integral handles on two or more sides.

G. Manufacturer: Fulcrum Acoustic, EAW, QSC, Electrovoice, Martin Audio, L'Acoustics.

2.9 PERFORMANCE LINE SOURCE LOUDSPEAKER ARRAY CABINETS

A. Passive:
   1. Internal crossover where Drawings show signal feeding drivers supporting multiple frequency ranges.

B. Active:
   1. Integral digital signal processing (DSP), including, at a minimum, limiting and equalization.
   2. Network controllable.

C. Integral adjustable rigging system that allows selection of vertical splay angles.

D. Cabinet construction as shown on the Drawings.

E. Manufacturer: Fulcrum Acoustic, EAW, QSC, Electrovoice, Martin Audio, L'Acoustics.

2.10 PERFORMANCE SUBWOOFERS

A. Passive:
   1. Multiple driver cabinets wired as single or multiple circuits or loads as shown on the Drawings.

B. Active:
   1. Integral digital signal processing (DSP), including, at a minimum, limiting and equalization.
   2. Network controllable.

C. Arrayable in omnidirectional or cardioid patterns.

D. Integral handles on two or more sides when shown ground stacked on the Drawings.

E. Integral flying/hanging points intended for overhead suspension when shown flown on the Drawings.

F. Manufacturer: Fulcrum Acoustic, EAW, QSC, Electrovoice, Martin Audio, L'Acoustics.

2.11 LOUDSPEAKER RIGGING HARDWARE

A. Applies to the following loudspeakers: all loudspeakers.

B. Steel construction.

C. Approved by the loudspeaker manufacturer for supporting the arrays as designed.

D. Working load limit of two times the array's weight.

E. Support raising and lowering speaker arrays where indicated on the Drawings.

F. Capable of suspending the array(s) at the angle(s) shown on the Drawings without modifications.

G. Manufacturer: same manufacturer as the specified loudspeaker(s) and/or subwoofer(s).

2.12 FOLDBACK (MONITOR) LOUDSPEAKER SYSTEMS

A. Enclosure with one or more angled sides to allow the cabinet to be placed on or near the floor and the on-axis point to be angled up.

B. Cabinet construction as shown on the Drawings.

C. Passive:
   1. Internal crossover where Drawings show signal feeding drivers supporting multiple frequency ranges.

D. Active:
   1. Integral digital signal processing (DSP), including, at a minimum, limiting and equalization.
   2. Network controllable.

E. Integral handles on two or more sides.

F. Parallel connections to allow daisy chaining monitors.

G. Manufacturer: Fulcrum Acoustic, EAW, QSC, Electrovoice, Martin Audio, L'Acoustics.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate loudspeaker array installation with structural, mechanical, electrical, theatrical rigging, or other Contractors as necessary to install the array(s) at location shown on the Drawings.

B. Observe loudspeaker manufacturer's installation instructions, including but not limited to installation procedures, accessories (i.e. tile bridges, mounts, safety cables, seismic restraints, and clamps), and supplies.

C. Loudspeakers shall not be relocated more than 12" in any direction without written approval from the Architect.

D. Color: Paint loudspeaker grilles to match finish color of mounting surface. Verify loudspeaker color with Architect prior to ordering.

E. Loudspeaker distribution lines shall be separate where indicated on the Drawings and shall be installed in conduit.

F. As a part of final acceptance testing, create a “default system configuration file.” The file shall consist of audio mixer software files and/or written documents (Microsoft Word, Excel, etc.) as necessary to describe and document the default system settings as they were at the time of final acceptance.

3.2 CEILING SPEAKERS

A. Confirm all speaker dimensions and installation locations with Architect prior to installation.

B. Provide tile bridges, safety cables, rough-in assemblies, and other necessary hardware to mount speakers at locations shown on the Drawings.

C. Unless otherwise indicated, use narrow dispersion loudspeaker assemblies where finished ceiling height is greater than 15’ above the finished floor.

D. Sound Pressure Level (SPL) shall be 20 dB above the ambient noise on-axis at 60” (standing) and 48” (seated) ear height. Set loudspeaker taps as required.

E. Loudspeaker coverage, throughout the space(s): ±3 dB.

F. Loudspeakers in ceiling grids shall be supported by the grid and/or the building structure. Safety restraints shall be attached to the structure.

G. No component shall be attached to or in contact with other building systems, such as mechanical, fire protection, electrical, or plumbing equipment.

H. Loudspeakers in inaccessible ceilings shall be supported by the building structure or using mounting accessories specifically approved for the type of ceiling in which the loudspeaker will be installed.

I. Permanently mounted loudspeakers, other than ceiling-mounted speakers, shall incorporate 50 durometer neoprene vibration isolation pads loaded to 40 psi.

3.3 PENDANT SPEAKERS

A. Confirm final pendant suspension height with Architect prior to installation.

B. Pendant speakers shall be supported by the structure.

C. Provide strain relief and safety cable as required by the loudspeaker manufacturer.

3.4 SURFACE MOUNTED SPEAKERS, PASSIVE

A. Confirm all speaker dimensions and installation locations with Architect prior to installation.

B. Coordinate speaker locations with adjacent equipment or architectural components, including but not limited to projection screens, displays, doors, windows, cameras, and lighting fixtures.

C. Provide blocking in wall as required to support the loudspeaker.

D. Follow manufacturer's installation instructions.

3.5 PERFORMANCE LINE AND POINT SOURCE LOUDSPEAKER AND SUBWOOFER ARRAY CABINETS

A. Coordinate loudspeaker array installation with structural, mechanical, electrical, theatrical rigging, or other contractors as necessary to install the array(s) at location shown on the Drawings.

B. Coordinate array locations with final locations of other items, including but not limited to display devices, so that one does not obstruct the other.

C. Provide loudspeaker manufacturer's on-site installation and configuration service.

3.6 PERFORMANCE LOUDSPEAKER RIGGING HARDWARE

A. Coordinate rigging installation with structural.

B. Coordinate rigging installation with theatrical rigging where applicable.

3.7 LOUDSPEAKER PERFORMANCE VERIFICATION

A. General:
   1. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in the following sections:
      a. Section 274010, "Audio-Visual General."
      b. Section 274110, "Microphones, Conferencing Systems, and Audio Source Equipment."
      c. Section 274111, "Mixing, Processing, and Amplification Equipment."
   2. rformance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.
   3. These requirements only apply to loudspeakers or loudspeaker systems covered by this section.
   4. Interior finishes and furnishings shall be in place for these tests.
   5. Documentation of performance tests shall be maintained for reference during the system acceptance tests.
   6. Tests and adjustments shall be performed in the sequence specified herein.
   7. Provide buffer amplifiers, transformers, or fixed attenuation pads to match signal levels, where required.
   8. Tests may include subjective viewing and listening at various points under various operating conditions, using live or recorded material.

B. Basic Loudspeaker System Tests and Adjustments:
   1. Background Noise:
      a. Using a calibrated ANSI/ASA S1.4-2014/Part 1/IEC 61672:1-2013 Type 1 or IEC 61672-1 ed2.0-2013 precision sound level meter, determine the average ambient noise level in the room. Record the level measured. The average background noise shall be 60 dBA or below during performance of the audio tests included herein. If the background noise level exceeds this criterion, promptly notify the Architect.

2. Impedance:
   a. Measure absolute overall impedance of each loudspeaker circuit. Ensure impedance is within load limitations of the specified power amplifier(s). Adjust circuiting if required.
3. Polarity:
   a. Verify that polarity is maintained throughout each loudspeaker system circuit, beginning with the power amplifier output through the last speaker in the circuit.
4. Gain Structure, Input Levels, and Output Levels:
   a. Adjust input and output gain controls of software and hardware components to achieve a 0 dBu reading through the entire signal chain up to the amplifiers. Set amplifier levels to allow the system to produce sound levels of at least 85 dBA in all spaces, unless otherwise indicated on the Drawings.
   b. Use pink noise to set gain structure.
   c. Bypass signal processing as required to set proper gain staging.
5. Hum, Noise Level, and RF Interference:
   a. Terminate inputs and outputs to prevent the introduction of hum or other noises into the audio signal chain. Hum and noise shall be at least 80 dBA below the output levels.
   b. Ensure that the system is free from spurious oscillation and RF pick-up with the absence of any input signal and with a 160 Hz signal at 0 dBu level on the audio mixer.
6. Buzzes and Rattles:
   a. Using a sine wave set to 0 dBu on the audio mixer, sweep all loudspeaker circuits from 50 Hz to 5.0 kHz. Identify and correct any buzzes, rattles, vibrations, or resonances caused by the system.
   b. If the cause is outside the system, promptly notify the Architect indicating the cause and recommended corrections.
7. Compression and Limiting:
   a. Set compressors as required to prevent drastic changes in audio levels. Compression levels shall be set to a minimum and increased as determined to be necessary during system testing or acceptance.
   b. Set hard limiters to prevent damage to loudspeaker components.
8. Equalization and Filtering:
   a. Equalization of all types, including high-pass and low-pass filtering, shall be set consistent with the intended primary use.
   b. The equalization process shall be repeated for each loudspeaker zone.
   c. Graphic equalizers on outputs shall have maximum 1/3 octave-band controls. Parametric equalizers on outputs shall have, at a minimum, the number of bands necessary to obtain the desired equalization settings.
   d. Equalization shall be set to maximize gain before feedback and shall maintain ±1.5 dB between low-pass and high-pass filter settings described herein.
   e. System equalization shall be set using a calibrated measurement microphone and a slow-response hardware or software 1/3 octave-band real time analyzer (RTA). With all equalizers and filters in bypass, obtain an average 1/3 octave frequency response in the room by placing the microphone at a minimum of four unique locations. Place the microphone at the one location that best represents the average of the frequency responses obtained. This location shall be used to set equalizers and filters for the system.

f. On 1/3 octave graphic equalizers, minimize the variation between adjacent filter settings.
g. Unless otherwise directed, set high and/or low pass filters with a 24 dB slope at the following frequencies:
    1) For voice-only systems (paging systems): high pass: 125 Hz, low pass: 10 kHz.
    2) For systems with voice reinforcement and program audio playback: high pass: 63 Hz, low pass: 12 kHz.
    3) For full music reinforcement systems without subwoofers: high pass: 50 Hz, low pass: none.
    4) For full music reinforcement systems with subwoofers: high pass: 32 Hz, low pass: none.
h. Feedback Stability:
    1) With required output levels set, measure, and record the available gain before feedback. Feedback stability margin shall be 6 dB, minimum.

C. Advanced Loudspeaker System Tests and Adjustments:
1. Time Delays:
    a. Set time delays on specific speaker circuits as necessary to prevent to the extent possible audio from two separate zones or circuits arriving at a specific area at different times.
    b. Adjust the delay settings using a TEF or FFT analysis and aural analysis to obtain the most natural sound possible.
    c. Document these settings.
2. Intelligibility:
    a. Using a TEF analyzer, measure the percent articulation loss of consonants (% ALCONS) for at least 4 various locations in the room in the 2.0 kHz octave band.
    b. % ALCONS shall be less than 10 for each location. Adjust system configuration as required, including equipment settings and loudspeaker positioning, as necessary. Notify the Architect in writing if the acoustical conditions in the room are preventing the system from meeting this requirement.
    c. Record results.

END OF SECTION

SECTION 274115 - PRODUCTION COMMUNICATION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wireless production communication systems.

1.2 RELATED REQUIREMENTS

A. Section 274111, Mixing, Processing, and Amplification Equipment.

B. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plan showing the position of all production communication equipment, including wall plates where portable devices will connect and antennae when wireless production communication systems are specified.
   2. Wiring diagram showing the interconnection of all components in the production communication system.
   3. Documentation showing proposed channel grouping of production communication outlets, speaker stations, or other devices where these devices will be permanently assigned to one or more channels.
   4. When wireless production communication devices are specified, a frequency spectrum analysis performed at the project site showing available frequencies and the frequencies to be used by the production communication system in this project.

PART 2 PRODUCTS

2.1 GENERAL

A. All components shall be from the same manufacturer, unless otherwise noted.

B. Connectors:
   1. Analog and digital audio: latching XLR connectors.

2. Communication and network audio: RJ-45 connectors. Cable-mounted connectors with latching metallic barrel shield (i.e., Neutrik EtherCON™) shall be used when connectors on the loudspeaker accept such a connector.

C. Manufacturer, except as noted: Clear-Com, RTS, or Reidel.

2.2 DIGITAL WIRELESS SYSTEMS

A. Main Stations:
1. Supported frequencies: 1.9 GHz and 2.4 GHz.
2. Minimum supported wireless belt packs: 5.
3. 2-Wire and 4-Wire signals supported as shown on the Drawings.
4. LAN uplink to communications network or matrix.
5. Dual antennae, expandable to 10 antennae.
6. Program audio input.
7. Stage announce output.
8. Four OLED displays with assignable soft keys.
9. 4-pin XLR headset connector.

B. Antennae (Transceivers):
1. Compatible with the selected system frequency.
2. IP-Based:
   a. For use with communications matrix.
   b. Support for AES67 IP based audio.
   c. Minimum 10 belt packs per antennae
   d. Support for 64 transceivers in a single communications matrix.
   e. 2 EtherCON RJ-45 connections and 2 SFP ports.
   f. IP-53 rated, minimum.
   g. PoE support up to 300’.
3. Non-IP-Based:
   a. Minimum 5 belt packs supported at 1.9 GHz.
   b. Minimum 65 belt packs supported at 2.4 GHz.
   c. IP-53 rated, minimum.
   d. EtherCON RJ-45 connection.
   e. Power: Local or from base station.
   f. Mountable on a microphone stand.
4. Connections to base stations as shown on the Drawings.
5. Splitters:
   a. Functionally designed to split one transceiver feed in to five transceiver feeds.
   b. SFP and RJ-45 uplink connection.
   c. LED status indicators.
   d. IP-63 rated, minimum.

C. Belt Packs:
1. Compatible with the selected system frequency.
2. 2-channel party line operation.

3. Range: 300’ indoors, 800’ outdoors.
4. Wireless registration.
5. Battery life, minimum: 18 hours.
6. USB port for wired power connection.
7. Built-in flashlight.
8. IP-53 rated, minimum.
9. 4-pin XLR headset connection.
10. Power and mute buttons.
11. Independent talk and call buttons for each channel.

D. Headsets:
1. Single or dual muff as shown on the Drawings.
2. 4-pin XLR connector.
3. Reversible (left or right worn).
4. Dynamic cardioid gooseneck microphone with 300 Hz to 20 kHz frequency response.
5. 300° boom mic rotation with mic mute switch activated by boom position.
6. Headphone: 40mm diameter neodymium driver in over-the-ear muff covering entire ear.

E. Chargers:
1. Drop in style charger for minimum of five batteries.
2. Wall-mountable with bracket.

F. Batteries:
1. Type: lithium-ion.
2. Voltage: 3.7 V.
3. Capacity: 1.9 AH.
4. Rechargeable.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate system configuration and programming with Architect.

B. Set system baseline volume levels for speech such that the baseline level is achieved when volume controls on user stations is between 40% and 50%. While the baseline level is subjective, said level shall be agreed upon by the Contractor, one or more Owner representatives, and the Engineer when present for initial system configuration.

3.2 DIGITAL WIRELESS SYSTEMS

A. Provide quantity of antennae, transceivers, or WAPs to cover required quantity of wireless belt packs.

B. Transceivers: Mount transceivers at locations shown on Drawings.

C. Provide sufficient RF coverage for the front of house, back of house, seating area, and stage areas.

D. Provide signal amplifiers as required to extend antenna cable length.

3.3 ACCESSORIES

A. Provide interconnects as required to inject program audio.

B. Provide interconnects as required and/or as shown on the Drawings to connect separate systems (i.e. wired and wireless party line systems used in the same space).

C. Provide 2-wire to 4-wire converters as required.

3.4 PRODUCTION COMMUNICATION SYSTEMS PERFORMANCE VERIFICATION

A. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Audio Tests and Adjustments:
   1. Impedance:
      a. Measure absolute overall impedance of each production communication circuit. Ensure impedance is within load limitations of the specified amplifier, main station, or other component providing or controlling the signal. Adjust circuiting if required.
   2. Polarity:
      a. Verify that polarity is maintained throughout each production communication circuit.
   3. Hum, Noise Level, and RF Interference:
      a. Terminate inputs and outputs to prevent the introduction of hum or other noises into the audio signal chain. Hum and noise shall not be plainly audible in the system.
      b. Verify that the shield of all lines is intact and connected for the length of the installed cable run.
      c. Ensure that the system is free from spurious oscillation and RF pick-up with the absence of any input signal.

D. Wireless Systems:
   1. Using a wireless belt pack and headset and moving through the coverage area(s), verify that the wireless production communication system signals are constant and free of dropouts in the entire coverage area. Adjust antennae, transceivers, and WAPs as necessary.

E. Remote Power:
   1. Verify that all remotely powered components, regardless of the power source, receive voltage and amperage within the manufacturer’s operating specifications. Adjust and/or add power supply capacity as required.

F. Programming:
   1. Install and configure system management software on management PCs or servers. This includes all PCs or servers included in this scope as a part of the production communication system. This includes up to two PCs or servers per space that are owner-provided outside of this scope.

2. Verify all channels for proper grouping. Testing shall include voice communications as if the system was in use, as well as visual and audio signals (calls) and tally signals as appropriate for each station.
3. For stations with channel switching functionality, verify that the appropriate channel grouping is heard from, talked to, and signaled to and from as selected on the station.

G. Interfaces to other Systems:
1. Verify that all interfaces to or from other systems send or receive the desired signals or channel groups. This shall include but not be limited to front and back of house announce lines, tally signals, and program audio feeds to the production communication system.

END OF SECTION

SECTION 274116 - ACCESSIBILITY SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. FM Assistive Listening Systems.

B. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Additional requirements as shown on the Drawings.

B. Section 274110, Microphones, Conferencing Systems, and Audio Source Equipment.

C. Section 274111, Mixing, Processing, and Amplification Equipment.

D. Section 274113, Loudspeakers and Related Equipment.

E. General provisions in Section 274010, Audio-Visual General and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

B. FCC part 15

C. ISO ICS-03

D. CE, RCM, MIC, RoHS, and WEEE.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plans and/or RCPs as required to show locations of all field devices, including but not limited to emitters, permanently installed inductive loops, antennae, visual paging displays, and connection points for portable accessibility equipment covered by this Section.
   2. Inductive loop layouts shall be approved in writing by the loop system manufacturer prior to submission to the Design Team.
   3. Wiring diagram showing proposed interconnects from audio mixing or processing and other systems to deliver single or multi-channel audio, data, and RF signals as required.

PART 2 PRODUCTS

2.1 GENERAL

A. Inputs and outputs as shown on the Drawings.

B. Receiver quantities and other system capacities as necessary shall comply with Americans with Disabilities Act requirements at the time the system is installed. Changes in these requirements that, in the opinion of the Contractor, bear significant financial burden, shall be brought to the attention of the Architect in writing prior to system installation.

C. All components shall be from a single manufacturer, unless otherwise noted.

D. Color of exposed components shall be coordinated with the Architect.

E. Signage:
1. Provide one wall-mounted sign indicating the presence of the hearing assistance system per system.
2. Where one system is shared by more than one space, provide on sign for each space.
3. Signage shall indicate the availability of standard and telecoil loop compatible receivers.

F. Manufacturer: Listen Technologies, Sennheiser, Williams Sound.

2.2 FM ASSISTIVE LISTENING SYSTEMS

A. General:
1. System base RF frequency: 72 MHz.

B. Modulators:
1. Adjustable input level.
2. Audio processing: compression, switchable on/off.
3. Audio frequency contouring.
4. Integral test tone generator.
5. Front panel channel selector and input level adjustment.
6. LED channel, audio level, and transmit level indicators.
7. Rack-mountable where shown in an equipment rack on the Drawings.
8. RF channel support: 2.

C. Antennas:
1. Remote-mountable.
2. Compatible with system base RF frequency shown above.
3. Type: dipole.
4. Unity gain: 0 dB.
5. Antenna range: 1,000’.

D. Receivers:
1. Style: stethoscope, neck lanyard, or body pack as shown on the Drawings.
2. Channels: 2.

3. User controls for power on/off, volume up/down, and channel selection.
4. OLED display showing channel designation, status, battery level, and volume.
5. Programmable automatic squelch.
6. Frequency range: 216.0125 MHz to 216.9875 MHz.
7. Channels: 19 wide band, 38 narrow band.
8. Programming via software and USB port.
9. Earphones:
   a. Worn over the ear.
   b. Useable with hearing aids.
   c. Frequency response: 20 Hz to 20 kHz.
   d. Connector: compatible with specified receiver.
10. Inductive Neck Loops:
   a. Functionally designed as a lanyard and inductive loop.
   b. Connectors compatible with specified receiver.
   c. Field strength: 400 mA/m, ±3.0 dB.
   d. Frequency response: 100 Hz to 5.0 kHz, ±3.0 dB @ 1.0 kHz.
11. Rechargeable Batteries:
   a. Type: Lithium-ion.
   b. Capacity: 1200 mAh.
   c. Full charging time: 120 to 150 minutes.
   d. Battery life: 3750 discharge cycles @ 10% depth of discharge, minimum.

E. Accessories:
1. Battery Chargers:
   a. Simultaneous charging of 12 batteries.
   b. Chassis type: Desktop.

PART 3 EXECUTION

3.1 GENERAL

A. Install signage related to the hearing assistance system at location(s) in front of house spaces identified by the Architect. Verify locations prior to installation.

B. Coordinate receiver channel assignments with the Architect.

3.2 EMITTERS AND ANTENNAS

A. Place antennas and/or emitters to provide even coverage, free of dropouts for the entire listening area, unless a specific coverage area is shown on the Drawings.

B. Aim emitter panels where best performance is obtained in the space(s) the panels are intended to cover.

C. Mount emitter panels and antennas to limit interference from other devices or systems.

D. Observe manufacturer’s cable length limitations.

3.3 INFRARED, WIFI, AND FM ACCESSIBILITY SYSTEMS PERFORMANCE VERIFICATION

A. General:
   1. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in Section 274010, Audio-Visual General.

B. Infrared, FM, and WIFI Systems:
   1. Verify that selected frequency bands are free from interference of any kind, including from other radio sources occupying the desired frequency, and lighting instruments.
   2. Using a receiver, walk the extents of the coverage area and ensure that the assistive listening signal is heard in the entire area. Adjust antennas and emitter positioning and strength as required.
   3. Test the reception of the system at six points within the coverage area. Adjust antenna and emitters accordingly.

END OF SECTION

SECTION 274116.10 - INTEGRATED AUDIO-VIDEO EQUIPMENT FOR CLASSROOMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUMMARY:

A. Section Includes:
   1. Stand-alone, networkable, scalable, one-room AV control and presentation system with user control panel and software.

B. Related Information:
   1. Division 27 Section "Common Work Results for Communications."
   2. Division 27 Section "Communications Copper Horizontal Cabling."
   3. Division 27 Section "Public Address System."

1.4 REFERENCES

A. Comply with the following codes, standards, and manuals:
   1. NFPA 70 - National Electrical Code.
   2. ANSI/TIA-588-C.0 - General Cabling Standards
   3. ANSI/TIA-568-C.1 -- Commercial Building Cabling Standard
   4. ANSI/TIA-568-C.2 -- Balanced Twisted Pair Cabling Standard
   5. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12
      a. Educational Institutions
   6. ANSI S12.60:2002 Acoustic Performance Criteria, Design Requirements, Guidelines for
      a. Schools
   7. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   8. ANSI/TIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces
   9. ISO/IEC 18010:2002 (2002) - Pathways and Spaces for Customer Premises Cabling
   10. ANSI/TIA-606-D -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   11. ISO/IEC 14763-1:1999 (1999) - Implementation and Operation of Customer Premises Cabling, Part 1 - Administration

12. J-STD-607-A -- Commercial Building Grounding and Bonding Requirements for Telecommunications
13. BICSI -- Telecommunications Distribution Methods Manual (TDMM)
14. BICSI -- Information Transport Systems Installation Methods Manual
15. BICSI - AV Design Reference Manual
16. BICSI - Network Design Reference Manual

1.5 SYSTEM DESCRIPTION

A. For each classroom, furnish and install a complete, networkable audio system that serves as a primary audio amplification for media and voice, and also an audio end-point for the Public Address system (see 27 51 16).
   1. Standard Classrooms with a mobile interactive display shall have a receiver (basis of design FRONTROW # 1000-00287 UNITY Campus Complete Kit) to be installed inside of a 2'x2' recessed, plenum-rated, ezRoom Trio enclosure with three integrated speakers (FRONTROW # 1000-00310), ClassLight, and a pre-installed analog page override (FRONTROW #1010-00004). The receiver must have one (1) teacher microphone, one (1) student microphone and a flip charger.
   2. Large classrooms with a mobile interactive display shall have an ezRoom 2x2 recessed, plenum-rated ceiling enclosure pre-installed with UNITY Campus Complete Kit, Powerline and ClassLight (basis of design FRONTROW # 1000-00309), pre-installed analog page override (FRONTROW #1010-00004), and shall be connected to four (4) 2x2 speakers (FRONTROW #SP-L2-4). The receiver must have one (1) teacher microphone, one (1) student microphone and a flip charger.
   3. Classrooms with a fixed, wall-mount displays shall have a receiver (basis of design FRONTROW # 1000-00287 UNITY Campus Complete Kit) to be installed inside of a 2x2 recessed, plenum-rated ezRoom Trio ceiling enclosure with three integrated speakers (FRONTROW # 1000-00310), ClassLight, a pre-installed analog page override (FRONTROW #1010-00004), and to the display via serial and audio cable (basis of design FRONTROW #6414-00028) for audio return. The receiver must have one (1) teacher microphone, one (1) student microphone and a flip charger.
   4. The System is to include all equipment, cabling, materials, labor, and training as required to install and test a complete operating System as described herein.
   5. Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
   6. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.
   7. Deviations from the installation drawings, except for minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

1.6 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section

B. "Communications Shop Drawings and Submittals" for products specified under PART 2 - PRODUCTS.

C. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section "Communications Shop Drawings and Submittals".

D. Shop Drawings: Indicate the following:
   1. Schematic diagram of controlled circuits.
   2. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.

1.7 INFORMATION SUBMITTALS

A. Sample of manufacturer's warranty.

B. Installation and setup guides.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For equipment and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:
   1. Record of Owner's equipment-programming option decisions.
   2. All instructions necessary for proper operation and manufacturer's instructions.
   3. "Proof of Performance" information.
   4. Manufacturer's maintenance information.
   5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

B. Record Drawings: Prior to final acceptance, provide a complete set of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

C. System Training: Submit the following information describing the training programs and system trainers as outlined in this Section and in accordance with Division 01 Specifications.
   1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the Owner's representative.
   2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
   3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the Owner's designated representative for the system's preliminary system programming and configuration.
   4. Include with the submittal copies of all documentation used to identify for the Owner those participants attending and completing the training programs.

D. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of controller with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

B. Source Requirements: Provide control panel, amplifier/switch, loudspeaker, receiver, microphone hardware and software through a single source from a single manufacturer.

C. Contractror shall be an authorized reseller and installer of the system as described in these specifications and on the project drawings. Installation of the systen shall be provided by a person or persons having completed, as a minimum, the factory training recommended by the system manufacturter and have direct field experience in the installation of a minimum of 3 projects of similar scope and size within the past 5 years.

D. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid. No allowances for any additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid.

E. All work materials shall be removed at the end of the work day and the work area left in the same condition as found.

F. The work herein specified shall be performed by fully competent workmen, in a thorough manner. All materials furnished by the Contractor shall be new, and all work shall be completed to the satisfaction of the Architect/Engineer.

G. All equipment shall be held firmly in place. This shall include speakers, receiver/amplifiers, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. All switches, connectors, outlets, etc., shall be clearly, logically, and permanently marked during installation.

H. Take such precautions as are necessary to guard against electromagnetic and electrostatic hum and ground loops, to supply adequate ventilation, and to install the equipment so as to provide maximum safety to the person who operates it.

I. Care shall be exercised in wiring so as to avoid damage to the cables (e.g., stapling, pinching, excessive bending) and to the equipment. All joints and connections shall be made with lead- free rosin-core solder or with mechanical connectors approved by the Engineer. All wiring shall be executed in strict adherence to standard broadcast practices.

J. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall utilize a duly authorized reseller of the equipment supplied for this project location with full Manufacturer's warranty privileges.

K. Test the installed System according to the Manufacturer's instructions and verify that the equipment has been installed properly and is functioning as designed.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of controls system that fail in materials or workmanship within the specified warranty period following substantial completion.
   1. Warranty Periods:
      a. Wireless transmitters, wireless receivers, infrared sensors, loudspeakers, and charging stands: Five (5) years.
      b. Rechargeable batteries, power cords, power supplies: One (1) year.
      c. Other components: Three (3) years.

B. Manufacturer's Extended Support Service: Extended telephone support for unlimited period.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products ofFrontRow by Boxlight, 1609 Corporate Circle, Petaluma, CA 94954, Phone +1 707 227 0735, www.gofrontrow.com.

B. Unity receiver specifications
   1. Dimensions: 45mm tall (1 - 49/64”) 175.7mm wide (6 - 59/64”) 203.6mm deep w/o faceplate (8 - 1/64”) 222.6mm deep w/ faceplate & Knob (8 - 49/64”)
   2. Weight 0.760kg / 1.68lbs
   3. Network Support 10/100 Mb/s (auto sensing) Control RS 232 1, RS 232 connection – 500mA – Phoenix connector Serial Baud Rate 2400 to 115200
   4. GPI 2, General Purpose Inputs – Phoenix connectors Relay 1, Normally open / Normally closed – Phoenix connector, Normally open
   5. Alarm Input – Phoenix connector
   6. Analog Page Mute
   7. Page Override (PGO) – Phoenix connector IR Output
   8. IR out – Phoenix connector
   9. Power Out 1, 24 VDC – Phoenix connector (Trio Speaker Power)
   10. 12 VDC (1.5 Amp) – Phoenix connector 12 VDC (0.5 Amp)
   11. 5 VDC - USB-A connector (For Charging 1 Microphone)
   12. Power In Fulltime or backup PoE+ Type 2 / Class 4 (25.5W) 802.3at
   13. Fulltime or backup PoE++ Type 3 / Class 6 (51W) and Type 4 / Class 8 (71W) (802.3bt)
   14. PowerLine – 90W, 48VDC, up to 100ft.
   15. Amplifier Power 32W continuous (2 channels x 16W @ 4Ω).
   16. Use two (2) - 8 Ohm FrontRow Lay-In speakers for 16W for smaller rooms, or four (4) FrontRow SP-L2-4 for larger rooms.
   17. THD 1kHz, at nominal level (1 watt, 8-ohm load) Type Class D

18. Signal-to-Noise >84 dB @ 20 Hz to 20 kHz at maximum output (unweighted, with balanced input)
19. Audio Speaker Out Left / Right channel - Phoenix connector
20. Line Out 1, 0.14 inch line level output (TRS Stereo Unbalanced)
21. ALD Line Out 1, 0.14 inch line level output (TRS - Mono Unbalanced) with rotary volume control for assistive listening devices.
22. USB-C In/Out 1, USB-C bidirectional audio (USB-2.0)
23. Line In 2, 0.14 inch line level inputs (TRS Stereo Unbalanced)
24. Classroom Control MyFrontRow App Available for Boxlight displays, MacOS, Android tablets, iPad, and Windows PC.
25. Power Over Ethernet Compatibility PoE+ Standard 802.3at Type 2 Class 4 Power Sent 30W Power at Endpoint 25.5W Cabling Cat5e UNITY Support Maximum amp power may be limited to 25.5W (same as any device running PoE+)

C. Elevate microphones specifications
1. General Spec Battery Type/Voltage/Amperage LiPo 3.7V, 650mA
2. Battery Life (hours) - talk time 8+hrs US / 7+ EU/AUS
3. Recharge Time 3.5 hrs RF Power (dBm) 19dbm peak (teacher only), 6dbm average - US/CAN, 24/10 inch UK/EU/AUS
4. Weight 44.3g / 1.5oz (teacher) 89.7g / 3.16oz (student)
5. Size (HxWxD) 68 x 36 x 22mm / 2.7 x 1.4 x 0.9 inches (teacher) 118 x 36 x 22mm / 4.6 x 1.4 x 0.9 inches (student)
6. Headset in 3.5mm TRRS (T=left, R1=Right, R2=Mic, S=Gnd), use with FrontRow headworn mic (1000-00235) or plug in an audio source Wireless Communication ELEVATE™
7. FlipCharger Size (HxWxD) 127 x 71 x 1.5 inch / 5 x 2.8 x 1.5 inch Weight 110g/3.9oz Power Supply 5.9V / 700mA Mounting Options Wall Mount (frame included).

D. Contoller / Receiver
1. The receiver must connect to a two-gang wall plate and ZipControl Audio Controller (basis of design FRONTROW #1000-00306)
    a. Master volume/mute knob with visual LED tracking.
    b. Wall plate lock button.
    c. Microphone pairing button.
    d. Bluetooth pairing button.
    e. Assistive Listening Device 3.5mm port with variable gain knob.

E. Speakers
1. For large classrooms use FRONTROW # SP-L2-4 kit with the following specifications:
    a. Average sensitivity: 92dB-SPL 1W/1M
    b. Loudspeaker power rating: 12W-RMS EIA 426A Standard
    c. Calculated maximum system output: 102dB-SPL, 12W/1M
    d. Magnet type: BeFe Ceramic, 5 oz. Nominal
    e. Size (WxHxD): 60.5 x 60.5 x 8.74cm/23.82 x 23.82 x 3.44 inch
    f. Impedance: 8 Ohm
    g. Frequency response: 65Hz – 17kHz EIA 426A standard
    h. Nominal coverage angle: 100˚ included angle -6dB/2kHz
    i. half space

j. Audio connection: Pre-cut 17.8cm/7in color-coded leads
k. UL Listed 1480, UL Listed 2043
l. Model # 1000-00321

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

3.2 INSTALLATION

A. Do not install AV or control devices until space is enclosed, HVAC systems are running, and overhead and wet work in work space are complete.

B. Install control devices in accordance with manufacturer's instructions.

C. Install speakers in accordance with manufacturer's instructions.

D. Install interactive display and mount in accordance with manufacturer's instructions.

E. Grounding: Provide electrical grounding in accordance with NFPA 70.

F. Perform setup for each audio-visual equipment component.

3.3 SYSTEM STARTUP

A. Provide system startup and adjustment to occupied conditions in accordance with manufacturer's recommendations.

B. Perform operational testing to verify compliance with Specifications. Adjust as required.

3.4 TESTING

A. Upon completion of installation of the, system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed retesting.

3.5 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 DEMONSTRATION AND TRAINING

A. The Contractor shall demonstrate the System to operate in accordance with the requirements of these specifications as well as the Manufacturer's performance specifications. The test shall be performed in the presence of an authorized representative of the Owner.

B. Should such a demonstration of performance show that the Contractor has not properly installed the System, the Contractor shall make all commercially reasonable changes or adjustments at no additional cost to the Owner.

C. Training: Provide a minimum of four (4) hours (minimum) training on the operation and maintenance of the audio/visual presentation system, at job site. Provide programming and software training as required to allow the district to do any programming that the supplier is allowed to do during commissioning, testing, service and field additions or deletions to the system. Illustrate utilization of all components and the interaction of the complete system. Conduct separate 2-hour sessions in each "pod" and each grade level. Provide this training at no cost to the Owner, including transportation, lodging, meals and training manuals.

END OF SECTION

SECTION 274121 - VIDEO CAMERA, SOURCE, AND RECORDING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High-Definition Cameras and Camera Mounts.

B. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. 274122, Video Transport, Switching, and Processing Equipment.

B. 274123, Video Display Equipment.

C. 274124, Video Conferencing and Collaboration Equipment.

D. Additional requirements as shown on the Drawings.

E. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plans and/or RCPs showing camera locations and other field devices within the associated spaces.
   2. Details (elevations, sections, and isometrics as necessary) showing mounting configurations at the appropriate locations.

PART 2 PRODUCTS

2.1 GENERAL

A. Inputs and outputs as shown on the Drawings.

B. Support of the base system resolution identified in Section 274122, Video Transport, Switching, and Processing Equipment.

2.2 HIGH DEFINITION SINGLE CHIP CAMERAS

A. Minimum supported resolution: 1080p @ 60 Hz, unless otherwise indicated on the Drawings.

B. Remote video, power, and control over one or two Category 6 cables via a rack-mountable control unit. Control function shall include but not be limited to white balance, color gain, brightness, gamma, chroma, and iris. It shall also include pan, tilt, and zoom control unless the specified camera is a fixed camera as noted on the Drawings.

C. Compatibility with video production switcher for native PTZ controls

D. User-definable presets (pan/tilt/zoom cameras only).

E. Cable distance limitation: 330’.

F. Native support for NDI HX3 video streaming format

G. Multiple simultaneous outputs.

H. 1/4-20 standard tripod thread.

I. Reversible image to allow the camera to be mounted upside down.

J. Pan, tilt, and zoom limits as shown on the Drawings.

K. Field of view as shown on the Drawings.

L. Rack-mountable Category cable extension interface where shown on the Drawings.

M. Remote controllable.

N. Mountable as shown on the Drawings.

O. Finish color as shown on the Drawings.

P. Browser-based user interface.

Q. Manufacturer: Birddog, PTZ Optics, Sony, Panasonic, AVer.

2.3 CAMERA MOUNTS

A. Additional details and dimensions as shown on the Drawings.

B. Manufacturer: same as the specified camera(s).

C. Wall-mount:
   1. Aluminum or steel construction.
   2. Color: same as camera.

PART 3 EXECUTION

3.1 GENERAL

A. Seismic restraints shall be provided as specified in Section 274010, Audio-Visual General.

B. See Section 274140, Audio-Visual Cabling for additional cabling requirements.

3.2 HIGH DEFINITION SINGLE CHIP CAMERAS

A. Use Category 6 or better for permanent Category cable links between cameras and interfaces or control units.

B. Use shielded Category cable where required by the specified signal type or the manufacturer.

C. Power all cameras from the equipment rack.

D. Use neoprene rings or mounts as necessary to isolate the camera from building vibration.

E. Adjust white balance as required.

F. Adjust pan-tilt limit settings and speed controls.

G. Verify and adjust focus, resolutions, limits, and speed settings.

H. Coordinate camera presets with the Architect.

3.3 CAMERA MOUNTS

A. Install mounts according to manufacturer’s instructions.

B. Wall-mounts shall be secured to structure, blocking, or to an electrical box.

3.4 VIDEO CAMERA, SOURCE, AND RECORDING EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Camera Equipment:
   1. Camera images shall be free of visible vibration.
   2. All cameras in a single system shall be white balanced, whether manually or automatically.
   3. Verify that presets are saved per Architect instructions.

4. Using automatic or manual white balancing, all cameras shall be white balanced uniformly.

END OF SECTION

SECTION 274122 - VIDEO TRANSPORT, SWITCHING, AND PROCESSING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flip-top recessed and table-top connector boxes.

B. Presentation switchers.

C. Video Matrix switchers.

D. Non-IP-based category cable video transmission equipment.

E. IP-based category cable and fiber video transmission equipment.

F. USB Extenders.

G. Display wall processors.

H. High-Definition multimedia streaming processors, encoders and decoders.

I. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Section 274121, Video Camera, Source, and Recording Equipment.

B. Section 274123, Video Display Equipment.

C. Section 274124, Video Conferencing and Collaboration Equipment.

D. Section 274132, Audio-Visual Network Equipment.

E. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS:

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plans showing locations of field-mounted devices. This includes but is not limited to input devices, transmitters, receivers, encoders, and decoders.
   2. Details showing specific mounting location of any devices mounted in or on millwork (including existing millwork, owner-furnished millwork, and millwork included in this scope).

PART 2 PRODUCTS

2.1 GENERAL

A. Inputs and outputs as shown on the Drawings.

B. All devices sending and/or receiving digital video signals shall be HDCP 1.4 compliant, unless otherwise noted, or unless a device category typically does not support HDCP in the use case defined herein.

C. All devices supporting HDMI shall support HDMI 1.4.

D. The base operating (default or native) resolution of the systems covered by this and related video Specifications is 3840 x 2160 @ 60 Hz. All devices covered by this and related video Specification Sections shall support this resolution unless otherwise noted.

2.2 FLIP TOP RECESSED BOXES

A. Steel or aluminum construction.

B. Quantity as shown on the Drawings.

C. Dimensions as shown on the Drawings.

D. Connectivity and power as shown on the Drawings.

E. Integral touch screen and/or keypad as shown on the Drawings.

F. Manufacturer: as shown on the Drawings.

2.3 TABLETOP BOXES

A. Construction: metallic.

B. Accommodates standard US size gang plates.

C. Quantity as shown on the Drawings.

D. Dimensions as shown on the Drawings.

E. Connectivity and power as shown on the Drawings.

F. Manufacturer: as shown on the Drawings.

2.4 PRESENTATION SWITCHERS

A. Functionally designed to accept multiple input signal formats, convert and/or scale them to one or more common signal format(s), and send the common signal format(s) out on one or more outputs.

B. Functionally designed to scale digital video signals up to 4096 x 2160 @ 4:4:4 (inclusive), and down to 3840 x 2160 @ 60 Hz.

C. Integral control system processor. See Section 274131, Audio-Visual Control Systems and Programming.

D. 10/100/1000 Mbps auto-switching/discovery/negotiating Ethernet.

E. Multiformat Ethernet stream encoding.

F. H.264 Ethernet stream decoding.

G. Wireless video input/presentation functionality.

H. HDCP compliancy: HDCP 1.4.

I. Minimum two independent scalers.

J. Audio and video matrix switching capabilities when the unit has two or more independent audio and/or video outputs.

K. Remote power of transmitter and receiver units.

L. Redundant power supplies where shown on the Drawings.

M. Scaled output(s).

N. Audio matrix switcher with input and output gain, DSP (delay, EQ, filtering, compression, and limiting), full matrixing of all audio inputs and outputs.

O. Audio break away.

P. Integral network switch.

Q. Ethernet control.

R. Switchable phantom power on all microphone inputs.

S. Integral power amplifier where shown on the Drawings, minimum 25 W/channel @ 8 Ω, 50 W/channel @ 70 V or 100 V.

T. Manufacturer: same as digital video matrix switching equipment.

2.5 VIDEO MATRIX SWITCHERS

A. Functionally designed to route any input to any one or more outputs.

B. Card frame chassis with card slots and cards as shown on the Drawings.

C. Conversion of signal formats for transmission over Category cable or fiber optic cable as shown on the Drawings.

D. Unless otherwise noted on the Drawings, minimum transmission distance for converted signals without a repeater or amplifier:
   1. On Category cable: 330'.
      a. Shielded or unshielded per manufacturer's requirements.
   2. On multimode fiber optic cable: 1000'.
   3. On single mode fiber optic cable: 7.5 miles.

E. Inputs and output signal formats as shown on the Drawings.

F. Frame and cards support digital video input signals up to and including 3840 x 2160 @ 60 Hz.

G. Scaling on local HDMI, DVI-D, and DisplayPort output that supports the same frequency range as the input cards.

H. Integral network switch with Ethernet pass through to remote devices.

I. HDCP compliancy: HDCP 1.4.

J. Serial control pass-through to remote devices.

K. Internal test pattern generator.

L. EDID management, including inter-device communication, EDID capture, and support for custom EDID files.

M. USB signal routing and extension.

N. Remote power for field devices.

O. Audio breakaway.

2.6 NON-IP CATEGORY CABLE AND FIBER OPTIC CABLE TRANSMITTERS AND RECEIVERS

A. Applies to equipment that uses a standard or proprietary non-IP transport protocol such as HDBase-T.

B. From the same manufacturer as the specified video matrix switcher, unless otherwise noted.

C. Compatible with the specified video matrix switcher.

D. Chassis style or wall-plate style as shown on the Drawings.

E. Extension of network, serial, and USB signals as shown on the Drawings.

F. Support digital video input signals up to and including 3840 x 2160 @ 60 Hz.

G. Internal scaling engine.

H. Unless otherwise noted on the Drawings, minimum transmission distance for converted signals without a repeater or amplifier:
   1. On Category cable: 330'.
      a. Shielded or unshielded per manufacturer's requirements.
   2. On multimode fiber optic cable: 1000'.
   3. On single mode fiber optic cable: 7.5 miles.

I. Remote power.

J. Manufacturer: same as matrix or presentation switcher to which it connects.

2.7 NETWORK VIDEO MATRIX ENCODERS AND DECODERS

A. Applies to encoders and decoders that are used in conjunction with a network switch to create an IP video matrix, sending streams from one encoder to one or multiple decoders.

B. Chassis style as shown on the Drawings: low-profile chassis, card-frame style, or OPS.
   1. Card frames shall have space and provide power for the card-frame style encoders and decoders shown.
   2. Low-profile shall be surface-mountable.
   3. OPS units shall conform to the Intel Open Pluggable Specification standard.

C. Category cable and/or fiber optic cable links as shown on the Drawings.

D. HDCP compliancy: HDCP 1.4.

E. Distance limitations shall follow IEEE standards for the specified network signal types.

F. Category cable links shall support up to and including 1000Base (1G) bandwidth.

G. Video Wall signal distribution functionality on decoders.

H. Control of connected devices via LAN, bi-directional serial, or unidirectional serial.

I. Scaled output.

J. Local or PoE, PoE+, or UPoE power, as indicated by the manufacturer.

K. Configurable as an encoder or decoder.

L. Fiber optic cable links shall support up to and including 10GBase (10G) bandwidth.

M. Manufacturer: QSC, Extron, or Crestron.

2.8 NETWORK VIDEO MATRIX ENCODER AND DECODER MANAGEMENT SOFTWARE AND HARDWARE

A. Manufacturer: Same as specified network video matrix encoders and decoders.

B. Sufficient capacity to support the quantity of encoders and decoders in the system(s) managed by each encoder plus 20%. Provide hardware and software keys as required.

C. Web or software-based configuration and control.

D. Secure communication with encoders and decoders.

E. Push firmware updates to connected encoders and decoders.

F. Compatible with the specified Audio-Visual control system as defined in Section 274131, Audio-Visual Control Systems and Programming.

G. Saving and recalling of routing presets.

H. Configuring ad hoc manual routs.

I. Hardware shall be rack mountable.

2.9 NETWORK SWITCHES FOR VIDEO TRANSPORT AND SWITCHING

A. See Section 274131, Audio-Visual Network Equipment.

2.10 USB EXTENDERS

A. Compatible with the specified touch panel displays and annotation processor specified.

B. Capable of transmitting touch coordinated data.

C. Ports as shown on the Drawings.

D. Support for USB 3.0 and data rates up to and including 480 Mbps.

E. Minimum supported transmission distance 330’.

F. Manufacturer: Extron, Icron, Geffen, Crestron

2.11 DISPLAY WALL PROCESSORS

A. Supported resolutions up to and including 3840 x 2160 @ 60 Hz.

B. HDCP compliancy: HDCP 1.4, unless otherwise noted.

C. Inputs and outputs as shown on the Drawings.

D. Rack-mount chassis with card slots and cards as shown on the Drawings.

E. Controlled via Ethernet.

F. Configured and controlled via software.

G. Data rate: 4.95 Gbps (1.65 Gbps per color).

H. Digital sampling: 24 bit, 8 bits per color.

I. Colors: 16.78 million (8-bit processing).

J. Upscaling and downscaling of all inputs to a selected resolution.

K. Restriction-free windowing.

L. Bezel compensation.

M. Manufacturer: Extron, RGB Spectrum, Crestron.

2.12 HIGH DEFINITION STREAMING MEDIA PROCESSORS/ENCODERS

A. Applies to encoders that are used to send compressed streams over a network for reception by generic devices, such as personal computers or set top boxes.

B. Simultaneous independent streaming of one input sources.

C. Internal storage: 400 GB SSD, minimum.

D. Simultaneous recording and streaming.

E. Recording source quantity: recording of one input source in H.264, AAC, MP4, JPEG, JSON, and XML formats.

F. HDCP compliant inputs.

G. Input Resolution: including 3840 x 2160 @ 60 Hz.

H. Dual bandwidth streaming on selected input(s).

I. Input cable equalization.

J. Compression and streaming format: H.264/AAC (ITU H. 264, ISO/IEC 14496-10) @ 4:2:0 8-bit color.

K. Rack-mountable.

L. Streaming bit rate: selectable between 200 kbps and 10 Mbps, inclusive.

M. Manufacturer: same as specified video switching equipment..

2.13 HIGH DEFINITION STREAMING MEDIA DECODERS

A. Applies to decoders that are used to receive a low bandwidth compressed video stream and display it on a display.

B. Live decoding of the streaming format(s) of the specified streaming media processor or encoder.

C. Supported resolutions: including 3840 x 2160 @ 60 Hz.

D. Aspect ratio management.

E. Channel list, playlist, and source management.

F. Minimum internal memory storage.

G. Playback from external USB drive and/or removeable SD card.

H. Manufacturer: Extron, Crestron, Teradek, Vaddio, Contemporary Research.

PART 3 EXECUTION

3.1 GENERAL

A. Configure all components of the video system described herein and in related Sections to operate at the specified base resolution. This includes but is not limited to video switching routes, control signal ingest and/or pass through, scalers, EDID tables, HDCP settings, and auto-switching functions.

B. Configure EDID and HDCP as required to support the base system resolution(s), as outlined herein.

C. Configure routing to provide the functionality described in the Functional Descriptions as shown in Section 274110, Audio-Visual General and in the Control System Programming and Functionality in Section 274131, Audio-Visual Control Systems and Programming.

3.2 FLIP TOP RECESSED BOXES

A. Cut and/or route furniture as necessary to install recessed flip top boxes per manufacturer's instructions at locations as shown on the Drawings. Coordinate locations with the Architect.

B. Install recessed flip top boxes in cut-outs in furniture. Cut-outs are fabricated by others.

3.3 TABLETOP BOXES

A. Secure table-top boxes in place at locations as shown on Drawings.

B. Table-top boxes shall not be secured to allow repositioning around the surface on which the box is installed. Provide rubber feet to prevent the box from scratching the surface on which it is placed.

3.4 PRESENTATION AND VIDEO MATRIX SWITCHERS AND RELATED EQUIPMENT

A. All outputs shall be scaled, either at the matrix switcher output or at the receiver or encoder at the display.

B. Configure scaled outputs to scale the outbound video signal to 3840 x 2160 @ 60 Hz.

C. Configure control pass throughs and/or the internal control system processor to provide the control identified in Section 274131, Audio-Visual Control Systems and Programming.

D. Configure inputs to properly accept source input signals.

E. Configure routing presets in accordance with the functional descriptions in Section 274110, Audio-Visual General.

F. Observe input and output distance limitations.

G. Unless otherwise noted, HDMI inputs shall be set to support embedded audio. Devices that have auto switching between digital and analog inputs shall also automatically switch the audio along with the video.

3.5 NETWORK VIDEO MATRIX ENCODERS AND DECODERS AND RELATED EQUIPMENT

A. For telecommunication switches and related equipment that is owner furnished: Coordinate installation with the Architect. The Contactor shall be responsible for guiding the Owner on configuring their own network equipment to pass IP video signals that are included in this scope.

B. For telecommunication switches and related equipment that is Contractor-furnished: The Contractor shall be responsible for full configuration of the switches to support the audio, video, control, and other network traffic included in this Project. This includes, but is not limited to configuring VLANs, IP addresses, gateways, subnet masks, and ports consistent with the Architect's requirements.

C. Configure units as encoders and decoders as necessary.

D. Configure encoder and decoder routing paths.

E. Configure scaling appropriate for the attached display device(s) and control functionality as required for connected equipment.

F. Limit switch hops to the extent possible, observing the manufacturer's recommendations and/or limitations concerning switch hops.

G. Register units with the control software and/or hardware.

3.6 DISPLAY WALL PROCESSORS

A. Provide manufacturer's on-site installation support and commissioning service.

B. Coordinate window layout, input routing, resolutions, content scheduling, and related features with the Architect.

C. Adjust system parameters to compensate for display mullions and physical display layouts.

3.7 HIGH DEFINITION STREAMING ENCODERS AND DECODERS

A. Mount at locations shown on the Drawings. Secure in place to display, mount, or wall behind display. Coordinate with the Architect.

B. Coordinate installation with the Architect. The Contactor shall be responsible for guiding the Owner on configuring their own network equipment to pass IP video signals that are included in this scope.

C. Configure channel lists to enable television style stepping through IP stream "channels."

3.8 VIDEO TRANSPORT, SWITCHING, AND PROCESSING EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. All test sources, except for test generators, shall be sources typical of what will be used on the systems as designed under normal operation conditions.

D. All test generators shall have current, unexpired calibration certificates. Any results of a test performed by a test performed with expired calibration may be rejected. Any test rejected for this reason shall be reperformed.

E. Verify that all displays show an image that is centered, free of noise, and scaled properly for the display and/or the base resolution of the system. Test sources shall be set to output multiple resolutions to ensure the most common resolutions are scaled properly. Adjust scalers as required.

F. Verify that the EDID tables for all switches, EDID minders, and other devices that facilitate negotiation between source and display are properly configured to allow that all source resolutions display using the full display area of each display device. Adjust EDID tables and/or force EDID information as required.

G. Verify that HDCP support is consistent through the entire system. Coordinate with the Architect regarding global HDCP settings and possible resulting compatibility issues.

H. All Video Switching Equipment:
   1. Test all possible video routes as defined herein to ensure proper switches are made and that sources show on the displays in an appropriate amount of time. Correct any deficiencies found, including sync, HDCP, color, and EDID issues.
   2. Verify that digital video routing and switching occurs in a reasonable amount of time.
   3. If this system is replacing an analog video system, verify that the Architect is aware that digital video switching has inherent unavoidable delays.
   4. Verify that audio switching within the video switches is configured. Observe audio-follow-video and/or audio breakaway requirements. HDMI audio/analog audio switching.
   5. Verify that audio and video synchronization is maintained throughout the entire signal path. There shall be no noticeable delay between audio and video. Correct as required, adding delays where appropriate.
   6. Verify that any display mutes, such as all mute or mute groups as defined herein, blank the appropriate displays.
   7. Verify that all video signal paths are free from noise and artifacts of any kind.

I. Display Wall Processors:
   1. Verify that display mullion width and height has been factored into the display wall layout.
   2. Verify that all images and windows are clear, free of artifacts, flickering, EDID, or other defects.
   3. Verify that the audio is intelligible, clear, free of noise of any type, and properly synced with the video.
   4. Adjust settings as required. If a defect is introduced by a system or device outside of this scope, notify the Architect in writing.

END OF SECTION

SECTION 274123 - VIDEO DISPLAY EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Display monitors.

B. Display monitor wall mounts

C. Direct-view LED display walls.

D. Projectors.

E. Projector overhead mounts.

F. Projector Lifts.

G. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Section 274121, Video Camera, Source, and Recording Equipment.

B. Section 274122, Video Transport, Switching, and Processing Equipment.

C. Section 274124, Video Conferencing and Collaboration Systems.

D. Section 274125, Electronic Signage and Wayfinding Equipment.

E. Section 274131, Audio-Visual Control Systems and Programming.

F. Section 274126, Projection Screens.

G. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

B. ISO 9241-300:2008

C. ISO 9241-302, -303, -304, -305, -306, -307:2008

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor plans and/or RCPs showing:
      a. The locations of all display devices of all types, including but not limited to individual flat panel displays, display walls, and projectors.
      b. RCPs shall be dimensioned to show the distance between the front of the projector (lens) and the projection screen.
      c. Floor plans shall be dimensioned to show the distance from the center of the display device to the nearest column and to any adjacent devices on the same wall or that otherwise might be impacted by the display's location.
   2. For wall-mounted displays and display walls, elevations showing:
      a. Dimensioned display overall size and mounting height, and distance between columns and other devices as described above.
      b. Type of display mount to be used, including make, model, and any accessories. Any custom mount proposed shall have a dedicated elevation and detail.
      c. Mounting location of all accessories or other devices to be mounted on or behind the display.
      d. Annotations including the display make and model, viewing area size, native resolution, and mount make and model.
      e. Typical elevations may be used where multiple displays in this scope have the exact same mount type and location.
      f. The annotation information listed above may be shown in a table if desired.
   3. Sections through rooms with fixed-mounted projectors, dimensioned to show the projector mounting height below the finished ceiling or structure as appropriate, and the projection distance from the front of the projector (lens) to the projection screen. Section shall be annotated with projector mounting system makes and models.
      a. Verify projection distances on Contract Documents and at the project site as appropriate, projection screen sizes, lens throw ratios, and the presence of any obstructions in the path of the projector mounting components prior to ordering.
      b. Sections shall be annotated, or a table shall be included indicating proposed projector makes and models, lens model, and zoom ratio. Note any deviation from the Contract Documents.
      c. Type of projector mount to be used, including make, model, and any accessories. Any custom mount proposed shall have a dedicated elevation and detail.
   4. For projector lifts, details showing the lift housing mounted to the structure and/or in the finished ceiling as appropriate, and the projector mounted to the lift. Lift make and model shall be annotated. Proposed lift stop heights (stored, show, and service) shall be annotated.
   5. For all display devices mounted in an enclosure, details as necessary showing airflow around the display and hot air exhaust consistent with the display manufacturer's requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. All displays shall be rated Class 0 per ISO 9241-3xx standards.

B. Minimum display native resolution, unless otherwise noted: 3840 x 2160 @ 60 Hz.

C. Inputs and outputs as shown on the Drawings.

D. All devices supporting HDMI shall support HDMI 1.4, unless otherwise noted.

E. All devices supporting HDCP shall support HDCP 1.4, unless otherwise noted.

F. Mounts and mounting accessories shall include anti-theft or locking functionality where indicated on the Drawings.

G. Unless noted otherwise, herein or on the Drawings, the color of all exposed components shall be: black.

2.2 DISPLAY MONITORS

A. Viewing area diagonal size as shown on the Drawings.

B. Outside dimensions shown on the Drawings are maximum dimensions.

C. Display type and brightness as shown on the Drawings.

D. Unless otherwise noted, minimum native resolution shall be 3840 x 2160 @ 60 Hz.

E. Maximum bezel size as shown on the Drawings.

F. Internal power supply.

G. VESA mounting hole pattern, except when shown with a proprietary display mounting system as a part of a display wall.

H. Touch functionality where shown on the Drawings. Touch functionality shall include:
   1. Applies to touch monitors used for content viewing, annotation, and control. Touch monitors by the control system manufacturer that are dedicated control interfaces are covered in Section 274131, Audio-Visual Control Systems and Programming.
   2. Touch membrane type: projected capacitive.
   3. Minimum simultaneous touch points: 10.
   4. Internal PC or signage processor where shown on Drawings.
   5. Content creation, editing/annotating, and management software where shown on the Drawings.
   6. USB interface.
   7. Maximum response time: 18 ms.
   8. Host compatibility: HID-compliant operation compatible with Windows 8, 10, and 11.
   9. Compatible with specified annotation processor or other specified equipment to which it connects.

I. Manufacturer: Planar, NEC, Samsung, Viewsonic, LG, Sharp.

2.3 DISPLAY MONITOR WALL MOUNTS

A. General:
1. Universal configuration to accommodate a range of VESA mounting patterns. Mounts shall not be custom or made for a specific display make and model unless otherwise noted on the Drawings.
2. Provide accessories as shown on the Drawings.
3. UL Listed.
4. Steel construction.
5. Support for variable stud spacing with mounting on two or more studs.
6. Rated to support the weight of the display the mount will support.
7. Color: black, unless otherwise noted.
8. Landscape and/or portrait orientation as shown on the Drawings.
9. Manufacturer: Chief, Premier, Peerless.

B. Tilt-Mounts:
1. Lateral shift to allow display centering.
2. Leveling.
3. Portrait or landscape orientation as shown on the Drawings.
4. Height adjustment.
5. Integrated security.
6. Tilt range: +2° to -12°.

C. Fixed Mounts:
1. Lateral shift to allow display centering.
2. Leveling.
3. Maximum depth from wall: 2.0”.
4. Portrait or landscape orientation as shown on the Drawings.
5. Height adjustment.
6. Integrated security.

D. Swing-Arm Mounts (Large Displays):
1. Dual arms.
2. Portrait or landscape display mounting.
3. Extension: minimum 25.0” for displays 50.0” diagonal and smaller; minimum 37.0” for displays larger than 50.0” diagonal.
4. Tilt range: +5° to -16°.

E. Swing-Arm Mounts (Small Displays):
1. For smaller swing-arm mounts used to mount smaller displays 32.0” diagonal or smaller or that are shipped from the factory with a desktop stand.
2. Supports one or two displays as shown on the Drawings.
3. Spring-assisted height adjustment: 13.0”.
4. Weight capacity: 25 lbs. per display.
5. Compatible with 75 mm x 75 mm and 100 mm x 100 mm VESA mounting patterns.
6. Tilt range: +75° to -10°.
7. Integral cable management.
8. Color: black, unless otherwise noted.
9. Manufacturer: Chief, Premier, Peerless, Ergotron, Ergomart.

F. Recessed Mounts:
   1. Functionally designed to recess the mount in the wall to reduce the display/mount assembly depth off the wall.
   2. UL Listed.
   3. Color: black.
   4. Wall Box:
      a. Dimensions as shown on the Drawings.
      b. Condit and wall-box knockouts as shown on the Drawings.
      c. Weight Capacity, excluding the mount assembly: 138 lbs.
   5. Mounting Assembly:
      a. Dual swing-arms.
      b. Landscape or portrait display orientation as shown on the Drawings.
      c. Extension: 22.0”.
      d. Display leveling (roll).
      e. Horizontal pivot up to ±76.5°.
      f. Weight capacity: 200 lbs.
      g. Tilt range: +2° to -15°.
   6. Manufacturer: Chief, Premier, Peerless, Ergotron, Ergomart.

2.4 DIRECT-VIEW LED VIDEO DISPLAY WALLS

A. Overall resolution and/or individual panel resolution as shown on the Drawings.

B. Overall dimensions and individual panel dimensions as shown on the Drawings.

C. Bezel dimensions as shown on the Drawings.

D. IP-30 rated where shown in an interior dry location.

E. IP-65 rated where shown on the Drawings in all exterior locations and all interior wet location.

F. Display brightness as shown on the Drawings.

G. Power supplies located as shown on the Drawings.

H. Pixel pitch as shown on Drawings.

I. Native resolution as shown on the Drawings.

J. Provide manufacturer’s display wall processor, when required, to distribute video signal to individual panels.

K. Rack-mountable control module.

L. Ethernet controllable and software configurable.

M. Minimum distance limitations between controller and display units:

1. Category 6 cable: 220’.
2. Multi-mode fiber optic cable: 1000’.
3. Single-mode fiber optic cable: 6.2 miles.

N. Manufacturer: SquareV, Planar, Taylorleds.

2.5 PROJECTORS

A. See the projector schedule on the Drawings for additional requirements.

B. Light source, brightness, and contrast ratio as shown on the Drawings.

C. Native resolution and aspect ratio as shown on the Drawings.

D. Dimensions and weight as shown on the Drawings.

E. Lens zoom ratio and throw distance as shown on the Drawings.

F. Mounting type as shown on the Drawings.

G. Manufacturer: Christie Digital, Digital Projection, Epson, Panasonic, Sony, Barco.

2.6 PROJECTOR OVERHEAD MOUNTS

A. Functionally designed to attach a projector to a metallic pipe column or other mounting system attached to the ceiling or structure above.

B. UL Listed.

C. Threaded for 1.5” NPT.

D. Color: Coordinate with the Architect.

E. Accessible Ceiling Mounts:
1. Functionally designed to be installed in a standard ceiling tile grid.
2. Dimensions as shown on the Drawings.
3. Provide plenum box where shown installed in a plenum airspace.
4. Weight rating: up to 50 lbs.
5. Mounts to structure via wire rope.
6. Knockouts as shown on the Drawings for receptacle plates and back boxes.
7. Metallic construction.

F. Projector Mounting Interfaces:
1. Compatible with the specified structural mounting assemblies.
2. Rated to support the weight of the specified projector.
3. Universal configuration to accommodate a range of projector makes and models, including the specified make and model. Mounts shall not be custom or made for a specific display make and model unless otherwise noted on the Drawings.

4. Micro-adjustable.
5. Quick-disconnect for projector service.
6. Roll: ±3°.
7. Pitch: ±20°.
8. Yaw: 360°.
9. Manufacturer: Chief, Premier, Peerless.

2.7 PROJECTOR LIFTS

A. Scissor style lift mechanism.

B. Dimensions and weight capacity as shown on the Drawings.

C. Compatible with specified projector.

D. Drop distance as shown on the Drawings.

E. Three configurable stop positions: stowed, show, and service.

F. Step distance: 0.0625” or better.

G. Quiet operation.

H. Integral cable management.

I. Provide an appropriate ceiling closure frame for ceiling in which lift is installed.

J. Provide plenum housing when mounted in a plenum space.

K. Low-voltage control as shown on the Drawings.

L. Housing and closure accessories, such as closures and plenum housings, as shown on the Drawings.

M. Manufacturer: Draper, Display Devices, Da-Lite.

2.8 STRUCTURAL MOUNTING ASSEMBLIES AND RELATED EQUIPMENT

A. Compatible with specified display and projector ceiling mounts.

B. All components shall be threaded for 1.5” NPT.

C. Color: Coordinate with the Architect.

D. Structural Adapters and Flanges:
   1. Functionally design for attachment directly to wood or concrete. Clamp accessory for attachment to the underside of steel beams.
   2. Minimum four attachment points to the structure.
   3. Weight capacity: 500 lbs.

4. Where shown on the Drawings, channel to allow cabling to travel down the inside of the extension column.

E. Extension Columns:
1. Aluminum construction.
2. Threaded on both ends.
3. Fixed or adjustable length as shown on Drawings.
4. Integral opening for routing cable inside the column.

F. Provide plenum box when mounted in a plenum airspace.

G. Manufacturer: Chief, Premier, Peerless.

PART 3 EXECUTION

3.1 GENERAL

A. Notify the Architect and receive confirmation in writing prior to relocating any device in any direction more than 12.0”.

3.2 DISPLAYS AND RELATED EQUIPMENT.

A. Mount displays at locations and with mount types as shown on the Drawings.

B. Position monitor on mount to achieve optimal viewing angles within the display viewing area.

C. Maintain ADA requirements where displays are shown mounted with the bottom of the display at 80” or lower. Coordinate opening in or size of architectural shroud or recess with Architect.

3.3 PROJECTORS AND RELATED EQUIPMENT

A. Projector shall be installed per the manufacturer’s recommendations.

B. Projectors shall be made level and secured in accordance with seismic requirements identified herein.

C. Field verify projector mounting heights and configurations, projection distances, projection screen sizes, lens throw ratios, and the presence of any obstructions in the path of the projector mounting components prior to installing.

D. Fixed projectors shall be installed at a height that is out of reach of most persons standing on the ground, but no higher than the top of the screen. The height shall minimize the need for lens shift. Coordinate height with lighting and other suspended elements in the space. If the projection path is obstructed, notify the Architect as soon as possible and prior to performing the installation.

E. Projectors shall be installed centered laterally on the projection screen, unless otherwise noted on the Drawings.

F. Do not attach any component to ductwork, piping, or any building component other than the structure. If necessary, use appropriately sized Unistrut to build a sub-structure around any obstructions or across any expansion joints in the path of any of the mounting components.

G. Use neoprene mounts and/or rings where the projected image is affected by building vibration.

3.4 VIDEO DISPLAY EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Verify that all images are clear, free of artifacts, flickering, EDID, or other defects.

D. Verify that the audio is intelligible, clear, free of noise of any type, and properly synced with the video.

E. Adjust settings as required. If a defect is introduced by a system or device outside of this scope, notify the Architect in writing.

F. Display Devices:
   1. Verify that displays are properly secured to their mounting structures and that blocking has been provided where required.
   2. Verify that all wall-mounted display devices are compliant with current ADA requirements. Adjust mounting as required. Notify the Architect in writing immediately upon discovery of instances where a display device cannot be adjusted to meet ADA requirements.
   3. Using a video test generator, apply the following test patterns:
      a. Using a crosshatch pattern, adjust display devices to show full image at specified system base resolution.
      b. Verify that all displays within a single space display colors uniformly. Adjust color calibration as required.
      c. Adjust the black level:
         1) Display a PLUGE color bar test pattern on the screens.
         2) Adjust the brightness control upward until the “blacker than black” bar is visible on the screen.
         3) Decrease the brightness control slowly until this bar becomes fully extinguished. Continue until the test pattern background reaches the same point, i.e., there is no light output.
         4) The remaining vertical bar should be dimly visible.
      d. Adjust the contrast:
         1) Display a PLUGE color bar test pattern on the screens.
         2) Adjust the contrast control until the 100% white bar begins to bloom or distort in size or stops getting brighter.
         3) Decrease the contrast control until the white bar is at the threshold of maximum brightness without any of these distortions.

e. Projected images shall be compliant with AVIXA standard 3M-2011. Projected images shall be centered vertically and horizontally on each respective projection screen. Adjust as required, using zoom and lens shift controls prior to using keystone correction. Projected images shall be fully focused and have a uniform focus across the entire projected image. All images shall be free from distortion, stretching, twisting, keystone, barrel, and pincushion.
   1) Coordinate with Architect as required to mitigate ambient light spillage onto the projection screen while in use.

f. Examine all display devices for failed pixels. All displays shall be compliant with ISO standard 9241-302, 303, 305, 307:2008, concerning pixel defects. All displays covered by this scope shall be considered Type 0 when examining compliancy.

END OF SECTION

SECTION 274125 - ELECTRONIC SIGNAGE AND WAYFINDING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Digital signage player hardware.

B. Small format computers used for digital signage.

C. Digital signage displays.

D. Digital signage display mounts.

E. Digital signage kiosks.

F. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED SECTIONS

A. Section 274123, Video Display Equipment.

B. Section 274131, Audio-Visual Control Systems and Programming.

C. Section 274132, Audio-Visual Network Equipment.

D. Section 274140, Audio-Visual Cabling and Connectors.

E. General provisions: Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Detail showing the mounting configuration of all peripheral devices with respect to the display and the display mount.
   2. Proposed configuration of signage players, including panel layouts, schedules, integration with existing headend equipment (if appliable), network information, and other requirements as stated by the Architect.

PART 2 PRODUCTS

2.1 GENERAL

A. Support of the base system resolution identified in Section 274122, Video Transport, Switching, and Processing Equipment.

B. All components shall be compatible with the Owner's existing digital signage equipment and systems.

C. All components shall support the following media formats:
   1. Images: BMP, ANIMGIF, JPEG/JPG, PNG, TIFF and WMF.
   2. Video: MPEG 2, WMV, H.264, HEVC/H.265, Apple ProRes A4H/4444.
   3. Audio: WMA, WAV, MP3, M4A/AAC.
   4. Streaming: H.265, MPEG 2, RTP, RTSP, Unicast, Multicast.
   5. Web: HTML5.

2.2 DIGITAL SIGNAGE PLAYER HARDWARE

A. Externally mounted, OPS module, or integral to the display as shown on the Drawings.

B. Rated for 24-7 continuous operation.

C. Fanless.

D. Multi-zone operation when shown with two or more outputs.

E. Native output resolution on all outputs: the specified base system resolution as described in Section 274122, Video Transport, Switching, and Processing Equipment.

F. Minimum CPU characteristics:
   1. Operating System: Windows 10 or Linux.
   2. Processor: Intel Celeron N3160 with 1.60 GHz quad-core processor.
   3. Graphics card: Intel HD Graphics 400.
   4. Inputs and outputs as shown on the Drawings.
   5. RAM: 4 GB DDR3L per output.
   6. Storage: 64 GB solid state.
   7. Network: Gigabit Ethernet, 802.11 a/b/g/n/ac.
   8. USB: Four 3.0 type A.

G. Compatible with Owner's existing digital signage management and content creation systems.

2.3 SMALL FORMAT COMPUTERS

A. Small or thin chassis designed for mounting on a wall behind a display, on a display mount, or to the display itself.

B. Native output resolution on all outputs: the specified base system resolution as described in Section 274122, Video Transport, Switching, and Processing Equipment.

C. Rated for 24-7 continuous operation.

D. Fanless.

E. Other requirements as shown on the Drawings.

F. Manufacturer: Scala, Intel, Dell.

2.4 DIGITAL SIGNAGE DISPLAYS

A. Refer to Section 274113, Video Display Equipment.

2.5 DIGITAL SIGNAGE DISPLAY MOUNTS

A. Refer to Section 274113, Video Display Equipment.

2.6 DIGITAL SIGNAGE KIOSKS

A. Technical furniture functionally designed to house a digital signage display and related accessory components as shown on the Drawings.

B. Dimensions, materials, and finishes as shown on the Drawings.

C. Americans with Disabilities Act (ADA) compliant.

D. Other requirements as shown on the Drawings.

E. Manufacturer: as shown on the Drawings.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate configuration of all network-based components with the Architect as necessary.

3.2 DIGITAL SIGNAGE PLAYER AND CONTROL EQUIPMENT CONFIGURATION AND PROGRAMMING

A. Mount players and related hardware for wall-mounted displays to the wall behind the display unless otherwise shown on Drawings. For overhead-mounted displays, mount the player to the display mount.

B. Set the output resolution as required if not automatically negotiated by EDID.

C. For systems where all components are to be provided new as a part of this scope:
   1. Configure the management software as required to control all hardware and software players.
   2. Configure LAN settings as required.
   3. Configure players to receive control information and content from the management system.
   4. Load a test pattern or other signage file template onto the system to test all components.

D. For players and related equipment that will be integrated with an existing system:
   1. Register signage player software and hardware with the existing digital signage management suite.
   2. Perform an initial configuration of the player and load an initial or test signage file as directed by the Architect.

3.3 DIGITAL SIGNAGE DISPLAYS AND RELATED EQUIPMENT

A. Refer to Section 274113, Video Display Equipment.

3.4 DIGITAL SIGNAGE KIOSKS

A. Assemble as necessary and install kiosks at locations on the Drawings.

B. Register kiosk(s) with appropriate management applications and appliances.

C. For interactive kiosks, calibrate touch display.

3.5 ELECTRONIC SIGNAGE AND WAYFINDING PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Digital Signage Systems:
   1. Verify that all signage players and field equipment can communicate with the digital signage controller, by sending one or more executable command to each.
   2. Using a signage content test program, push the content to all players installed as a part of this scope.
      a. For systems where all components are to be provided new as a part of this scope, the Contractor shall use a simple test program.
      b. For players and related equipment that will be integrated with an existing system, a template provided by the Architect shall be used.
   3. Verify that motion video media plays without glitches, artifacts, or hangs due to network traffic congestion, including streaming video and video images stored locally or served by the controller.

4. Verify that crawls and other elements capable of importing data are showing the proper data.
5. For interactive (touch) systems, verify that touch controls are calibrated, and operate the correct functionality as indicated by the buttons in the digital signage program file.

D. Digital Signage Displays:
   1. Refer to Section 274113, Video Display Equipment.

END OF SECTION

SECTION 274126 - PROJECTION SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrically operated retractable projection screens.

B. General Provisions are specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Performance Verification responsibilities and obligations related to the projection screens are specified in Section 274010, Audio-Visual General.

1.3 REFERENCE STANDARDS

A. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

D. Conform to all codes and standards listed in Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Floor Plans and/or RCPs showing the location of each projection screen and projection screen control device.
   2. The projection screen manufacturer’s submittal form completed specifically for this Project. When this scope includes multiple projection screens, one submittal form shall be submitted for each screen and shall indicated the space in which that screen will be installed.
   3. Drawings showing connections to suspension systems and details showing the screen’s anchoring to structure.
   4. Details of juncture of exposed surfaces with adjacent finishes.
   5. Submittals are required before installation or fabrication begins. The Contractor shall not procure any equipment or perform any fabrication on any portion of this scope that has not received approval as defined herein. The Contractor shall be responsible for any costs related to returning, replacing, or not using any component of this scope that is ordered, fabricated, or installed prior to receiving such approval. Pay requests will not be approved for any work performed without approved Submittals.

6. Dimensioned shop drawings of all fabricated, custom, or modified hardware, components, or devices. Provide a finish sample for all exposed finishes.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise specified herein, quantities of equipment are indicated on the Drawings, and performance values specified herein are minimum acceptable values.

B. All projection screens shall be from a single manufacturer, unless otherwise noted herein or on the Drawings.

C. See the Projection Screen Schedule on the Drawings for additional requirements.

D. All products shall be UL listed.

E. Manufacturer: Draper, Da-Lite, Stewart Filmscreen.

2.2 FRONT PROJECTION SCREENS

A. Material and Viewing Surfaces:
1. Screen fabrics shall be mildew resistant and shall be flame resistant in accordance with NFPA 701-2019.
2. Viewing surfaces shall be seamless unless otherwise indicated on the Drawings.
3. Edge treatments hall be black masking borders unless otherwise indicated on the Drawings.

B. Electrically Operated Front Projection Screens:
1. Screens shall be mounted such that the top edge of the fabric is securely anchored to a rigid metal roller and the bottom edge is formed into a pocket holding a weighted metal rod with the ends of the rod protected by plastic caps.
2. Provide tab-tensioning where indicated on the Drawings.
3. Provide additional black drop as required to achieve desired viewing height as indicated on the Drawings.
4. Each screen shall include case, screen motor, controls, mounting accessories, and any other necessary components for a complete installation.
5. Provide three stage low voltage controller capable of raising, lowering, and stopping screen travel. Low voltage switch shall be a three-button keypad with cover plate at locations indicated on the Drawings.
6. Provide low voltage control connections to the Audio-Visual control system where shown on the Drawings.
7. Motors shall be instant-reversing, gear-drive, end-mounted type with permanently lubricated ball bearings, automatic thermal overload protection, preset limit switches to automatically stop the screen in up and down positions, and positive stop action to prevent coasting.
8. Where indicated on the Drawings, an automatic closure shall cover the screen opening when the screen is in the retracted position.

PART 3 EXECUTION

3.1 GENERAL

A. Provide all necessary incidental equipment or devices to deliver a complete and operable system.

B. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.

C. Equipment shall be installed in accordance with the manufacturer's instructions.

D. Equipment, except portable equipment, shall be held in place. This shall include equipment, enclosures, components, and cables. Fastenings and supports shall support their loads with a safety factor of at least 3 unless otherwise specified herein.

E. Prevent and guard against electromagnetic and electrostatic hum and install the equipment to provide safety for the operator.

F. Repair or replace any equipment or materials damaged during the construction or installation period.

G. Provide power connections as required.

H. Cut and repair walls and ceilings, including inaccessible and tile grid systems, as required to install the projection screens.

I. Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including luminaries, HVAC equipment, fire protection systems, and partitions.

J. Projection screens shall not be supported by or suspended from any other building system, including but not limited to HVAC equipment, plumbing, telecommunications equipment, raceway, or fire protection equipment.

K. Initial projection screen delivery and installation shall include only the projection screen case and mounting hardware. Install the case when the building is enclosed and other construction within spaces where screens will be installed is substantially complete. Deliver and install the roller assembly, motor, and fabric at a time when the building is dust-free. Coordinate with other trades as required.

L. Procure and install each projection screen as a complete unit, including mounting hardware and accessories. Do not deliver projection screens until the building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.

M. Coordinate and verify with the Architect the screen size, black drop, height of the bottom of viewing area, case mounting height and configuration, mounted depth, and required edge tolerances with construction of wall recesses to house screens prior to ordering screens that are mounted in walls.

N. Coordinate requirements for blocking and structural supports to ensure adequate installation of screens.

O. Prior to installation of electrically operated screens, verify the type and location of the power supply.

P. Install projection screens at locations indicated on the Drawings and comply with the projection screen manufacturer's written instructions and shop drawings.

3.2 FRONT PROJECTION SCREENS

A. Install manually and electrically operated front projection screens with screen cases in position and relationship to adjoining construction indicated on the Drawings. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

B. Adjust limit switches to ensure correct positioning, screen tensioning, and silent screen case opening and closure.

C. Test electrically operated units to verify that screen, controls, limit switches, closure, and other operating components function.

D. Provide access to equipment requiring connections or service within the life of the assembly.

3.3 PROJECTION SCREENS PERFORMANCE VERIFICATION

A. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Verify that projection screens are installed level and flat.

D. Verify that no extraneous noise is made by any component of the projection screen assembly as the tensioning bar at the bottom of the screen enters or exits the screen case.

E. Verify that the viewing surface is square and not contorted in any way.

F. Where projection screens are recessed in a tile grid ceiling, verify that the grid is properly installed around the case and tiles are cut as necessary.

G. Verify that projection screens descend to the proper viewing height and retract completely into the case. Where applicable, verify that the screen case closure opens and closes without extraneous noise.

H. Verify that projection screen switches operate the intended functions (i.e., UP, DOWN, and STOP).

END OF SECTION

SECTION 274131 - AUDIO-VISUAL CONTROL SYSTEMS AND PROGRAMMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control system processors

B. Touch panel controllers.

C. USB Extenders.

D. Control system functionality and programming requirements.

E. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. Section 274132, Audio-Visual Networking Equipment.

B. General provisions in Section 274010, Audio-Visual General, and other Sections of Division 27.

1.3 REFERENCE STANDARDS

A. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Touch panel page layouts submitted in one of two ways:
      a. A screen shot of each page annotated with the functions and/or to what page each button links, as appropriate.
      b. A working demonstration executable file that allows the user to click or press buttons and navigate through the pages that will be used on the touch panels.
   2. Keypad layout showing all button labeling. Layouts shall be annotated with descriptions of each button’s functionality as needed. Keypad layout drawings with custom engraved button caps shall be the manufacturer’s shop drawings, and not recreations.

PART 2 PRODUCTS

2.1 GENERAL

A. Systems shall be compatible with existing systems.

B. Compatible with all devices shown on the Drawings and in other Sections as being controlled by devices covered in this Section.

C. Supported protocols: 10/100/1000Base-T, half/full duplex, auto-switching, auto-negotiating, auto discovery, industry-standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH FileTransfer Protocol), IEEE 802.1X, SNMP, HTTP, HTTPS.

D. Configurable I/O ports: analog or digital connections, input rated for 24 V DC @ 20 kΩ, minimum.

E. Relays: normally open, rated minimum 24 V DC @ 1.0 A.

F. Front panel LED status indicators.

G. Manufacturer, unless otherwise noted: Q-SYS (QSC), Crestron, Extron

2.2 CONTROL SYSTEM PROCESSORS AND RELATED EQUIPMENT

A. Applies to main control system processors, expansion control modules, and network peripheral control modules.

B. Inputs, outputs, and control ports as shown on the Drawings.

C. Expansion slots as shown and populated on the Drawings.

D. PoE, PoE+, or UPOE power where shown on the Drawings.

E. Serial ports shall support data rates up to and including 115.2k baud.

F. Minimum two serial ports shall support RS-232, RS-422, and RS-485.

G. Dual LAN ports, allowing connection to a main network and a separate AV network or subnet.

H. Minimum 4.0 GB internal flash memory.

I. Compatible with the specified control system management equipment.

J. Rack-mountable where shown on the Drawings in an equipment rack. Surface-mountable where shown on the Drawings mounted to a display, wall, millwork, or other surface.

2.3 TOUCH PANEL CONTROLLERS AND RELATED EQUIPMENT

A. Screen sizes as shown on the Drawings.

B. Physical bezel-mounted keys as shown on the Drawings.

C. Mounting as shown on the Drawings.

D. Capacitive touch membrane.

E. Integral streaming decoder.

F. Wall-mount panels shall mount in a standard electrical box unless otherwise noted on the Drawings.

G. Color depth: 24-bit, 16.7 million colors.

H. Memory: 2.0 GB, minimum.

I. Internal SSD storage: 4.0 GB, minimum.

J. Power: PoE, PoE+, or UPOE.

2.4 USB EXTENDERS

A. Compatible with the specified touch panel displays and annotation processor specified.

B. Capable of transmitting touch coordinated data.

C. Ports as shown on the Drawings.

D. Support for USB 3.0 and data rates up to and including 480 Mbps.

E. Minimum supported transmission distance: 330’.

F. Manufacturer: Extron, Icron, Geffen, Crestron.

2.5 AUDIO-VISUAL NETWORKING EQUIPMENT

A. See Section 274132, Audio-Visual Networking Equipment.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate as required with other trades to facilitate interconnects between the Audio-Visual Systems and other systems, including but not limited to lighting, window shades, building management and controls, building and/or client networks, and computer systems and software operated by the Owner.

B. Use control protocols as shown on the Drawings. Where no such connection or protocol is shown and control is required, or when multiple control connections are shown, such devices shall be controlled by the first protocol provided by the device manufacturer from the following list:
   1. Ethernet.
   2. Bidirectional hardwired serial control.
   3. Unidirectional hardwired serial control.
   4. Hardwired infrared emitter over infrared receiver on device.

5. Contact closures or relays.

3.2 CONTROL SYSTEM PROCESSORS, PERIPHERALS, AND RELATED EQUIPMENT

A. Control system processors shall be mounted as shown on the Drawings. Control equipment mounted in locations other than the equipment rack shall be secured to a surface in such a way that the device's ventilation is not obstructed.

B. Feedback shall be provided via programming code to control panels capable of receiving and displaying feedback from each feature or set of features found on the control panel for which device feedback is possible. When direct feedback is not possible because the controlled device does not provide it, state variables shall be used in the programming code to provide feedback to the user that the button in question has been pressed.

C. The master control system processor shall be used for AC sequential switching and should remain constantly powered.

D. Configure occupancy sensor lens masking as needed to minimize false triggers.

3.3 TOUCH PANELS, KEYPADS, AND ROOM SCHEDULING PANELS

A. Provide mounting accessories as required to mount or place panels and keypads at locations shown on the Drawings.

B. Apply programming to panels as described below.

C. Coordinate colors and numbering of stand-alone room availability indicators with the Architect.

3.4 CONTROL SYSTEM PROGRAMMING AND FUNCTIONALITY

A. General:
   1. The following are minimum functionality requirements.
   2. Coordinate final programming, terminology, and related functionality with the Architect.
   3. It shall be the responsibility of the Contractor to obtain and adhere to any templates or standards currently in use by the Owner. Any discrepancy between any such templates or standards and these requirements shall be brought to the attention of the Architect.
   4. Provide remote IP-based control of each space via local executable files or programs, web pages, and/or mobile device applications as directed by the Architect.
   5. For the purposes of this Section, the following definitions apply:
      a. "Volume control" or "volume controls:" two momentary buttons, one for volume up, one for volume down, and one latching button for a mute/unmute state for a given input or output. Volume controls shall have a bar graph or numerical indication of the current level relative to the minimum and maximum possible levels.
      b. "Latching toggle:" A single button that toggles the system from an original state to another state and back to the original state. When released, the toggled state shall remain active.

c. "Momentary toggle:" A single button that toggles the system from an original state to another state and back to the original state. The system shall remain in the toggle state only when the button is pressed. The system shall return to the original state when the button is released.

d. "Transport control:" Buttons that control any function that affects media stored in/on or played by a source device or the output image from a source device. This includes, but is not necessarily limited to play, stop, pause, advance, reverse, chapter selection, next, track, pan, tilt, focus, zoom, light on/off. Full control of devices shall be provided where indicated herein or on the Drawings. Each source or device requiring shuttle control have its own dedicated shuttle control page.

e. "All mute:" A single button or pair of buttons that cause all inputs and outputs to be muted. This applies to audio and video as applicable to this scope, including but not limited to audio inputs, loudspeaker zones, video inputs, display devices, and streaming encoders. "All Audio Mute" and "All Video Mute" shall have similar functionality only for the respective systems.

f. "Preset" or "Presets:" System states saved in a way that they can be recalled quickly and easily. Presets shall be approved by the Architect at the time of Substantial Completion.

1) "Default Preset(s): Preset programmed by the Contractor such that the user cannot overwrite it.

2) "User Preset(s)" Presets programmed by the Contractor such that the user can save, delete, or overwrite presets created by the user. When there is a requirement for presets on any given system, the user shall be able to save and recall a minimum of four presets.

g. "Projection screen control(s):" Three momentary toggle buttons, programmed for up, down, and stop motions of an electrically operated projection screen.

6. Adjustment buttons for volume controls and camera controls shall utilize fine adjustment for single button pushes and coarse adjustment for an extended button push.

7. The "all mute" function shall mute all audio sources to all outputs. When the user toggles out of the "all mute" state the system shall return to the same state it was in prior to entering the "all mute" state.

8. Single pages described herein, or functionality shown as a requirement of a page, may be divided into multiple pages as necessary to maintain clarity, ease of use, or an organized appearance.

9. Color selection shall provide the greatest contrast possible between the background and buttons or text. All text shall be in CAPITAL LETTERS. There shall be no spelling errors and correct grammar shall be used.

10. Buttons shall reflect feedback in one of two ways. If true bidirectional control of the device is indicated on the Drawings, then the buttons shall provide constant feedback by permanently changing colors to indicate the state the source equipment is in. If only one-way control is indicated on the Drawings, or if the device in question does not provide feedback, the buttons shall provide feedback by changing colors to indicate that the button has been pressed.

11. The following actions shall cause a user verification prompt ("are you sure?"):

a. System power on/off.

b. Overwriting any system preset.

c. Recalling any default preset.

d. Projector power on/off and projection screen up/down.

12. When a system shuts down, it shall remember the states of all controls. When the system is restarted, it shall start up in the same state that it was in when it was shut down, except as otherwise indicated herein.

B. System-specific control functionality: as shown on drawings.

3.5 CONTROL SYSTEMS AND PROGRAMMING PERFORMANCE VERIFICATION

A. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Verify that all devices connect to and maintain a connection to the appropriate LAN.

D. Verify that remote control over the LAN is functional.

E. Verify that the occupancy sensors trigger only when a person enters the target area.

F. Verify that the appropriate system presets are called when the operable partitions are in the open and closed positions.

G. Verify that all buttons perform the intended function and reflect feedback properly.

H. Verify that presets are saved and recalled as desired.

I. Verify that the control system executes commands without any kind of delay.

J. Verify that the system powers on and off properly and powers up according to the Specifications.

K. Verify that there are no spelling or grammar errors in custom touch panel or keypad layouts.

END OF SECTION

SECTION 274132 - AUDIO-VISUAL NETWORK EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Managed edge switches.

B. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. General provisions are specified in Section 274010, Audio-Visual General, and other Sections of Division 27.

B. Section 274111, Mixing, Processing, and Amplification Equipment.

C. Section 274122, Video Transport, Switching, and Processing Equipment.

D. Section 274124, Video Conferencing and Collaboration Systems.

E. Section 274125, Electronic Signage and Wayfinding Equipment.

F. Section 274131, Audio-Visual Control Systems and Programming.

1.3 REFERENCE STANDARDS

PART 2 PRODUCTS

2.1 GENERAL

A. The installation of the systems described in this Section shall be under the direct supervision of a person or persons having completed the factory training recommended by the network switch manufacturer.

B. Unless otherwise noted, all network switches shall be from the same manufacturer.

C. All switches shall be pre-programmed by the manufacturer as required to support the AVoIP proptocols shown connected thereto on the Drawings.

D. Supported protocols:
   1. Protocol support: IEEE 802.3-2015/COR1-2017 10Base-T, 100Base-TX, and 1000Base-T.
   2. Simple network management protocol (SNMP) with management information base (MIB) support, as well as support for SNMP v1, v2, and v3 commands.

3. Remote network monitoring (RMON I) for history, statistics, alarm and events.
4. IGMP snooping (multicast filtering).
5. Domain name service (DNS).
6. Simple network time protocol (SNTP).
7. Dynamic host configuration protocol (DHCP), and DHCP client.
8. Audio-Visual protocols supported: AVB, DANTE, Q-LAN, MADI over IP, AES-67, EtherSound, NDI, COBRANET.
9. Fault recovery in less than 0.5 second via rapid spanning tree protocol (RSTP) as defined in IEEE 802.1D-2004 (R2011).
10. Differentiated service (context-aware service).
11. Quality of service (QoS) as defined in IEEE 802.1D-2004 (R2011).
12. Virtual local area network (VLAN) trunking as defined in IEEE ISO IEC 802.1Q-2016/COR1 -2017 (E).
13. 19" rack-mountable.
14. Operating power: 120 V AC @ 60 Hz with redundant power supply.

E. Coordinate make and model switch with the Owner.

F. Manufacturer: Netgear, Extreme Networks, Cisco.

2.2 MANAGED NETWORK SWITCHES

A. Edge Switches:
1. Configuration:
a. Compatible with the specified audio and audio-video network platform(s).
b. Port quantity and type as shown on the Drawings, including RJ45 ports and SFP ports, used and unused.
c. Per-port bandwidth: 1.0 GHz, minimum, all ports.
d. Layer 3 switching.
e. Jumbo frames control per port.
f. VLAN assignment per port.
g. Support for UPoE on all ports.
h. Uplink: 10 GHz minimum, via built in port or SFP module.
i. Power supply: sufficient capacity to power all connected field devices that support PoE, POE+, and/or UPoE as shown.
2. Features:
a. Minimum switching capacity: 128 Gbps.
b. Minimum forwarding rate: 190 Mpps.
c. Minimum MAC address table size: 32000 entries
d. VLAN capacity: 4000 IDs.
e. Stackable.
f. Autosensing (10/100/1000 Mbps) and auto-negotiation (full or half duplex and flow control).
g. Port mirroring.
h. Rate limiting on a per-port basis.

i. Link aggregation control protocol (LACP) between switches.
j. Password-protected with multiple user levels of access.
k. Web browser-based administration secured with HTTPS and command line interface (CLI).
l. Multicast routing by port.
m. Per port broadcast storm control.

PART 3 EXECUTION

3.1 GENERAL

A. The network shall be configured as indicated on the Drawings and in cooperation with the Owner's IT department. Configuration shall not be limited to the equipment provided but shall also include the existing switches and other equipment as necessary. Prior to commencing work, meet with representatives of that IT department to gain an understanding of local requirements regarding network configuration and personnel that shall be granted access to perform configurations that may be necessary to fully execute the scope described herein and on the Drawings. In the event that network security regulations prevent the Contractor from directly modifying the Owner's network equipment, the Contractor shall be responsible for directing the Owner in configuring the same.

B. Uplink switches to the Owner's existing LAN or WAN as directed by their IT staff. Depending on network policies in force at the time of installation, switches may not be uplinked to the existing LAN or may be connected as their own physically isolated LAN. Terminate or re-terminate existing structured cabling, including copper and fiber optic cabling, as necessary and/or as directed.

C. Network traffic shall be assigned to VLANs. Coordinate final VLAN configurations and assignment with the Owner. Assignments may be as follows:
1. VLAN 1: Audio-Visual control traffic.
2. VLAN 2: Audio traffic.
3. VLAN 3: IP Video traffic.
4. VLAN 4: VoIP traffic.
5. VLAN 5: Video Teleconferencing Traffic.

D. Specific configuration may include, but is not necessarily limited to:
1. Assigning IP addresses and ports to connected devices.
2. Applying local security policies to new equipment and modifying existing security policies to accommodate the systems in this scope.
3. Configuring devices with gateway and subnet mask information.
4. Assigning ports and/or addresses to VLANs.
5. Configuring VLANs across multiple switches.
6. Entering connected device MAC addresses into the switch’s MAC address table.
7. Configuring QoS per connected device requirements.
8. Configuring port trunking if necessary.
9. Configuring jumbo frames settings.
10. Configuring multicast permissions and other settings.
11. Configuring user account access to switch configuration pages.

3.2 AUDIO-VISUAL NETWORK EQUIPMENT PERFORMANCE VERIFICATION

A. General Performance Verification requirements are contained in Section 274010, Audio-Visual General.

B. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.

C. Network Switches and Related Equipment:
   1. Verify that devices are using the correct IP address and on the correct VLAN.
   2. Verify that all devices have the necessary network access to perform as specified.
   3. Verify that one type of traffic (i.e., audio network traffic).

END OF SECTION

SECTION 274140 - AUDIO-VISUAL CABLING AND CONNECTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Category cabling.

B. Fiber optic cable and related equipment.

C. Coaxial cabling.

D. Single pair shielded cable.

E. Single pair unshielded cable.

F. Multipair shielded cable

G. Premade audio cables.

H. Premade video cables.

I. Active optical video cables.

J. Multi-adapter loops.

K. Audio connectors.

L. Video connectors.

M. Data connectors.

N. Responsibilities and obligations in support of the Performance Verification specified in Section 274010, Audio-Visual General.

1.2 RELATED REQUIREMENTS

A. General provisions in Section 274010 - AUDIO-VISUAL GENERAL and other Sections of Division 27.

B. 271313 - Communications Copper Backbone Cabling

C. 271323 - Communications Optical Fiber Backbone Cabling

D. 271333 - Communications Coaxial Backbone Cabling

E. 271513 - Communications Copper Horizontal Cabling

F. 271523 - Communications Optical Fiber Horizontal Cabling

G. 271533 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING

H. 271611 - COMMUNICATIONS HYBRID CABLING

1.3 REFERENCE STANDARDS

A. AES3-4 Annex D - AES standard for digital audio - Digital input-output interfacing - Serial transmission format for two-channel linearly-represented digital audio data; 2009.

B. AES10 - Serial Multichannel Audio Digital Interface (MADI); 2008.

C. AVIXA F501-01-2015 - Cable Labeling for Audiovisual Systems; 2015.

D. SMPTE 259 - SDTV1 Digital Signal/Data — Serial Digital Interface; 2008.

E. SMPTE ST 292 - 1.5 Gb/s Signal/Data Serial Interface; 1-2008.

F. SMPTE ST 424 - 3 Gb/s Signal/Data Serial Interface; 2012.

G. SMPTE ST 2081-1 - 6 Gb/s Signal/Data Serial Interface — Electrical; 2023.

H. SMPTE ST 2082-1 - 12 Gb/s Signal/Data Serial Interface — Electrical; 2023.

I. Conform to all codes and standards listed in PART 1 of Section 274010, Audio-Visual General.

J. NEC 725

K. NEC 800

L. FT4

M. FT6

N. RoHS

1.4 SUBMITTALS

A. General submittal requirements as identified in Section 274010, Audio-Visual General. In addition to those requirements, submittals for this Section shall include the following:
   1. Run sheets or field wiring details.
   2. Floor plans and/or RCPs showing the locations of the equipment rack and all field connector boxes and plates. Cable pathway shall be shown for all cable that will be free-run or installed in raceway provided by the Audio-Visual Contractor.
   3. Shop Drawings of all panels, plates, and designation strips, including details relating to terminology, engraving, finish, and color.

4. A cable color scheme identifying the types of cabling, and where necessary the signal types, and the colors that will be used.
5. Category Cable submittal requirements as defined in 271313 - Communications Copper Backbone Cabling and 271513 - Communications Copper Horizontal Cabling.
6. Fiber Optic Cable submittal requirements as defined in 271323 - Communications Optical Fiber Backbone Cabling and 271523 - Communications Optical Fiber Horizontal Cabling.
7. Coaxial Cable submittal requirements as defined in 271333 - Communications Coaxial Backbone Cabling and 271533 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING.

PART 2 PRODUCTS

2.1 GENERAL

A. This Section covers all cabling required to complete the scope defined by 274010 - AUDIO-VISUAL GENERAL and other sections listed therein. Not all cabling is used in every system. Reference the Drawings as necessary to correlate cable types to specific systems or cable links.

B. Cable gauges listed herein are the minimum required gauges.

C. Cables rated for use in wet locations shall be UL rated CM and CL3 and be RoHS compliant. Cable shall pass TIA455-82 Water Penetration Test.

D. Cables used for direct burial connections shall be UL rated for direct burial and factory marked as such on the outer jacket.

E. Cables shall be UL listed for direct burial where shown as run in the ground without a raceway.

F. All plenum cables shall UL listed CMP for use in plenums.

G. All non-plenum cables shall be UL listed CMR, riser rated.

H. Plenum cable use: All permanently installed cabling in this Project shall be plenum-rated, regardless of whether it is required by code or not.

I. Definitions:
   1. “Installed Cable” or “Permanent Links:” any cable of any type between the last connection in the equipment rack to the back side of connector plates in the field.
   2. “Patch Cables” or “Premade Cables” shall be defined as any cable of any type that connects a device in the equipment rack to another device or the patch bay, or any cable that connects a field connector plate to a device in the field.

2.2 CATEGORY CABLE AND RELATED EQUIPMENT

A. Refer to 271513 - Communications Copper Horizontal Cabling.

2.3 FIBER OPTIC CABLING AND RELATED EQUIPMENT

A. Refer to section 271523 - Communications Optical Fiber Horizontal Cabling.

2.4 COAXIAL CABLING

A. Refer to Section 271100, Broadband Cabling Systems.

B. Where shown on the Drawings carrying digital video signals, coaxial cabling shall be rated for use with serial digital signals per SMPTE 259, SMPTE ST 292, SMPTE ST 424, SMPTE ST 2081-1, and/or SMPTE ST 2082-1 as applicable.

C. RG/6U:
   1. Rated for use with MADI signals (AES10)

D. RG/59U:
   1. Rated for use with MADI signals (AES10)

2.5 SINGLE PAIR SHIELDED CABLING

A. General:
   1. Conductors: 7-strand tinned copper.
   2. Dielectric: Cellular polyethylene.
   3. Shield: 100% foil with 7-stranded tinned copper drain wire.
   4. UL voltage rating: 300 V.

B. Commercial Cabling:
   1. This paragraph applies to cabling used for the following signals or signal levels:
      a. Microphone.
      b. Analog line-level.
      c. RS-232C.
      d. Other signal paths as noted on the Drawings.

C. Precision Cabling:
   1. Complies with AES3-4 Annex D
   2. This paragraph applies to cabling used for the following signals or signal levels:
      a. All digital audio signal paths.
      b. All audio signal paths.
      c. RS-422 and RS-485.
      d. Other signal paths as noted on the Drawings.
   3. Rated for use with AES/EBU AES3 digital audio signals.
   4. Nominal impedance: 110 Ω.

2.6 SINGLE PAIR UNSHIELDED CABLING

A. Conductors: 19-strand copper.

B. Twist: 2.7/1.0’.

C. NEC UL rating: CL3, FPLR.

D. UL voltage rating: 300 V.

2.7 MULTIPAIR SHIELDED CABLING

A. Shield: individual pairs in aluminum foil, outer/overall aluminum foil shield.

B. Gauge: 22 AWG.

C. Pairs: enough to provide connectivity shown on the Drawings.

D. Characteristics and performance of individual pairs shall meet or exceed the Specification for single pair shielded cable as described herein and/or on the Drawings.

E. There shall be an overall shield.

F. UL voltage rating: 300 V.

2.8 PREMADE AUDIO CABLES

A. General:
1. Length: as shown on Drawings and/or as needed to make required connection(s).
2. Specifically designed for temporary or portable use on stage.
3. Manufacturer: Cables 2 Go, Whirlwind, ProCo, Mogami, Liberty Cable, BTX.

B. Microphone and Balanced Line-Level:
1. 3-conductor shielded, unless otherwise noted.
2. Connectors:
   a. Microphone: XLR-F and XLR-M. Shall meet or exceed XLR connector specification included herein.
   b. Line-Level: male or female XLR or TRS, as required by the device manufacturer and/or indicated on the Drawings without adapters.
3. Flex life: 131,000 cycles.
4. Tensile strength: 578 N.
5. Gauge: 22 AWG stranded copper.
6. Outer jacket: flexible PVC.

C. Production Communication Cables:
1. 3-conductor or 6-conductor shielded, as shown on the Drawings.
2. Connectors: microphone: XLR-F and XLR-M. Shall meet or exceed XLR connector specification included herein.
3. Flex life: 131,000 cycles.
4. Tensile strength: 578 N.
5. Gauge: 22 AWG.
6. Outer jacket: flexible PVC.

D. Speaker Cables:
   1. Connectors: Neutrik SpeakON, unless otherwise indicated on the Drawings.
   2. Outer jacket: flexible PVC.
   3. DC resistance: 0.005 Ω/ft.
   4. Capacitance: 32.3 pF/ft @ 100 Hz, 28.4 pF/ft @ 1.0 kHz.
   5. Inductance: 0.18 µH/ft.
   6. Voltage: 500 V, 15 second minimum.
   7. Gauge: 12 AWG stranded copper.

2.9 PREMADE VIDEO CABLES

A. Manufacturer: Crestron, Extron, BTX, Liberty Cable, Cables 2 Go, Belden, Gepco.

B. Factory terminated to match the connectors on the device(s) to which it will connect without the use of adapters.

C. Length: as short as possible to make the required connection without unnecessary strain on the cable and/or unnecessary length in the equipment rack.

D. Gold-plated contacts.

E. CM-rated where shown on the Drawings as installed in raceway.

F. Conductors: tinned copper, including drain wire.

G. Shielding: aluminum-mylar tinned copper braid.

H. Outer jacket: PVC.

I. HDMI Cables:
   1. Support for 4K (4096x21600) @ 60 Hz, 4:4:4 chroma sampling, maximum 8 bit per color, and 18.0 Gbps overall data rate for the entire length of the cable.
   2. Voltage: 30 V.
   3. HDMI 2.0 compliant.
   4. Pair impedance: 100 Ω, ±10 Ω.

J. DVI Cables:
   1. Applies DVI-DVI and DVI-HDMI cables.
   2. Support for 1920x1200 @ 60 Hz and 4.59 Gbps data rate for the entire length of the cable.
   3. Voltage: 30 V.
   4. Pair impedance: 100 Ω, ±10 Ω.

K. Display Port Cables:
   1. Support for 4K (4096x2160) @ 60 Hz, 4:4:4 chroma sampling, maximum 8 bit per color, and 21.6 Gbps overall data rate for the entire length of the cable.
   2. HDCP support: HDCP 1.4, HDCP 2.2.
   3. DisplayPort 1.2 compliant.
   4. Voltage: 40 V.
   5. Pair impedance: 100 Ω, ±10 Ω.

6. Latching connectors.

L. VGA Cables:
1. Molded HD-15 connectors with screws.
2. Integral stereo audio connection.
3. Transmission of EDID signals and +5.0 V on pin 9.
4. Electrostatic discharge protection.

2.10 ACTIVE OPTICAL VIDEO CABLES

A. Functionally designed as a hybrid copper and fiber optic cable designed to carry digital video and low voltage power beyond the distance limitations of copper cable.
1. Support for 4K (4096x2160) @ 60 Hz, 4:4:4 chroma sampling, maximum 8 bit per color, and 21.6 Gbps for the entire length of the cable.

B. Detachable or fixed connectors.

C. Video standards compliance, HDMI, HDCP2.2, CEC.

D. Audio support:
1. return channel.
2. 32 discreet channels.
3. 8-channel including PCM, Dolby Digital TrueHD, and DTS-HD.

E. Power: +5.0 V DC via HDMI pin 15.

F. No external power supply.

G. Passes hot plug detect signal.

H. Manufacturer: Liberty Cable, Covid, Kanex Pro, Legrand, Kramer.

2.11 MULTI-ADAPTER LOOPS

A. Functionally designed as a steel cable securing multiple adapters to convert multiple signal types to HDMI.

B. Input adapter types: as indicated on the Drawings.

C. Manufacturer: Liberty Cable, Covid, Digitalinx, Kramer.

2.12 CONNECTORS

A. General:
1. Manufacturer, unless otherwise noted: Neutrik, BTX, Leviton, Amphenol, Switchcraft, Whirlwind, West Penn, Belden, Liberty, Crestron, Canare.
2. Solderable connectors shall comply with IEC 68-2-20 for solderability.

3. Color: black or sliver, unless otherwise noted.

B. XLR:
1. Shall conform to ECIA RS297-A-1970, IEC 61076-2-103.
2. Mating cycles: 1000, minimum.
3. Shell: nickel plated zinc.
4. Latch: diecast zinc or steel.
5. Supports wire up to 14 AWG.
6. Contacts: silver plated bronze.
7. Cable mount: integral strain relief and insert, and polyurethane boot.
8. Panel mount: nickel housing, D shape, 1.024” x 1.22” face plate dimensions.

C. TRS and TS (Tip-Ring-Sleeve and Tip-Sleeve):
1. Shall conform to IEC 60603-11, EIA-453.
2. Mating cycles: 1000, minimum.
3. Shell: nickel plated zinc.
4. Supports wire up to 18 AWG.
5. Contacts: sulfur-plated brass or silver-plated bronze.
6. Cable mount: diecast zinc or steel latch, integral strain relief and insert, and polyurethane boot.
7. Panel mount: nickel housing, D shape, 1.024” x 1.22” face plate dimensions.

D. Multi-Pole Twist-Lock Speaker Connectors:
1. Poles: 2, 4, or 8 as required to support connected loudspeakers.
2. Rated current: 50 A, per contact.
3. Rated voltage: 250 V AC.
4. Mating cycles: 5000, minimum.
5. Supports wire up to 10 AWG.
6. Screw terminals.
7. Contacts: silver plated brass or sliver plated bronze.
8. Latch: diecast zinc, quick lock type.
9. Cable mount: integral strain relief, with polymer-based thermoplastic insert and shell.
10. Panel mount: polyamide or nickel housing, D type, 1.024” x 1.22” face plate dimensions.
11. Basis of design: Neutrik SpeakON SPX (NL) Series.

E. HDMI:
1. Standards compliance: HDMI 2.0.
2. Front connector: female HDMI.
3. Rear connector: female HDMI or phoenix type if all HDCP, HDMI and other standards are met and/or maintained.
4. Chassis: Panel mount: polyamide or nickel housing, D type, 1.024” x 1.22” face plate dimensions.
5. Mating cycles: 1000, minimum.
6. Contacts: silver plated brass.

F. RJ-45:
1. TIA/EIA-, IEC/ISO/EN-, IEEE-rated for the Category cable and signal path that will connect to it.
2. Chassis: Keystone snap-in type or polyamide/nickel housing D type.
3. Front connector: RJ-45.

4. Rear connector: 110 or IDC punch down.
5. Shielded where required by the signal path.
6. Cable mount: integral strain relief, with polymer-based thermoplastic insert and nickel-plated zinc diecast shell.
7. Mating cycles: 1000, minimum.
8. Supports POE, POE+, or UPOE where shown carrying such a signal on the Drawings.
9. Color: as indicated on the Drawings or approved by the Architect.
10. Manufacturer for shielded cable-mount RJ-45 connectors: Weidmuller or equal by Crestron, Neutrik, Panduit, or Leviton.

G. DB-9:
1. Brass contacts.
2. Metallic housing.
3. UL94V thermoplastic insulator.
4. Solder or phoenix-type connections.

H. HD-15:
1. Brass contacts.
2. Metallic housing.
3. UL94V thermoplastic insulator.
4. Solder or phoenix-type connections.

I. Fiber Optic Connectors:
1. TIA/EIA-, IEC/ISO/EN-, IEEE-rated for the Category cable and signal path that will connect to it.
2. Chassis: Keystone snap-in type or polyamide/nickel housing D type.
3. Tethered cover to protect optical connections when not in use.
4. Front connector: feed through, type as required by signal path and/or other connectors serving it.
5. Cable mount: integral strain relief, with polymer-based thermoplastic insert and nickel-plated zinc diecast shell.
6. Mating cycles: 1000, minimum.
7. Color: as indicated on the Drawings or approved by the Architect.

J. BNC:
1. Rated for 4.5 GHz.
2. Impedance: 75 Ω or 50 Ω.
3. Panel mount: barrel-type or D-type.
4. Mating cycles: 1000, minimum.
5. Connectors: BNC, both sides.
6. Bayonett-style locking mechanism.
7. Contacts: brass and aluminum.
8. Shell: brass.

PART 3 EXECUTION

3.1 GENERAL

A. This Section pertains to installation of the cabling and related equipment and supplies described in this Section.

B. Any person installing and/or terminating permanently installed category cable or fiber optic cable shall have a current BICSI installation certification.

C. Refer to the Drawings for related cabling scope that may interface with the audio-visual cabling. The Audio-Visual Systems Contractor shall be responsible for verifying and interfacing with the Structured Cabling Contractor as necessary to execute the scope described herein and on the Drawings.

D. These general requirements apply to all cable types in this Project.

E. Tie wraps (also known as cable ties or zip ties) shall not be used anywhere on this Project unless directed specifically to do so by a manufacturer. Cable shall be secured with Velco cable wraps.

F. Add raceway as required by code when it is necessary for a non-plenum cable to pass through a plenum space.

G. Install plenum-rated cable in all locations where cables are not installed in conduits or other enclosed wireways.

H. Wet-rated cabling as defined herein shall be used where cable is shown installed in raceway enclosures or raceways underground or in slabs on grade.

I. Cables and conductors installed in enclosures or raceways underground or in slabs on grade shall be UL listed for use in wet locations.

J. Permanent links terminating in equipment racks shall be connected to a patch panel or other back plane. Provide custom patch panels as required.

K. Where a connector plate is not shown on the Drawings, permanent links terminating in the field shall be connected directly to its destination device through a plate with a grommet hole. This plate is not required when a device mounts directly to the wall box.

L. Cut, drill, or otherwise provide cable pass through holes as required. Verify the locations of all pass throughs with the Architect prior to installation.

M. Cables leaving or entering the equipment rack(s) shall be strapped, dressed, and supported. Cabling within an equipment rack shall be completed prior to the rack being delivered to the installation site.

N. Make joints and connections with either 60/40 resin-core solder or mechanical connectors. Temperature-controlled soldering irons rated at least 60 W shall be use for soldering work.

O. Where possible, cables shall be grouped as follows:
   1. Data (Ethernet, digital audio, digital video, control).
   2. Analog video.
   3. Fiber-optic connections.
   4. Line-level audio and speaker-level audio.
   5. Microphone-level audio.

P. All cables, regardless of length, cable type, or signal format, shall be labeled as follows:
   1. AVIXA F501-01-2015.
   2. Provide self-laminating computer printed cable markers with black text and white background for all cable designations.
   3. No cables shall be marked with handwritten markers.
   4. Cable labels shall be full wrap unless otherwise noted. No label shall protrude from any cable, similar to a flag on a flagpole.
   5. Label both ends of every cable to correspond exactly with the approved shop drawings and run sheets provided during the submittal process. Coordinate with the Architect prior to labeling cables and adhere to any stated cable numbering or identification standards.
   6. Labels shall use text with a minimum height of 0.2".
   7. Label shall identify cable number, type, source, destination as shown below.
      a. Example: Where V=Video I=Input, 0010=Cable Number corresponding to the Shop Drawings (XXXX), R210=Source Room Number (SRC), R250=Destination room number (DST) PPP=Patch Point if applicable.
      b. Example: VI-0010-R210-R250
      c. Specific signal/cable types:
         1) Microphone level – M-XXXX-SRC-DST
         2) Line level audio – L-XXXX-SRC-DST
         3) AES digital audio – DA-XXXX-SRC-DST
         4) SPDIF – SP-XXXX-SRC-DST
         5) Speaker, 70 V – S70-XXXX-SRC-DST
         6) Speaker, low Ω – S-XXXX-SRC-DST
         7) STP Video – V(I or O)-XXXX-SRC/PPP-DST/PPP
         8) UTP – AV-XXXX-SRC/PPP-DST/PPP
         9) Multimode Fiber – AV-XXXX-SRC/PPP-DST/PPP
         10) Singlemode Fiber – AV-XXX-SRC/PPP-DST/PPP

Q. Cable color requirements are identified on the Drawings. If no cable color scheme is stated thereon, or if the required cable types are not available in the stated colors, the Contractor shall develop a cable color scheme for approval by the Architect.

R. It is the intent for all permanent links to be concealed. To this end, the Contractor shall provide materials and labor to drill holes through hard walls and provide surface mounted raceways as needed. If it is demonstrated to be impossible to drill the required holes, the Contractor shall provide wooden moldings (stained to match existing millwork) configured to best blend in with any existing finishes.

S. The Contractor shall remove all abandoned low voltage cable from conduits, wall boxes, and floor boxes that will be reused in this Project. This includes all abandoned cable, whether the abandonment was not caused by the Contractor's work or not. This also includes conduit that is connected to a wall or floor box that will be reused regardless of whether that conduit will be reused or not. It shall be the Contractor's responsibility to differentiate abandoned cable from cable to remain in use. If existing conduit contains cables that are to remain in service, and if the Contractor determines that it is necessary to remove those cables in order to install any new cabling, the Contractor shall be responsible for removing and reinstalling said existing cabling.

T. The Contractor shall ensure that all cabling in this scope is neatly dressed using split loom tubing or equivalent for pleasing appearance and safety.

U. When it is necessary to coil cables within an equipment rack, do so in a manner that does not obstruct the backs of the racked equipment.

V. Do not install any low voltage permanent links in the same cable pathway as high voltage cabling of any kind.

W. Secure cable to captive screw connectors per manufacturer's recommendations.

X. Cables shall be routed at least 24" from any fluorescent ballast and at least 3.0' from any electric motors or other high-level source of electromagnetic interference.

Y. All cables shall be cut to the length dictated by the run. NO splices shall be permitted in any pull boxes without prior permission of the Architect. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of sufficient length for the slide or drawer to open fully.

Z. All cables in conduits must be insulated and shielded from each other and from the conduit for the entire length and must not be spliced. Ground all the shields at the high-level termination end of the respective circuits only, unless otherwise specified herein. Heat shrink tubing shall be used to dress the ends of all wire and cabling including a separate tube for the drain or ground wire.

AA. Ensure that the maximum pulling tensions of the specified permanent links are not exceeded, and cable bends maintain the proper radius during the placement of the facilities. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer. Observe the bending radius and pulling strength requirements of the cables during handling and installation. Provide clutch or s hear pin protection from cables during the cable pulling process to ensure cable pulling tension is not exceeded.

BB. Provide temporary protection of cables before termination. Cables shall not be left lying on the floor. Bundle and tie cables to provide protection.

3.2 CATEGORY CABLE

A. Refer to Section 271513 - Communications Copper Horizontal Cabling.

B. General installation means and methods shall comply with the BICSI Telecommunications Distribution Methods Manual-2014, unless otherwise indicated.

C. All Category cable used for control signals, including but not limited to bidirectional serial, one-way serial (IR), real time transcription (RTT), USB, and Ethernet, shall use Category 6 or 6A cabling, unless otherwise directed by the Architect.

D. All Category cable used for video signal transmission, except for video over IP paths, shall be shielded Category cable. The shield shall be maintained for the entire length of the signal path.

E. All non-permanently installed field Category cables that connect a field device to a field plate (such as the connection between a desktop display and a field plate), shall use an RJ-45 connector with a metal shell protecting the connector at the field plate.

F. No permanent links shall be field terminated with male (cable mount) RJ45 connectors at/on field plates. The back side of plate-mounted RJ45 connectors shall be punch-down style. When the Specifications or Drawings require the equipment rack end of permanent links to be directly connected to its destination device (and not a patch panel), punch-down RJ45 cable-mount connectors shall be used.

G. Where patch bays are required, the patch bay shall be shielded as necessary, support up to and including 6a shielded cabling, and shall have punch-down connectors for permanent links.

H. Patch cables shall be factory pre-made cables of appropriate lengths. These cables shall be shielded or unshielded to match the cabling and/or signal originating or terminating in the field.

3.3 FIBER OPTIC CABLES AND CONNECTORS

A. Refer to Section 271523 - Communications Optical Fiber Horizontal Cabling.

B. All non-permanently installed field fiber optic cables that terminate to a field plate (such as from a field plate to a device), shall use a fiber optic connector with a metal shell that protects the connection at the field plate.

C. Provide necessary fiber optic cable termination tools.

D. Provide all necessary panels, clamps, covers, and couplings.

E. Follow manufacturer’s installation instructions for connector installation.

3.4 AUDIO CABLES

A. Do not increase cable gauge (provide smaller cable) without written consent from the Architect.

B. Reduce microphone cable gauge (provide larger cable) as required to carry full phantom power voltage and current required by the connected microphone from the audio mixer to the microphone location. Provide local phantom power supplies at microphone locations if the required voltage and/or current cannot be delivered to the microphone by a reasonable decrease in cable gauge.

C. Reduce loudspeaker cable gauge (provide larger cable) as required to deliver required wattage, current, and voltage to the specified loudspeakers.

D. Audio Cable Shields: All audio cable shields shall be grounded at one point only. There are no exceptions. For inter and intra-rack wiring this requires that the shield be connected at one end only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.

3.5 VIDEO CABLES

A. All video cables shall be rated for the resolution and refresh rate of the system at the distance required to make the necessary connections.

3.6 PREMADE CABLES

A. All pre-made cables used within an equipment rack shall be the shortest length available that completes the connection.

B. Provide equalizers as required to maintain resolution, refresh rate, chroma sampling, color bit depth, and data rate for the entire length of the cable.

C. Provide CM-rated cables for all pre-made cables shown on the Drawings as installed in raceway.

D. Verify length of pre-made cables used between field connector plates and source or destination devices with the Architect.

3.7 CONNECTOR ASSEMBLIES

A. Provide engraved wall connector assembly plates for all connector assembly plates for all connections. The finish of all connector assemblies shall be coordinated with and approved by the Architect. Thickness as required.

B. Coordinate the final placement of all connector assemblies with the Architect.

C. Unless otherwise specified herein or on the Drawings, female type receptacles shall be used for floor, wall, and panel mountings. Male type connectors shall be used for cable mountings.

D. Provide strain relief on all connectors.

E. Receptacles shall be insulated from the mounting panel, box, or cable pathway. Unless otherwise specified herein or on the Drawings, this shall be accomplished by using insulated-from-panel type receptacles.

F. Provide blank cover plates for all boxes shown on the Drawings but not used in the installation. Provide blank cover plates for all boxes vacated as a part of the removal of existing cabling and/or connectors.

G. Insulate cables from receptacle faceplates.

3.8 GENERAL CABLE AND CONNECTOR PERFORMANCE VERIFICATION

A. General:
   1. These requirements pertain to all cabling included in this Project, as applicable.
   2. Performance Verification of these systems shall be performed in conjunction with the Performance Verification requirements in Section 274010, Audio-Visual General.

3. Performance Verification of the equipment included herein should be conducted in accordance with requirements in other Specification Sections that cover related equipment.
4. The Contractor shall test all elements of the cabling as defined herein. This testing shall be conducted in accordance with the submitted and approved test plan.
5. Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems. The Contractor shall submit a written request to the Contracting Officer, with justification and technical support materials, for approval of alternate grounding methods and practices.
6. The Contractor shall be responsible for terminating all cable provided by others that will be used by the systems included in this scope of work. The Contractor shall notify the Architect promptly if any such cable is found to be defective or otherwise unusable for the intended signal path.

B. Terminations:
1. Verify that all solder terminations are secure, strong, and not causing shorts.
2. Verify that all screw terminals are tightened, and the wire cannot pull out.
3. Verify that all phoenix connectors are properly attached.

C. Impedance:
1. Check the resistance and continuity of all circuits covered by this and other Sections included in Division 27. Document and repair any deficiencies fount.

D. Polarity:
1. Verify and document that polarity is maintained throughout the system on microphone and line level signals from field input and output connections to their respective active components and on loudspeaker from power amplifier outputs to the last speaker in each circuit.

E. Hum, Buzz, and Interference:
1. Verify that all cables are terminated such that they are not introducing hum, buzz, EMF, or any other unwanted noise into the signal chain.

F. Cable Shields:
1. Verify that the shield of all shielded lines is intact and connected for the length of the installed cable run.

3.9 CATEGORY CABLE AND CONNECTOR PERFORMANCE VERIFICATION:

A. Refer to Section 271513, Communications Copper Horizontal Cabling.

B. General:
1. These requirements apply to all Category and fiber optic cabling in this scope, regardless of the signal that any given cable will ultimately carry.
2. All individual installed Category and fiber optic cable lines shall be tested as follows for data rate and dropped bits.
3. Test 100% of the permanent links.

4. Input the test results into a spreadsheet created by the Contractor or the test equipment manufacturer's reporting software. Tabulate and analyze results to ensure cabling system meets requirements specified herein.
5. Document failed links, including individual pairs in Category cable. Repair or replace cable, then retest. Repeat procedure until cable passes requirements.
6. A representative of the Architect shall be invited to witness the field testing. The representative shall be notified of the start date of the testing phase at least 5 business days before testing commences.

3.10 OPTICAL FIBER CABLE AND CONNECTOR PERFORMANCE VERIFICATION:

A. Refer to section 271523, Communications Optical Fiber Horizontal Cabling.

B. General:
1. All individual installed Category and fiber optic cable lines shall be tested as follows for data rate and dropped bits.
2. Test 100% of the permanent links.
3. Input the test results into a spreadsheet created by the Contractor or the test equipment manufacturer's reporting software. Tabulate and analyze results to ensure cabling system meets requirements specified herein.
4. Document failed links, including individual pairs in Category cable. Repair or replace cable, then retest. Repeat procedure until cable passes requirements.
5. A representative of the Architect shall be invited to witness the field testing. The representative shall be notified of the start date of the testing phase at least 5 business days before testing commences.

END OF SECTION

SECTION 274200 - ELECTRONIC DIGITAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION:

A. This Section covers LED message centers and control software.

B. Specialty systems general provisions are specified in Section 27 40 10, Audio-Visual General.

C. This Section includes responsibilities and obligations in support of the performance verification specified in Section 27 40 90, Audio-Visual Performance Verification.

1.3 REFERENCES:

A. Standard for Electric Signs, UL and CUL Listed.

B. Standard for Control Centers for Changing Message Type Signs

C. Federal Communications Commission Regulation Part 15

D. National Electric Code

E. Designed to current UBC or IBC standards

F. FCC Class A Compliant

1.4 SUBMITTAL:

A. The electronic LED display manufacturer shall provide a complete technical submittal within 60 days of contract award and shall not proceed with LED Matrix manufacture until the submittal is approved.

B. Submit the following:
   1. All LED display manufacturer qualifications, as specified herein.
   2. LED display shop drawing.
   3. LED display Riser diagram.
   4. AC Site Power Requirements, including legs and Amps per leg.
   5. LED display control software operator’s manual.
   6. LED display installation and maintenance manual.

1.5 QUALIFICATIONS:

A. LED Display Manufacturer shall:
1. Have been in the business of manufacturing permanently mounted outdoor LED displays for a minimum period of 15 years prior to the contract bid date. An “LED” display contains pixels constructed solely of high-intensity discrete LEDs.
2. Have in operation at bid date a minimum of 100 large outdoor permanently mounted LED displays as defined above. Each of these LED displays shall have operated successfully for a minimum period of one (1) year prior to the contract bid date.
3. Have been in business under the same corporate name for a period of no less than 40 years prior to the contract bid date.

B. Experience with manufacturing the following types of electronic sign products shall not satisfy the requirements of this LED display specification:
1. Indoor displays of any size or type.
2. Back-lit displays.
3. Any type of matrix display that cannot be programmed to show a nearly infinite quantity of messages.

1.6 WARRANTY:

A. Provide 5 years of parts coverage.

B. Provide toll-free service coordination.

PART 2 PRODUCTS

2.1 GENERAL:

A. Unless otherwise specified herein, quantities of equipment are indicated on the Drawings, and performance values specified herein are minimum acceptable values.

B. Obtain digital signs through one source from a single manufacturer. Obtain each as a complete unit, including mounting hardware and accessories.

C. Basis of DesignManufacturer:
1. Manufacturer: Daktronics
2. Model Number: GS6-40-125-15.85-RGB-SF

2.2 LED DISPLAY:

A. Cabinet Construction:
1. Cabinet dimensions 2' 7" high by 6' 9" wide. The front-to-back cabinet depth shall not exceed 5 inches.
2. The cabinet shall contain a full LED matrix measuring a minimum of 40 pixel rows high by 125 pixel columns wide.
3. Cabinet display configuration is:

a. Single-Face (SF), one sided display.

4. The distance from the center of one line or column of pixels to the center of all adjacent lines or columns shall be 15.85 mm both horizontally and vertically.
5. Maximum display power per face shall not exceed 570 watts when 100% of the pixels are operating at their maximum possible drive current.
6. Cabinet weight per face shall not exceed 130 lbs.
7. Display shall operate from the following power sources: 120/240 VAC, 60 Hz single-phase, including neutral and earth ground.
8. Display shall operate in a minimum ambient temperature range of -40° to +120°F (-40 to +50°C) and to a 95% humidity.
9. Internal display component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the signage application.
10. Electrical display components shall be 100% solid-state.
11. The presence of ambient radio signals and magnetic or electromagnetic interference, including those from power lines, transformers, and motors, shall not impair performance of the display system.

B. Housing Frame:
1. Display materials shall use non-corrosive materials or have a protective coating so they shall be anti-corrosive and not degrade or oxidize.
2. Adequate ventilation shall be provided through convection without the need to provide extra space around the sides or behind the display.
3. Steel mounting points that can be used for mounting purposes shall be provided with the display and have the ability to be adjusted for alternative mounting methods.
4. Shall include lifting supports that can be removed after installation.

C. Exterior Finish:
1. The LED display border pieces shall be coated with an automotive-grade acrylic urethane paint.

D. Front Face Construction
1. To meet the display readability requirements, the front face must be constructed in such a manner that it provides high contrast, low sunlight reflection and durability in all weather and site conditions.
2. Minimum features of front face shall:
a. Provide UV resistance to prevent discoloring.
b. Include horizontal louvers for contrast enhancement.
c. Include vertical ribbing for contrast enhancement
d. Use surface materials in the active LED area, such as metal, plastic, or other face materials, designed for low sunlight reflectivity

E. Serviceability:
1. The display housing shall provide safe and convenient front service access for all modular assemblies, components, wiring, and other materials located within the housing.
2. All internal components shall be removable and replaceable by a single technician with basic hand tools.
3. Service access shall be easily obtained by removal of one or more modules in front of the associated internal component.

4. Each module should allow simple removal with a single latch system.
5. Displays shall be designed with service features that minimize potential bodily harm.

2.3 DISPLAY COMPONENTS:

A. LED display modules shall be constructed for good readability, long life, and ease of service. Each display module shall be constructed as follows:
   1. Each module within the product family shall be designed with the same physical footprint of 12.48” x 15.59”.
   2. All modules and their components shall be fully encapsulated and sealed to meet IP-67 standards.
   3. An LED module shall consist of LEDs with all drive electronics mounted on a single Printed Circuit Board (PCB).
   4. LEDs shall be auto-inserted in order to maintain quality and uniformity of the LEDs within each LED module.
   5. All PCBs shall be wave-soldered to ensure uniformity, quality, and durability of all solder joints.
   6. All PCBs shall be cleaned in a manner so as not to contain more than 2 parts per million contaminants.
   7. Module signal and electrical connections shall be of the positive locking and removable type. Removal of a module from the display shall not require a de-soldering operation.
   8. Data to the modules shall be redundant in that the signal can reach the module from multiple directions in the event of a loss in signal path from either direction.
   9. All LED display modules in a single display shall be identical in construction and interchangeable throughout the display with the ability to be field calibrated.
   10. All module rows shall include continuous louvers over the LEDs for sunlight shading and enhanced contrast.
   11. Modules shall be individually attached to the cabinet frame.
   12. Removal of one or more modules shall not affect the display’s structural integrity.
   13. The distance from the center of one line or column of pixels to the center of all adjacent lines or columns shall be 0.62" both horizontally and vertically.
   14. The failure of a single pixel, module or power supply shall not cause the failure of any other pixel, module or power supply in the display.
   15. All modules shall have no less than a 140° horizontal half-intensity viewing angle and a readability angle of 160° horizontal.
   16. The transition of the viewing intensity shall be consistent throughout the viewing cone.

B. Pixels shall be constructed with discrete LEDs, and these discrete LEDs shall conform to the following specifications:
   1. LEDs shall be non-diffused, ultra-bright, solid-state light emitting diodes.
   2. The red LEDs shall be constructed of AlInGaP technology and the green and blue LEDs shall be constructed of InGaN technology.
   3. Each color of LEDs used in all LED displays provided for this contract shall be from the same bin.
   4. LED half-life shall be an estimated minimum of 100,000 hours.
   5. Display shall have a minimum intensity of 12,000 cd/m2 for RGB maximum light output, 4,500 cd/m2 for Red maximum light output, and 6,000 cd/m2 for Amber maximum light output.

C. Power Supply:

1. All power supplies shall be regulated, auto-ranging AC to DC power, with protection for the LED pixel, LED display and driver circuitry in the event of power spikes or surges.
2. Each power supply and their connectors shall be fully sealed to protect from corrosive environmental factors meeting IP-67 standards.

D. Internal Wiring:
1. Wiring for LED display modules and other internal components shall be installed in the housing in a neat and professional manner.
2. Wiring shall not impede the removal of display modules, power supplies or other display components.
3. The display shall be protected from electrical spikes and transients.
4. The manufacturer shall provide an earth-ground lug on the display.

E. The display shall be protected from electrical spikes and transients.

F. The manufacturer shall provide an earth-ground lug on the display.

2.4 DISPLAY PERFORMANCE:

A. Display Capability
1. The LED display shall present messages that are continuous, uniform, and unbroken in appearance.
2. The LED display shall be capable of producing 281 trillion colors for RGB and 4096 shades of color for monochrome red or amber at all dimming levels.
3. Each display pixel shall be composed of one each – red, green, and blue LEDS or one red or one amber
4. The LED display shall be capable of displaying all true type fonts.
5. The display shall be able to display messages composed of any combination of alphanumeric text, punctuation symbols, graphic images, and pre-canned video files.
6. Video and message files shall have up to a 30 frame per second playback capability.

B. Controller
1. The display’s controller shall be able to run independently from a controlling computing device allowing the display to operate even when the controlling device is unhooked or turned off.
2. Communication protocol shall support other matrix products from the vendor such as other outdoor or indoor displays of varying sizes and/or colors.
3. Each controller shall be connected to a light sensor allowing each LED display to automatically adjust brightness according to display direction and lighting conditions.
4. The controller shall allow connection to a temperature sensor that provides accurate site temperatures.
5. Active presentations, stored presentations, schedules, display configuration, time and date shall be stored in non-volatile memory. No external power or battery backup will be required to maintain this data.

C. Control and Communications
1. The display controller should be DHCP-enabled and allow for static IP addressing.
2. Each single-face display shall be controlled and monitored by its own LED controller.

3. The LED controller shall be able to receive instructions from and provide information by accessing the Venus Control Suite using the following communication modes:
   a. Ethernet Cellular Modem

2.5 CONTROL SOFTWARE:

A. Control Software: Display content and scheduling shall be via Venus Control Suite (VCS) cloud-based solution. Software to be hosted on manufacturer's servers at no cost to the customer. Web browser access to the solution to support iOS Safari, Android Chrome, Internet Explorer v11+, Microsoft Edge, Google Chrome and Mozilla Firefox.

B. Basic content creation to be performed via browser-based online editor.

C. Expanded content creation tools available via PC-compatible Content Studio download.

D. Supports import of images (PNG, BMP, GIF, JPG, PSD) and video files (AVI, MPG, MP4, MOV) in both browser-based and downloadable content utilities.

E. Sign to be added to existing customer VCS account, if applicable.

PART 3 EXECUTION

3.1 GENERAL:

A. Coordinate layout and installation of digital sign with other construction including the outdoor monument to house the digital sign.

B. Mounting structure to be installed by contractor to support desired displays in all locations. Verify that separate conduit is in place for power and data to display unless fiber is being used. Verify that all control equipment has access to 120 VAC.

3.2 INSTALLATION:

A. Support structure design depends on the mounting methods, display size, and weight. The structure design is critical and should be done only by a qualified individual. It is the customer's responsibility to ensure that the structure and mounting hardware are adequate.

B. It is the customer's responsibility to ensure that the installation meet local standards. The mounting hardware shall be capable of supporting all components to be mounted.

C. All mounted displays must be inspected by a qualified structural engineer.

D. Possible power and signal entrances are designated by etched markings. Separate conduit must be used to route the power, signal in wires, and signal out wires.

E. Displays must be grounded according to the provisions outlined in Article 250 of the National Electrical Code. The display must be connected to earth-ground. Proper grounding is necessary for reliable equipment operation and protects the equipment from damaging electrical disturbances and lightning.

END OF SECTION

SECTION 275116 - PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Power amplifiers.
   2. Telephone paging adapter.
   3. Informacast Paging Adapter
   4. Loudspeakers.
      a. 70V Interior Speakers
      b. IP (Informacast) Outdoor Horn Speakers
   5. Line Matching Transformers
   6. Conductors and cables.

1.3 DEFINITIONS

A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

B. VU: Volume unit.

C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Power, signal, and control wiring.
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Rack arrangements.
   4. Wiring Diagrams: For power, signal, and control wiring.
      a. Identify terminals to facilitate installation, operation, and maintenance.
      b. Single-line diagram showing interconnection of components.

c. Cabling diagram showing cable routing.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For public address systems to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 7700 "Closeout Procedures" and Section 01 7823 "Operation and Maintenance Data," include the following:
      a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
      b. Operating instructions laminated and mounted adjacent to operating console location.
      c. Training plan.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   1. At a minimum, CTS certified and qualified through Vendor for installation .

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Atlas Sound LP.
   2. Bogen Communications, Inc.
   3. Biamp (Vocia)
   4. Toa Electronics, Inc.
   5. Valcom, Inc.

B. Source Limitations: Obtain public address system from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:
   1. Selectively connect any zone to any available signal channel.
   2. Selectively control sound from microphone outlets and other inputs.
   3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
   4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
   5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
   6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 SYSTEM DESCRIPTION

A. Paging and Bell Schedule is controlled by the existing Singlewire Informacast system. All paging equipment shall be integrated with Informacast.

B. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

C. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

D. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with EIA/ECA-310-E.

E. Exterior Speaker Color & Finish: Provide finish options for selection by architect, or alternatively, provide outdoor speakers that are field paintable.

2.4 POWER AMPLIFIERS

A. Mounting: Rack.

B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected stations and speakers connected in all-call mode of operation, plus a 20 percent allowance for future stations.

C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

D. Minimum Signal-to-Noise Ratio: 80 dB, at rated output.

E. Frequency Response: Within plus or minus 3 dB from 20 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.5 TELEPHONE PAGING ADAPTER

A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
   1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
   2. Impedance Matching: Adapter matches telephone line to public address equipment input.
   3. Rack mounted.

2.6 INFORMACAST PAGING ADAPTER

A. For use with Singlewire's InformaCast paging and emergency notification software. The Paging Adapter provides a direct connection to analog paging systems enabling InformaCast paging events to be broadcast.

B. Paging Adapter Features:
   1. Ethernet: 10/100 Mbps
   2. Protocol:SIP RFC 3261 Compatible
   3. Notification Software: Singlewire InformaCast v4.0 and abovePower
   4. Power Input: PoE 802.3af or 48VDC
   5. Input: PoE 802.3at or 802.3afAud
   6. Page Port Output: Balanced 600 Ohm
   7. Payload Types: G.711 a-law, G.711 μ-law, G.722, G.729
   8. Network Security: TLS 1.2, SRTP, HTTPS

2.7 LOUDSPEAKERS

A. Cone-Type Loudspeakers:
   1. Minimum Axial Sensitivity: 91 dB at 1 m, with 1-W input.
   2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
   3. Size: 6 inches or 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
   4. Rated Output Level: 3 Watt minimum.
   5. Minimum Dispersion Angle: 100 degrees.
   6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
   7. Flush-Ceiling-Mounted Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel for white ceilings. Coordinate final color and finish with Architect prior to procurement.

B. IP (Informacast) Horn Speakers
   1. Ethernet: 10/100 Mbps
   2. Protocol: SIP RFC 3261 Compatible
   3. Notification Software: Singlewire InformaCast v4.0 and above
   4. Power Input: PoE 802.3at or 802.3af

5. Audio Output:
   a. 802.3at: 107.7 (+/- 0.2) dBC @1M and 1kHz
   b. 802.3af: 104.8 (+/- 0.2) dBC @1M and 1kHz
6. Network Security: TLS 1.2, SRTP, HTTPS
7. IP Rating: IP66
8. Operating Range Temperature: -40 degrees C to 55 degrees C (-40 degrees F to 131 degrees F)
9. Humidity: 5-95%, non-condensing

2.8 LINE MATCHING TRANSFORMERS

A. Matches a 100, 70 or 25 volt speaker line to an unbalanced line-level audio input.

B. Use for audio input to Audio-Visual system and/or Classroom Integrated Audio-Visual System from 70V speaker lines.

C. Products
1. RDL Model# TX-70A
2. Atlas Sound Model# TSD-TXHL
3. Approved Equal

2.9 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.
2. Plenum Cable: Listed and labeled for plenum installation.

PART 3 EXECUTION

3.1 WIRING METHODS

A. Wiring Method:
1. Install cables in pathways and cable trays except in gypsum board partitions where unenclosed wiring method may be used. Conceal pathway and cables except in unfinished spaces.
   a. Install plenum cable in environmental air spaces, including plenum ceilings.
   b. Comply with requirements for pathways and boxes specified in Section 27 0528 "Pathways for Communications Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:
   1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
   2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
   3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
   5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.
   3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.3 INSTALLATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

C. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

D. Equipment Cabinets and Racks:
   1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
   2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
   3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

E. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

F. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

G. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

H. Connect wiring according to Section 27 1500 "Communications Horizontal Cabling" and Section 28 0513 "Conductors and Cables for Electronic Safety and Security."

3.4 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Section 27 0526 "Grounding and Bonding for Communications Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Schedule tests with at least seven days' advance notice of test performance.
   2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
   3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
   4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
      a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
      b. Repeat test for each separately controlled zone of loudspeakers.
      c. Minimum acceptance ratio is 50 dB.
   5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel.

For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 27 0526 "Grounding and Bonding for Communications Systems."

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

E. Public address system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.
1. Include a record of final speaker-line matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

3.6 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Adjust transformer taps for continuous and symmetrical sound levels. The dB levels shall be appropriate for the application and approved by the User.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

D. Adjust devices, wall plates and speakers to be flush and level.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment. Refer to Section 01 7900 "Demonstration and Training."

END OF SECTION

SECTION 275313 - CLOCK SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Secondary indicating clocks.
   2. Program signal devices.
   3. System wire and cable.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. Federal Communications Commission (FCC): U.S. agency responsible for regulating the use of wireless frequencies.

B. Innovation, Science and Economic Development (ISED): Canadian agency responsible for regulating the use of wireless frequencies.

C. NIST: The National Institute of Science and Technology.

D. NTP: Network Time Protocol.

E. PC: Personal computer.

F. PoE: Power over Ethernet.

G. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; a worldwide standard for time synchronization.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:
   1. Indicating clocks.
   2. Signal equipment.
   3. Equipment enclosures and back boxes.
   4. Accessory components.

B. Shop Drawings: For clock systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring and correction circuits.
      a. Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
      b. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Indicate protection from overcurrent, static discharge, and voltage surge.

C. Samples for Initial Selection:
   1. Manufacturer's color photographs or color chips indicating the full range of colors available for clocks, signal equipment, and control panels.
   2. Representative operating models of clock type .

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For clock and program control to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 MASTER AND SECONDARY CLOCK SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Primex Inc.; OneVue or comparable product by one of the following:
   1. American Time & Signal Co.
   2. Telecor, Inc.
   3. Sapling, Inc.

B. System Functions and Features:
   1. Ensure clock system components are designed to operate as part of complete system.
   2. Ensure system synchronizes all clocks and devices to each other.
   3. Maintain correct synchronized time and transmit time-correction signals utilizing Wi-Fi 802.11 b/g/n (2.4 GHz only).
      a. Analog Synchronous Clocks: Correct for minute- and second-hand synchronization and hour-hand synchronization at least once each day.
   4. Ensure system works with monitoring software for system controls from one location and including options as follows:
      a. Mark clocks as priority for quick viewing.

b. Displaying when clocks last received (S)NTP time.
c. Configuring email alerts.

5. Ensure Wi-Fi Monitoring Software is run on PC on same subnetwork as Wi-Fi clock system:
   a. Server installation is not required.
   b. No licensing restrictions or recurring service fees.
6. Ensure system is capable of operating without physical servers and software.
7. Ensure each clock in system has built-in web interface for programming.
8. Regulate system timing functions using Ethernet network NTP, backed up for power outages by an internal battery-powered, crystal-controlled oscillator.
9. Provide programming for automatic daylight saving time correction.

2.2 SECONDARY INDICATING CLOCKS

A. Analog Clock: Equipped with a sweep second hand. Movement shall be driven by self-starting, permanently lubricated, sealed synchronous motor equipped with a correcting solenoid actuator.
   1. Ensure secondary clock is capable of receiving NTP protocol through 2.4 GHz Wi-Fi 802.11 b/g/n.
   2. Clock Size and Design
      a. Clock Type: Analog
      b. Face Configuration: Single
      c. Display Size: 12-diameter. 16-inch at locations noted on drawings.
      d. Dial Face Color: white face with black numbers.
      e. Dial style: Hour, minute and second hands.
      f. Lens: Clear thermoplastic.
      g. Frame: High-impact thermoplastic.
      h. Finish:
         1) Brushed Aluminum in Offices & Classrooms
         2) Black in Gymmasium, Auxillary Gymnasium, Black Box, and Planetarium.
      i. Tamper-proof/theft resistant clock-lock mounting slots.
      j. Operating Temperature: 32 to 95 deg F.
      k. Power Connection: 120 V AC
   3. Built-in Web Interface includes features as follows:
      a. Three-level password protected interface. Open access is unacceptable;
      b. Naming of the clock;
      c. Selecting time interval clock receives NTP time;
      d. Bias seconds configuration for altering correct time +/- 9999 seconds;
      e. Setting UTC/GMT offset for time zone configuration;
      f. Built-in diagnostic mode;
      g. Troubleshooting capability;
      h. Select all IP settings;
      i. DHCP capability;
      j. Server redundancy capability. Up to 5 servers can be used as backup in case of failure.
      k. Domestic and International Daylight Saving Time capability

2.3 BACK BOXES FOR SECONDARY INDICATING CLOCKS AND PROGRAM DEVICES

A. Description: Box and cover-plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting the device unless otherwise indicated.
   1. Compliance: UL 50E.

2.4 GUARDS

A. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch maximum clearance.
   1. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.
   2. Finish: steel with zinc plating.

B. Description: Clear polycarbonate, shaped to fit around guarded device, with 1-inch maximum clearance.
   1. Mounting Provisions: Fixed tabs, integral to guard.
   2. Water-resistant gasket for high-humidity areas.

2.5 PATHWAYS

A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 27 0528 "Pathways for Communications Systems."

B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 26 0533 "Raceway and Boxes for Electrical Systems."

C. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

D. Flexible metal conduit is prohibited.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount system components with fastening methods and devices designed to resist the seismic forces indicated in Section 27 0548.16 "Seismic Controls for Communications Systems."

B. Install Wi-Fi communication clock system in accordance with manufacturer’s written recommendations and in accordance with NFPA 70E.

C. Integrate clock system with Owner’s electrical and communications network.

D. Install wiring in accordance with requirements of local Authority Having Jurisdiction.

E. Install clocks only after painting and other finish work is completed in each room.

F. Install clocks and other devices square and plumb.

3.2 ELECTRICAL CONNECTIONS

A. Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

B. Use splices for connections to clocks and signal devices.

C. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.3 IDENTIFICATION

A. Comply with Section 27 0553 "Identification for Communications Systems."

B. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
   2. Fix or replace devices which fail test or are functioning incorrectly.
   3. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

B. Clock system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Program system in accordance with Owner's requirements.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components.

END OF SECTION

SECTION 280000 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, services, software, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.

B. The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

C. The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.

D. The work included in this section shall be coordinated with related work specified elsewhere in these specifications.

1.2 QUALITY ASSURANCE

A. Every component, device, transmitter, software, etc., that are included in the work, to make up a complete Fire Alarm System shall be listed as a product by the manufacturer under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

B. The system power, signal and controls wiring shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

1.3 GENERAL

A. Furnish and install a complete digital multiplex Voice Evacuation Fire Alarm System as described herein and as shown on the plans; to be wired, connected, completely tested, and left in first class operating condition. The contractor to provide any additional equipment necessary to make the system fully functional in compliance with NFPA 72, local AHJ and any other applicable codes. The system shall use individually addressable digital multiplex device circuit(s) with individual device supervision, appliance circuit supervision, incoming normal and stand-by power supervision. In general, systems shall include a control panel, manual pull stations, automatic fire detectors, horns, flashing lights, annunciators, raceways, all wiring, connections to devices, connections to valve tamper switches, water flow switches and mechanical controls, outlet boxes, junction boxes, and all other necessary materials for a complete, operating system.

B. The fire alarm control panel shall allow for loading or editing of any special instructions or operating sequences as required. No special tools, modems, or an off-board programmer shall be

required to program the system to facilitate future system expansion, building parameter changes, or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory.

C. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. Any catalog numbers specified under this section are intended only to identify the type, quality of design, materials, and operating features desired.

D. The listing of specific catalog numbers and equipment parameters is not intended to limit competition among other manufacturers that propose to supply equivalent equipment and services. Fire alarm systems as manufactured by Simplex, Siemens/Cerberus, Edwards, Honeywell, or Notifier will be acceptable. However, equivalent manufacturer will be acceptable with AHJ approval.

E. Equipment submissions for shop drawing review must include a minimum of the following:

F. Floor plans showing the proposed fire alarm system equipment, device, and appliance locations, inclusive of candela ratings and wattage tap settings for all notification appliances. Corresponding riser diagram inclusive of information required by NFPA 72 requirements.

G. Wiring Diagrams: Point-to-point fire alarm control equipment installation diagrams inclusive of information required by NFPA 72 requirements.

H. Battery Calculations: Prepared in accordance with NFPA 72 requirements and showing total standby power and total alarm power required to meet the specified system requirements. Include a complete list of current requirements during normal, supervisory, trouble, and alarm conditions for each component of the system.

I. Voltage-drop Calculations: Prepared in accordance with NFPA 72 requirements to demonstrate that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

J. Sequence of Operation: A sequence of operation that describes how the system responds during an alarm, supervisory and trouble condition. The description shall include fire alarm control unit LEDs, audible and visible indications, initiating devices, notification appliances, and auxiliary functions. The description shall provide sufficient information so that the exact function of each installed device and appliance is known.

K. Statement of Equipment Lifecycle: A written statement, signed by a representative of the equipment manufacturer stating that the equipment to be supplied is not at or near the end of its life cycle and that replacement components for all control equipment shall be available from the manufacturer for a minimum of 15 years from the date of installation.

L. Manufacturer Capabilities: The Owner may request a product demonstration of the proposed manufacturer equipment prior to installation.

M. Complete descriptive data indicating UL listing for all system components.

N. A copy of any state or local Fire Alarm System equipment approvals.

O. An Autocad (latest version) produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as zoning boundaries and schedule of zone legends as intended to appear on annunciators. Provide three CD-Rom copies of as-built drawings and all system operational software at close of project, to be included in operation and maintenance manuals.

P. Provide as-built cabinet adjacent to fire alarm control unit. Provide complete fire alarm system as-built drawings (graphical map for building) in the cabinet.

Q. No work shall be done until the drawings are approved by the local Authority Having Jurisdiction.

1.4 OPERATION

A. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:
   1. The appropriate initiating device circuit indicator (red color) shall flash on the control panel until the alarm has been silenced at the control panel. Once silenced, this same indicator shall latch on. A subsequent alarm received after silencing shall flash the subsequent zone alarm indicator on the control panel and resound alarms and flashing signals. These same conditions shall occur at any remote annunciator.
   2. A pulsing alarm tone shall occur within the control panel until silenced.
      a. All alarm indicating appliances shall sound in a temporal code pattern until silenced by an alarm silence switch at the control panel (or the remote annunciator, if any).
      b. All doors normally held open by door control devices shall close. Doors shall also be released in the event of incoming normal power failure.
      c. A supervised signal to notify the local fire department or an approved central station (as required by local codes) shall be activated.
      d. A supervised signal shall directly activate, shut down or reconfigure the air handling systems as required by NFPA or as otherwise indicated herein. Provide necessary interlock wiring as required to control mechanical equipment..
      e. The Contractor(s) shall coordinate with each other as necessary to provide all required auxiliary contacts, DDC systems interfaces, equipment, etc., as needed to shut down or otherwise control air handling systems per NFPA and all applicable codes.
      f. The system shall be wired with two circuits to all Notification devices so that when an alarm is acknowledged, silencing the audibles, the visual units shall continue in operation until the main control panel has been reset. If local codes require other than this arrangement, the system shall be wired in accordance with the code that is applicable.
   3. The alarm indicating appliances shall be capable of being silenced only by authorized personnel operating the alarm silence switch at the main control panel or by use of a similar key operated switch at the remote annunciator (where remote units are provided). A subsequent alarm shall reactivate the signals. Operation of the alarm silence switch shall be indicated by trouble light and audible signal.
   4. The alarm activation of any elevator lobby shaft, pit or equipment room smoke detector shall, in addition to the operations listed above, cause the elevator cabs to be recalled according to the following sequence:
      a. If the alarmed detector is in any location or on any floor other than the main level of egress, the elevator cars shall be recalled to the main level of egress.

b. If the alarmed detector is on the main egress level elevator lobby, the elevator cabs shall be recalled to the pre-determined alternate recall level.
c. Provide auxiliary contacts within the base of each elevator lobby smoke detector, with each separate landing to be wired back separately to the elevator controller. Coordinate all equipment terminations and sequence of operation with the elevator installer. The use of digital to analog controllers to accomplish this function will be acceptable, if in compliance with codes.
d. Provide heat detectors within 12" of each sprinkler head where they are installed in elevator equipment rooms, shafts or pits, in accordance with code.
e. The temperature rating and wiring of the detectors shall be coordinated with the sprinklers, per ANSI Elevator Code and NFPA. Wire to interrupt elevator power per the applicable code.

5. The activation of any standpipe water valve tamper switch or sprinkler zone valve tamper switch shall activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper Switch" indicator at the system controls (and the remote annunciator[s]). There shall be a distinction in the audible trouble signals between valve tamper switch activation and opens or grounds on fire alarm circuit wiring.
   a. Activating the trouble silence switch will silence the supervisory audible signal while maintaining the "Sprinkler Supervisory Tamper" indicator showing the tamper contact is still activated.
   b. Restoring the valve to the normal position shall cause the audible signal and visual indicator to pulse at a fixed rate.
   c. Activating the trouble silence switch shall silence the supervisory audible signal and restore the system to normal.
6. Include with the control panel, as an auxiliary function, a built-in test mode that, when activated, will cause the following operation sequence:
   a. The city connection circuit shall be disconnected.
   b. Control relay functions shall be bypassed.
   c. The control panel shall show a trouble condition.
   d. The panel shall automatically reset itself.
   e. Any momentary opening of an initiating or indicating appliance circuit shall cause the audible signals to sound for a minimum of two seconds to indicate the trouble condition.
7. A manual evacuation switch shall be provided to operate the system indicating appliances and/or initiate "Drill" procedures.
8. Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system and initiate a trouble condition at the control panel.
9. Include any and all detection equipment and interface relays as required to provide a 100% code approved and supervised pre-action Fire Suppression system. Coordinate with the Fire Protection installer as required.

1.5 SUPERVISION

A. The system shall contain Class "B" (Style "B") independently supervised initiation circuits as required for the zoning indicated. Circuits shall be arranged so that a fault in any one zone shall not affect any other zone. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

B. There shall be supervisory initiation circuit(s), as required, for connection of all sprinkler valve tamper switches. Wiring methods which require any fire alarm initiation circuits to perform this function shall be deemed unacceptable; i.e., sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). These independent initiation circuit(s) shall be each labeled "Sprinkler Supervisory Tamper Switch" and shall differentiate between tamper switch activation and wiring faults. Provide individual annunciation for the main post indicator valve and each tamper switch as indicated by the zoning schedule on the plans or as otherwise required by codes. For these circuits and all exterior underground copper circuit wiring, provide proper surge suppression and protection for circuit.

C. There shall be independently supervised and independently fused indicating appliance circuits as required for alarm audible signals and flashing alarm lamps.

D. All auxiliary manual controls shall be supervised so that all switches must be returned to the normal (automatic) position to clear system trouble.

E. Each independently supervised circuit shall include a discrete (amber color) "Trouble" indicator to indicate disarrangement conditions, per each circuit.

F. The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel and the annunciator. A green color "power on" indicator shall be displayed continuously while incoming power is present.

G. The system batteries shall be lead-acid type, supervised so that disconnection or failure of a battery shall be audibly and visually indicated at the control panel (and the annunciator).

H. Wiring to a remote annunciator (if provided for system) shall be supervised for open and ground conditions. An independent annunciator trouble indicator shall be activated and an audible trouble signal shall sound at the control panel.

1.6 POWER REQUIREMENTS

A. The control panel shall receive 120 VAC power via a dedicated circuit. The incoming circuit shall have suitable overcurrent protection within the control panel, as well as at the circuit source. If additional circuits are required for this or other control units, they shall be provided by the Contractor.

B. If the facility is equipped with an emergency standby power generator, the fire alarm equipment shall be connected to this system, per N.E.C.

C. The system control panel and auxiliary equipment, such as power supplies shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of time as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes.

D. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

E. Power supplies for Notification signals, whether in the main panel or within remote power supply cabinets, shall be designed to provide a minimum of 20% spare capacity for future signals.

1.7 FIRE ALARM CONTROL PANEL

A. Where shown on the plans, provide and install the Fire Alarm Control Panel. Construction shall be modular with solid state, microprocessor based electronics. All visual indicators shall be high contrast, light-emitting diode type. Panel shall be provided with emergency voice evacuation communication equipment, including supervised amplifiers, back-up amplifiers, distributed amplification (where applicable), a digitized voice evacuation message and low frequency temporal pattern evacuation tone, and power supplies.

B. The control panel shall contain the minimum following features as per plans:
   1. Minimum Capacity of 120 Control or Monitor Points or greater, to Suit Building Requirements, expandable to 1000 points
   2. Initiation Device Circuits
   3. Alarm Indicating Appliance Circuit
   4. Supervised Annunciator Circuits
   5. Local Energy City Connection, if required
   6. Form C Alarm Contacts (2.0 Amps ea., minimum of two unless otherwise required)
   7. Earth Ground Supervision Circuit
   8. Automatic Battery Charger, of proper rating
   9. Standby Battery, Lead/Acid Type
   10. Resident non-volatile programmable operating system for all operating requirements
   11. Supervised Manual Evacuation Switch
   12. Internal power supplies as required for auxiliary functions as indicated
   13. Auxiliary contacts or relays for auxiliary functions as indicated
   14. All Custom Software and Programming as required to suit the project requirements

1.8 SYSTEM SOFTWARE AND PROGRAMMING

A. Provide all programming and software necessary to place annunciators and controls in full operation. System set-up shall allow for changes in annunciator legends without rewiring or addition of programming or electronics. Furnish initial programming and reprogramming as needed to accommodate changes in the system up to the time of system acceptance by the engineer without extra charge.

1.9 REMOTE ANNUNCIATOR

A. Where indicated on the plans, provide and install annunciator/control panel. The panel shall be of vandal-resistant construction and shall contain a liquid crystal illuminated display for alphanumeric indication of all required functions. The panel shall also contain the following control functions, activated by a master system enable key switch on front panel
   1. Remote system reset switch, to complement main control panel reset switch.

2. Remote alarm signal silence switch.
3. Remote manual evacuation switch, to initiate fire drill functions, same as at main control panel.
4. Remote trouble silence switch to silence trouble alarms in annunciator panel and main control panel.
5. Install panel on properly sized outlet box, 54" AFF to centerline. Panel shall contain tamper-resistant LED test switch in panel, local audible alarm, system power on, trouble LED indicators and master system enable key switch, keyed alike with the main control panel.

B. Annunciator legends shall be custom, to display both zone number and brief legend indicating the area or device associated with that zone. The legends shall be electronically generated on an alphanumeric display panel. The fire alarm system vendor shall coordinate the legends with the Engineer at shop drawing review.

C. Wiring between main control panel and annunciator(s) shall be fully supervised and accomplished over twisted shielded pair and/or THWN wiring as required by the manufacturer, per N.E.C. and NFPA.

1.10 WARRANTY

A. The Contractor shall guarantee all new equipment installed and new raceways, new wiring, and connections to existing wiring from defects in workmanship and inherent mechanical and electrical defects for a period of three (3) years from the date of substantial completion of the project. See Part 1 “Submittals”.

B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of three (3) years from the date of substantial completion of the project. See Part 1 “Submittals”.

C. The Manufacturer or the authorized representative shall cover any software updates and associated costs for a period of five (5) years from the date of substantial completion of the project.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Nameplates
1. Comply with ANSI a13.1, 29 CFR 1910.144 and 29 CFR 1910.145, and ANSI z535.4 for safety signs provide nameplates for all equipment and components installed in enclosure. Nameplates shall designate equipment controller, function, ratings, source of power, and voltage.
2. Nameplates shall be laminated, black bakelite with 1/4" high, white recessed letters unless otherwise indicated on drawings or per owner standards. Nameplates shall be securely attached to the equipment with galvanized screws. Adhesives or cement shall not be used.

B. Wire Markers
   1. Markers for wire and cable circuits shall be brady self-laminating vinyl data labels or acceptable equal.

C. Cable Tags
   1. Cable tags for 600V or less rated circuits, self-adhesive vinyl labels: preprinted, flexible label laminated with a clear, weather and chemical resistant coating and matching wraparound adhesive tape for securing ends of legend label

2.2 FIRE STOPPING MATERIAL

A. Fire stopping materials shall consist of commercially manufactured products capable of passing ASTM e-814 (UL 1479).

B. Fire stopping materials shall maintain the rating of the wall, partition or floor opening that penetration is made.

C. Fire stopping materials shall be UL classified.

D. Acceptable products
   1. 3M: fire barrier
   2. Hilti: firestop
   3. Thomas & Betts: flame safe
   4. Nelson Electric: flameseal

2.3 MANUAL PULL STATION

A. Manual stations shall be double action and shall be constructed of high impact, red lexan or cast metal with raised white lettering and a smooth high gloss finish. The manual pull station shall have a hinged front with key lock. Stations shall be keyed alike with the fire alarm control panel. All pull stations shall have an alarmed cover. When the station is operated, the handle shall lock open in a protruding manner. Furnish one key for each manual station to owner at close of project, during instruction period. Install within 60" of each exit, per code, whether indicated on the drawings or not.

2.4 CEILING-MOUNTED SMOKE DETECTORS, PHOTOELECTRIC TYPE

A. Furnish and install where indicated on the plans or required, ceiling-mounted smoke detectors. Provide separate outlet-box mounted base with auxiliary relay, or standard base, as required.

B. Smoke Detectors shall be listed to U.L. Standard 268 and shall be compatible with their control equipment. Detectors shall be listed for this purpose by Underwriters' Laboratories, Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. Loss of the operating voltage shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Detectors shall be capable of being reset at the main control panel.

C. No radioactive materials shall be used. Detector construction shall provide mounting base with twist-lock detector head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-cleaning contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide full solid state construction, and compatibility with other normally open fire alarm detection loop devices such as heat detectors, pull stations, etc.

D. To minimize nuisance alarms, voltage and RF transient problems, suppression techniques shall be employed as well as a smoke verification circuit and an insect screen. The detector head shall be easily disassembled to facilitate cleaning.

E. Remote LED alarm indicators shall be installed where required.

F. Smoke detectors (and all other system electronics) shall be shielded to protect circuitry from EMI problems generated by power fields, cellular phones, etc.

G. Special Note: The Contractor installing smoke detectors shall use care in the final positioning of all devices. They shall not be installed closer than 36" from an air diffuser or return grille, closer than 24" from a ceiling/wall intersection, or similar location that would diminish detector performance. Refer to and comply with NFPA 72E, "Standard On Automatic Fire Detectors".

H. Provide smoke detector at each fire alarm system control component, as required by code.

2.5 AUTOMATIC HEAT DETECTORS (RATE-OF-RISE TYPE)

A. Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. When the fixed-temperature portion is activated, the units shall be non-restorable and give visual evidence of such operation. Heat detectors shall be 135, 165 or 195NF, as indicated on plan. Where not indicated, provide 165º F units. Provide as indicated or required.

2.6 AUTOMATIC HEAT DETECTORS (FIXED TEMPERATURE TYPE)

A. Where indicated on the plans, provide automatic heat detectors of the non-restorable type, of the temperature rating as indicated or required. Detector heads shall be mounted to an outlet-box mounted base. Provide auxiliary contacts as needed. Provide as indicated or required.

2.7 AUDIBLE AND VISUAL UNITS

A. Audible signals shall be polarized and shall be operated by 24 VDC. Each audible assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors will not be accepted. The audible visual units shall be equipped with a xenon-type strobe which shall be semi-flush mounted on 4" square outlet box. Each audible device shall produce a minimum sound pressure level of 92db at 36" on axis. Provide units as manufactured by Wheelock, Inc., or approved equivalent. Locate as indicated or required. All audible tones for same function shall be identical, per NFPA. Provide sufficient audible units to comply with code for required coverage. Provide temporal coded signals.

B. The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements.

C. Audible units and visual units shall be wired to separate Notification circuits, allowing for silencing of audibles with alarm acknowledgment, continuing operation of strobes until system reset. Addressable devices may be used to fulfill this requirement.

D. Provide system-wide synchronization of all visual devices, so that all strobes flash at the same rate and at the same time, complying with A.D.A.

2.8 VISUAL UNITS

A. Stand-alone visual indicating units shall be xenon type strobe matching audio-visual units. These devices shall be UL listed and be or wall mounted. A high-impact clear lens shall project out from backplate. Lettering, if any, shall be oriented upright to the standing viewer. Candela output values of all visual units shall be selected for the covered spaces geometry and size, complying with A.D.A. and NFPA.

2.9 DOOR HOLDERS

A. Magnetic door holders shall be 24 volt A.C. and shall have an approximate holding force of 25 lbs or greater, if required to restrain door. The door-mounted portion shall have a plated steel pivot mounted armature with shock absorbing bearing. Unit shall be capable of being either surface, flush, semi-flush or floor mounted as required. Door holders shall be UL listed for their intended purpose. Where door mounted, locate armature 6" down from top and 6" in from strike side of leaf. Where door swing prevents direct contact between armature and holder pole piece, provide non-removable plated chain to close gap as tightly as possible. Verify holder positioning with Architect prior to mounting any devices. Unless otherwise indicated, provide semi-flush mounted holders 6" below top of door leaf as noted above, with blocking in wall to support force of door impact against holder and outlet box. Provide at all needed locations as indicated or required. Coordinate with architectural hardware schedule, as applicable to project.

2.10 DUCT SMOKE DETECTORS

A. Duct smoke detectors shall be of the solid state photoelectric type, operating on the light scattering photodiode principle. The detectors shall ignore invisible airborne particles or smoke densities that are below the set alarm point. No radioactive materials shall be used. The basic construction of duct smoke detectors shall be the same as that previously described for ceiling-mounted smoke detectors. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm status LED visible through a transparent cover, panel or in housing.

B. The Contractor shall furnish air duct smoke detectors with template to the sheetmetal or air handling unit installer for installation. Coordinate length of sampling probe required and furnish appropriate length. Probe tube shall be located in accord with manufacturer's recommendations, to give maximum sampling rate of airflow. Provide multiple detectors, as required, if a single device will not provide adequate sensing due to duct size or air velocity. Wire multiple detectors

on a single air handling system as a single zone or address unless otherwise required by prevailing codes. Field verify quantity of detectors needed to provide NFPA-compliant coverage of the air handling unit and provide as required.

C. Detector supervised power and alarm wiring (from F.A. control panel) is to be provided by the Contractor. Interlock wiring from auxiliary contacts to stop or otherwise control air handling unit fan motor(s) is to be provided by the Contractor. Provide auxiliary contacts as required. Zone wiring and indication for air duct smoke detectors shall be maintained separate from area detection devices. Detector shall be capable of being reset at the main control panel, and at a local test/reset station.

D. Where air duct smoke detectors are located in other than Mechanical Rooms or in spaces not easily visible, a remote alarm/power indicating LED key reset station shall be installed. These remotes shall be ganged together, if required, and labeled accurately as to which unit is reporting an alarm condition.

E. Where air duct smoke detectors are indicated to be furnished at concealed air handling units above ceilings or smoke damper locations, furnish as outlined above. Also provide remote indicating alarm LED flush in corridor wall at 7'-0" A.F.F. immediately below installation, or as close as practical to installation. The Contractor is to provide control wiring, E.P. switches, etc., as required to operate smoke dampers, as well as the required operating circuit. Coordinate all requirements with the installer of smoke dampers.

F. Ionization - type detectors shall not be utilized for air duct smoke detection.

G. All air duct smoke detector installations and materials shall be in accord with U.L., NFPA, and any other applicable codes.

2.11 WEATHERPROOF DEVICES AND EXPLOSION-PROOF DEVICES

A. Where the anticipated atmosphere or installation conditions require weather-proof, explosion-proof or other specially housed devices, they shall be U.L.-listed and NFPA-compliant and provided as indicated or required. Verify installation conditions and indicate type of device on shop drawing submission.

2.12 END OF LINE RESISTOR

A. End-of-line devices (if required) shall be flush-mounted, located at 7'-0" A.F.F. in corridor walls or as indicated.

2.13 GUARDS FOR DEVICES

A. Where detectors, manual stations, signals, etc., require or are indicated to be furnished with a guard, utilize a U.L. listed unit, compactly covering and compatible with the device. Provide as indicated or required. Guards shall not diminish the performance of any device.

2.14 DIGITAL ALARM COMMUNICATOR/TRANSMITTER

A. Provide a U.L.-listed and NFPA-compliant digital alarm communicator/transmitter (D.A.C.T.). Install at telephone terminal board or telephone service entrance and provide supervised wiring to fire alarm control panel as required. This unit may be semi-flush mounted at the F.A.C.P. location with prior approval by the Engineer. It may also be integrated within the main control panel, if U.L.-listed for the purpose.

B. The installation and connection of the D.A.C.T. shall be in compliance with all provisions of N.F.P.A. 71 and all other applicable codes. The installation and connection shall be acceptable to the Authority Having Jurisdiction, as well as the telephone company (or companies) over whose lines the signal(s) will be transmitted. Include any costs associated with telephone company work and services required in bid. Telephone connection shall be in compliance with NFPA 71, chapter five.

C. The D.A.C.T. shall be capable of transmitting all information relative to system status changes due to alarm, trouble, water flow, and any other information as required by current codes applicable to the facility. This information shall be transmitted to a U.L. listed Central Receiving Station, that also is maintained in accord with the requirements of NFPA 71. Connect system to transmit signals as required by local codes.

D. As a part of this contract, the services of a Central Receiving Station shall be engaged for a period of one year from the date of substantial completion, this date as defined elsewhere in these documents. The Central Receiving Station facility selected shall be in full compliance with NFPA and other applicable requirements. The Contractor shall initiate this service, provided on a contract basis, and shall include any costs associated with this provision in his bid. The actual beginning date of the contract with the central receiving station may be adjusted at the discretion of the Engineer, but in no case shall be for less than one year. The contractor shall notify the owner in writing by certified mail that this service has been contracted for and explain the provisions of this service adequately. A copy of this communication and the return receipt shall be forwarded to the Architect and the Engineer.

2.15 REMOTE POWER SUPPLY UNITS FOR PERIPHERAL

A. Provide remote power supply(ies) as required for proper system operation.

B. Remote power supplies shall be provided with local intelligence compatible with the digital multiplex network, so they have a unique address, providing the ability to monitor the supply for loss of power, shorts, grounds and other supervisory functions.

C. Where required by the fire alarm system manufacturer, remote power supplies shall be provided that will provide sufficient current to drive audio/visual or other required devices.

D. These units shall be located in electrical closets, mechanical rooms or similar spaces. They shall not be installed in finished areas, storage rooms, etc., without the permission of the Engineer. All locations shall be indicated on the shop drawing submissions.

E. Provide dedicated 120 volt power circuit(s) from nearby panelboards as required, whether indicated on the plans or not.

2.16 REMOTE FIRE ALARM TEST STATIONS

A. Remote fire alarm test stations shall be installed to test fire alarm devices including, but not limited to, duct smoke detectors, beam-type smoke detection.

B. Remote test stations shall be keyed with LED indicator.

2.17 ADDRESSABLE MONITOR MODULES

A. Each addressable monitor module shall be able to support any number of normally open (N/O) devices (including but not limited to sprinkler waterflow switches, sprinkler valve supervisory switches, etc). Wiring to the device(s) being monitored shall be supervised.

B. Module status (normal, alarm, supervisory, trouble) shall be transmitted to the FACU.

C. Addressable monitor modules shall include a mounting plate for installation in a junction box or shall be mounted in a locked cabinet or approved box, as shown on the manufacturer's recommended specifications.

D. The addressable monitor modules shall provide address-setting means.

E. An LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control unit.

2.18 ADDRESSABLE CONTROL RELAY OUTPUT MODULES

A. Each relay shall operate according to the control program resident in the FACU.

B. Relays shall be supervised for trouble conditions (open, short, device missing/failed) at the FACU.

C. Relay output modules shall include a mounting plate for installation in a junction box.

D. The relay output module shall provide address-setting means and shall also store an internal identifying code which the control unit shall use to identify the type of device.

E. An LED shall be provided which shall flash under normal conditions, indicating that the Relay Output Module is operational and is in regular communication with the control unit.

F. Provide transient suppressors for inductive loads.

G. As applicable, the Contractor shall provide reliable power services for all relays.

H.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Refer to the Division 01 specifications for general requirements that relate to work provided by all contractors.

B. Refer to any project specific documents that the Owner's general contractor shall issue that references electrical work and coordination required by the Owner's electrical contractor.

3.2 SAFETY REQUIREMENTS

A. This contractor shall comply with the provisions of the "construction safety act" and the latest OSHA requirements as well as all other applicable federal, state and local requirements and specific requirements set forth by the division one spec and the GC.

B. This contractor shall be responsible for the safety, efficiency and adequacy of his furnished equipment, materials and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

C. This contractor shall notify the general contractor of any flammable, combustible and/or toxic materials intended for use on this project and shall furnish the general contractor literature pertinent to the use and control of such materials.

D. If required by the GC, this contractor shall attend all project safety meetings scheduled by the GC.

3.3 PROTECTION AND CLEAN-UP

A. This contractor shall be responsible for the maintenance and protection of all materials and equipment furnished by him during the construction period from loss, damage or deterioration until final acceptance by the Owner. All materials and equipment on the job site shall be suitably stored and protected from the weather, dirt and debris. All piping and equipment openings shall be temporarily closed during construction to prevent obstruction and damage.

B. All equipment with damaged finished surfaces shall be cleaned and repainted with the same paints as was factory applied.

C. Remove all trash and empty containers at the end of each working day. All other materials and equipment shall be returned to the contractor's storage area at the end of the day. At the completion of the job, the contractor shall thoroughly clean the work area.

3.4 OWNER'S OPERATOR TRAINING

A. For all new equipment furnished, provide Owner's operator training to instruct Owner-designated personnel on the start-up, operation, shut-down and servicing of all equipment and systems furnished and installed by this contractor.

B. Coordinate the scheduling of all training with the Owner, giving a minimum of ten (10) days' notice for Owner to schedule with his personnel. Operator training shall be a prerequisite to system acceptance.

3.5 SYSTEM START-UP AND OPERATION

A. Provide all labor and materials and services necessary for the initial start-up and operation of all systems and equipment furnished and installed under this specification.

B. Provide the services of a qualified representative for all major equipment pre-start set-up, start-up and initial operation.

C. During start-up operation and the first-year operation of the new equipment and systems installed under this project, review and inspect equipment/systems to verify proper operation. Failure of equipment during this period due to lack of proper supervision is the responsibility of this contractor, and continued failures shall be grounds for the Owner to obtain such services from another contractor and back-charge this contractor.

D. INSPECTIONS AND TESTING

E. All work and materials covered by these specifications shall be subject to inspection at any and all times by representatives of the Owner.

F. If the Owner's inspector finds that any material does not conform to these specifications, the electrical contractor shall remove the material from the premises. If said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the electrical contractor.

G. At the time of final inspection, all connections at equipment must be completed.

3.6 COOPERATION WITH OTHER TRADES

A. Coordinate the installation of the fire alarm system and testing of associated equipment and circuits with all related trades, contractors, equipment maintenance and testing representatives, the Engineer, the Owner, and the authorities having jurisdiction.

B. Emergency Generator. The Contractor shall be responsible for all wiring, components, and connections required to supervise the emergency generator "generator running" contact. The Contractor shall verify correct operation of the interconnections during a generator running condition.

C. Door Hold Opens. The Contractor shall be responsible for all wiring, components, and connections required to interface the door-hold open devices and circuits to the fire alarm system. The Contractor shall verify that the appropriate door-hold open devices release upon receipt of an alarm condition.

3.7 COMPLETENESS

A. It is the intent of the specifications to provide a complete system. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is operating properly as designed.

3.8 FIRE ALARM

A. Installation
   1. All interconnections shall be installed in accordance with the manufacturer's system wiring diagrams.
   2. Final connections, panel start up, program, editing, and testing shall be conducted by qualified personnel with one of the following qualifications:
      a. Factory trained and certified by the equipment manufacturer.
      b. National institute of certification in engineering technologies (NICET) or IMSA fire alarm certified.
      c. Trained and qualified by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
   3. Provide UL certification of the installation by a UL certified testing company.
   4. The control panel manufacturer's representative shall be present to supervise panel start up, program, editing and all tests.
   5. A dedicated circuit connection for supplying power to each building fire alarm panel shall be provided. The power supply shall be equipped with a UL listed locking mechanism and identified with a red "fire alarm circuit control" label.
   6. Provide a terminal cabinet above FACP, as required. Provide at least one terminal cabinet per floor and as required.

B. Initiating Device Installation

C. In general, automatic detectors shall be mounted on the structural ceiling, finished ceiling, or finished wall; as shown on the drawing.
   1. Automatic detectors shall be installed as indicated on the plans and in conformance with all codes and Regulations and these specifications.
   2. The detectors shall be installed within five (5) feet of the location shown on the drawings to accommodate construction.

D. Automatic detectors shall be located near points where air currents normally intersect.
   1. Detectors shall not be located in the direct path of the draft from an HVAC air supply grille, a door, window, or hallway.
   2. Detectors shall be installed a minimum of three (3) feet from an HVAC air supply diffuser, in accordance with NFPA 72.

E. Addressable photoelectric smoke detectors shall be installed in accordance with this specification, and as shown on the drawings.
   1. Unless otherwise shown on the drawings, these detectors shall be spaced at thirty (30) foot centers, and in accordance with NFPA 72 and the manufacturer’s installation instructions.
   2. Smoke detectors shall only be installed in those environments suitable for proper smoke detector operation.

F. Addressable heat detectors shall be installed in environments appropriate for proper detection in accordance with NFPA 72 and the manufacturer's installation instructions.

G. Where the environment is not suitable for proper operation of addressable heat detectors, conventional spot-type heat detectors shall be furnished and installed.
   1. Conventional heat detectors shall be monitored and supervised by addressable monitor modules.
   2. Addressable monitor modules shall be installed in an area where the environmental conditions are suitable and the monitor modules' initiating circuits extended to the conventional heat detectors alarm contacts.

H. Linear heat detection shall be installed above all suspended ceilings and hard ceilings throughout.

I. Manual fire alarm boxes shall be installed at every exit and in common areas in accordance with NFPA 72, as shown on the drawings.

J. Manual fire alarm boxes shall be mounted at a height between 42 inches and 48 inches measured to the activating handle, above the finished floor, in accordance with NFPA 72 and the ADA Guidelines.

K. Labels
   1. All panels, terminal cabinets and annunciators shall be labeled with the red plastic nameplates in accordance with other sections of this specification.
   2. Remote alarm indicators and remote test and alarm stations shall be labeled with the red plastic nameplates in accordance with other sections of this specification.
   3.
   4. The label shall indicate the device monitored and associated mechanical equipment tag or room designation where applicable.
   5. All detectors shall be labeled with its assigned address on both the detector housing and the base with a black on clear typed label equal to KROY. The base address shall be legible without removal of the detector. The detector address shall be concealed when placed into the base.
   6. Provide an engraved brass nameplate at the exterior beacon, mounted on the weatherproof box, indicating "building fire alarm system in alarm".

L. Wiring
   1. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems.
   2. The conductors for the notification appliance circuits shall not be installed in the same raceway as the conductors for signaling line circuits unless written certification from the manufacturer is supplied to the Engineer indicating that the inclusion of these circuits in the same raceway is acceptable and that no additional consideration is needed for these circuits.
   3. Notification appliance circuits and control equipment shall be arranged and installed so that loss of anyone (1) notification appliance circuit shall not cause the loss of any other notification appliance circuit in the system.
   4. Color coding of conductors shall be approved by the Engineer and the Owner and shall be in accordance with the 2022 Connecticut State Life Safety Code (CSLSC). Contractor shall submit proposed color codes for fire alarm system wiring prior to installation of circuits.
   5. All fire alarm wiring shall be class 'A'. Provide a dedicated SLC per floor.

6. Provide fault isolation modules after every 18 devices; style 6 modified. Isolation modules shall be located in common areas where possible.
7. Wiring for the fire alarm system shall be installed in conduit with limitation.. The use of MC cable where accessible acoustical ceiling tile (ACT) exists. MC-cable is not permitted to be used where wiring would be exposed below the ceiling tiles. Exposed plenum rated wire/cable and/or fire alarm low energy cable will not be accepted.
8. Minimum wire sizes shall be as follows:
    a. Addressable loop wiring shall be utilize minimum #16 AWG.
    b. Notification appliance circuits shall utilize minimum #14 AWG.
    c. Network communications wiring shall be a solid conductor non-shielded #16 twisted pair minimum.
9. All junction boxes shall be sprayed red and labeled “fire alarm”. Conduit couplings shall be spray painted red prior to installation.
10. Connections and splices shall be made using screw terminal blocks. No more than one conductor shall be installed under any screw terminal. The uses of wire nut type connectors are prohibited in the system.
11. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be labeled in accordance with the wiring diagram. Labeling and color coding shall be consistent throughout the conductor run.
12. Wiring within any enclosure shall be readily accessible without removing any component parts.
13. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings only in permitted areas.
14. Raceway shall not be exposed in common corridors or common spaces.
15. Raceway shall only be exposed in mechanical spaces, electrical rooms, any storage spaces. MC cable is not permitted to be installed in exposed areas.
16. Wherever practical, exposed raceways shall be run on the ceiling as close as possible to a wall or as high as possible on a wall.
17. Where exposed raceways shall cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib.
18. No spanning from beam to beam or rib to rib shall be permitted.
19. The use of a raceway body on one side of a beam or rib shall be permitted provided it shall be readily accessible.
20. No more than half loudspeaker/strobes or speaker/strobes serving any floor or zone shall be connected to same circuit. Adjacent devices shall be alternately wired between circuits.
21. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

M. Control panel
1. The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor.
2. All manually operable controls shall be between 36 inches to 42 inches above the finished floor.

N. Detectors
1. Detectors placement shall be in accordance with NFPA 72 requirements and recommendations.
2. Detectors shall be at least 12 inches from any part of any lighting fixture and at least 3 feet from diffusers of air handling systems.

3. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.
4. Detectors, which mount in free space, shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided.
5. Smoke detectors shall not be installed until the building has been thoroughly cleaned. Dust covers shall be installed over all smoke detectors until final testing commences. All detectors, which indicate reduced sensitivity due to dirty condition, shall be cleaned prior to commencement of final cleaning.
6. Detectors shall be provided with wire guard cages where subjected to physical abuse, such as in gymnasiums.
7. All smoke detectors shall be programmed for smoke verification.

O. Notification appliances
1. Notification appliances shall be mounted in accordance with ADA between a minimum of 80” above finished floor or 6” below the ceiling and a maximum of 96” above the finished floor.

P. Testing
1. The contractor shall notify the Owner’s representative 10 business days before the tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Owner’s representative. The contractor shall furnish all instruments and personnel required for the tests.

2. Preliminary tests
   a. The contractor shall perform insulation testing (megger), continuity and loop resistance checks on all system conductors to determine that the system is free from grounded, shorted, or open circuits. These tests shall be conducted prior to the installation of fire alarm equipment. Loop resistance measurement shall verify that the loop resistance does not exceed the manufacturers specified limits. Corrections shall be made and the system shall be retested to assure if deficiencies are found.
   b. The contractor shall perform complete functional and operational performance tests. Testing shall include verification that the circuits and components are electrically supervised and operate as intended.
   c. A written report shall be submitted detailing the results of the preliminary tests shall accompany the request for final acceptance test. The written preliminary test report shall be submitted with:
      (1) The operations and maintenance manual for the system.
      (2) The record (as-built) drawings.
3. Final acceptance test:
4. The fire alarm system, other systems and equipment associated with the fire alarm system and accessory equipment shall be tested in accordance with NFPA 72. The listed tests in NFPA 72 table 7-2.2 shall be conducted as well as manufacturer and job specific procedures to verify that the circuits and components are electrically supervised and operate as intended. The test shall include but shall not be limited to the following:
5. Visual inspection of all wiring connections.
6. Test of each function of the control panel.
7. Test of each circuit in both trouble and normal modes.

8. Tests of each alarm initiating device in both normal and trouble conditions. Open the circuits at each alarm-initiating device to test the wiring supervisory feature.
9. Tests of each control circuit and device.
10. Tests of each alarm notification appliance. Open the circuit at each notification appliance to test the wiring supervisory feature.
11. Tests of the primary and secondary power supplies and associated loss of each.
12. Complete operational tests under emergency power supply.
13. Ground fault monitoring circuit function.
14. Measurement of sound pressure levels in all rooms of the protected space.

Q. Maintenance Contract
1. The contractor shall include as part of their base bid the cost of a one-year test and inspection contract, to be held by the company which shall certify the completed installation. The contract shall provide for quarterly inspections in accordance with NFPA72 and local requirements. Any equipment found to be defective during the warrantee period shall be replaced by the contractor at no additional charge to the Owner.

R. Training
1. Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Owner’s representative.
2. (Continued) The training period shall consist of one training day (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover all of the items contained in the operating and maintenance instructions.

END OF SECTION

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SECURITY SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers general security system requirements, as well as components common to multiple subsystems specified in other sections of Division 28.

B. Division 1 requirements also apply to these sections.

1.2 RELATED REQUIREMENTS (DIVISION 28 SECTIONS TO WHICH THIS SECTION APPLIES)

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 280513 - Conductors and Cables for Electronic Security.

C. 280528 - Pathways for Electronic Security.

D. 280800 - Commissioning of Electronic Security.

E. 281000 - Access Control.

F. 281353 - Security IP Network Compatible Intercom Systems.

G. 282000 - Video Surveillance.

H. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

B. NEMA 250 - Enclosures for Electrical Equipment; 2020.

C. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces; 2023.

D. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2026.

E. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

F. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.4 DEFINITIONS

A. Words which have well-known technical or trade meanings are used in accordance with such recognized meanings.

B. The words “Security Contractor,” or simply, “Contractor” means the organization charged with installation and configuration of the Systems described herein

C. The words “Basis of Design,” mean a device representing the benchmark or minimum requirements in the Specifications or Drawings for this Project. This shall not be interpreted as a sole-source requirement, unless it is stated that “no substitutions are allowed”.

D. The words "as required" mean: as required to provide a complete and satisfactory Work in conformance with the Drawings and Specifications.

E. The word "new" means: new Work provided by the Contractor. Work not indicated as existing shall be considered new work provided by the Contractor.

F. The word "provide" means: furnish, install, connect, test and make ready for use.

G. The words "relocate existing" mean: remove existing item from present location. Reinstall, reconnect, and test existing item and make ready for use at new location as indicated on the Drawings.

H. The words "remove existing" mean: remove existing item and return item to the Owner.

I. The word "replace" means: remove existing item and return item to the Owner. Provide new item as indicated on the Drawings or as specified herein.

J. The word "work" means: the Work is the completed construction required by the Drawings and Specifications, and includes labor necessary to produce such construction, and materials and equipment incorporated or to be incorporated in such construction.

K. The word "furnish" means: supply item as specified herein. Item will be installed by others.

L. Infrastructure: as used herein shall mean conduit, raceway with required boxes, fittings, connectors, and accessories, completely installed.

1.5 SUBMITTALS

A. See Division 1 for additional submittal requirements.

B. Within 5 days after notice to proceed, submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping, and integration into the construction

sequence. Architect will advise of any conflicts in reviewing submittals that the proposed schedule presents.

C. Resubmittals that are required to address review comments shall include a cover transmittal with a written explanation of how each review comment has been addressed.

D. Submittals not specifically required, or not complying with the format requirements, will be returned unreviewed. Work installed prior to submittal approval is

E. Submittals are required before installation begins. Equipment shall not be ordered prior to receipt and approval of submittals.

F. Action Submittals
   1. Submittals shall be submitted as a single package.
   2. Product Data:
      a. Provide product data sheets for equipment, materials, and cables in PDF format. PDF submittals shall be organized in the same order as the specifications and include a table of contents and hierarchical bookmarking system to clearly identify the location of each product within the submittal.
      b. For product data sheets that contain multiple options for the same component, indicate the exact model or option provided on the submittal cover sheet and on the product data sheet by highlighting or by use of a red arrow.
      c. Finish samples for selection of console work surface finish and color.
      d. Indicate deviations, if any, including any from the manufacturer's installation instructions.
   3. Shop Drawings:
      a. Reproductions or electronic versions of design drawings shall not be used in the preparation of shop drawings.
      b. Floor plans and diagram shop drawings shall be submitted as PDF plots on the same drawing size and at the same scale as the design drawings.
      c. Include floor and site plans indicating equipment locations.
      d. Wiring diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
      e. Provide plans and elevations consoles, equipment cabinets, and equipment racks and include enlarged, to scale plan (top), and front views. Indicate the location of all specified electronics.
      f. Provide project specific manufacturer shop drawings of fabricated or modified units, if any.
      g. Provide riser diagrams indicating components of the system and proposed cabling between these components.
      h. Provide detailed project specific mounting diagram for each type of device including raceway and back box requirements. These details shall be referenced on the floor plans or schedules.
      i. Provide proposed elevation for each security enclosure location, including equipment identification and model/part numbers.

G. Informational Submittals:
1. Seismic and wind restraint devices, including calculations, restraint selection, installation details and written confirmation that a licensed engineer prepared the calculations.
2. Proposed project specific raceway layouts including conduit sizes, and back box sizes.
3. Required raceways and power outlets, including quantity, locations, and capacity characteristics.
4. Environmental requirements, including heat release.

H. Close-out Submittals:
1. Functional Test Reports: Provide a spreadsheet with all electronic security system devices and major components listed in the first column by device designator (e.g., camera number) with each test parameter listed by name (or code) in the remaining columns.
2. Operations and Maintenance Documentation Package: The Security Systems Performance Verification Supervisor shall compile and prepare documentation for equipment and systems covered in these Security Specifications and deliver this documentation for inclusion in the operation and maintenance manuals prior to the training of the Owner's personnel. The Architect shall receive a copy of the operation and maintenance manuals for review.
3. Instruction of Operating Personnel: The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.

1.6 QUALITY ASSURANCE

A. Provision of manufactured components, installation, wiring and testing shall be the responsibility of a single Contractor.

B. Qualifications of Electronic Security Systems Contractor:
1. Installation of each of the electronic security subsystems shall be provided by a person or persons having completed, as a minimum, the factory training recommended by the manufacturer of each subsystem and have direct field experience in the installation of a minimum of 3 projects of similar scope and size within the past 5 years.
2. The Electronic Security Systems Contractor shall be a contractor regularly engaged in the sale, installation, integration, maintenance, and service of electronic security systems.
3. Additional requirements are defined in other security sections.

C. Supervision of Work:
1. Contractor shall employ a competent Foreman to be in responsible charge of the Work. Foreman shall be on the project site daily during the execution of the Work.
2. Contractor's Foreman shall be a regular employee, principal, or officer of Contractor, who is thoroughly experienced in projects of a similar size and type.

D. Qualifications of Technicians:
1. All security systems Work shall be performed by electronic technicians thoroughly trained in the installation and service of specialty low-voltage electronic systems.
2. Journeymen or Master Electricians may be used to install conduit, raceways, wiring, and the like provided that final termination, hook-up, programming, and testing is performed by qualified electronic technicians, and that all such Work is supervised by the Contractor's Foreman.

3. Incidental Work, such as cutting and patching, lock hardware installation, painting, carpentry, and the like shall be accomplished by skilled crafts persons regularly engaged in such type of work. Such Work shall comply with the industry standards applicable to that respective industry or craft.
4. 120 V AC power wiring and connections shall be performed by a qualified Journeyman or Master Electrician, licensed to perform such work in the State of Conecticut.

E. Subcontractors:
1. Definition: a Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site.
2. Use of any Subcontractor is subject to the approval of the Owner. The Contractor shall identify Subcontractors on the Bid Form. The Contractor shall make no substitution for any Subcontractor previously selected without approval from the Owner.
3. Contractor's Foreman shall be on the project site daily during periods when Subcontractors are performing any of the Work. Contractor's Foreman shall be in responsible charge of Work, including any Work being performed by Subcontractors.
4. By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Drawings and Specifications, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these documents, assumes toward the Owner.

F. Supply only new equipment, parts and material currently manufactured at the time of submittal and operate only for testing as part of installation procedure.

G. Codes, standards, and regulations are defined on the Drawings and are minimum requirements. Where the requirements of these Specifications or other requirements shown or indicated on the Drawings exceed those of the codes, standards and regulations, the Drawings or Specifications shall govern.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Electronic security equipment.
1. Store in temperature- and the humidity-controlled environment in the manufacturer's original sealed containers. Maintain ambient temperature between 50° and 85° Fahrenheit and not more than 80% relative humidity, non-condensing.
2. Open each container; verify contents against packing list, and file a copy of packing list, complete with container identification for inclusion in operation and maintenance data.

1.8 LICENSING

A. Licensing for product installation and/or use shall be provided by manufacturer for a period of one (1) year from date of Substantial Completion.

1.9 DISTRIBUTION

A. System shall be offered commercially through authorized resellers who will install its security components on customer premises and connect the customer's existing systems.

1.10 FIELD CONDITIONS

A. Systems or equipment installed in environmentally controlled areas shall meet performance requirements specified herein in the following conditions:
   1. Temperature:40°F to 95°F.
   2. Humidity: 20% to 80% RH.
   3. Air purity: systems shall be capable of continuous operation in an environment where the level of dust, lint, paper fiber, and other airborne particles is equal to that found in a standard office.

B. Systems or equipment installed in indoor environmentally uncontrolled areas shall meet performance requirements specified herein in the following conditions:
   1. Temperature: 0°F to 120°F.
   2. Humidity: 5% to 95% RH.

C. Systems or equipment installed in outdoor areas shall meet performance requirements specified herein in the following conditions:
   1. Wind-driven dust, dirt, sand, and snow for 6 hours.
   2. Rain at a maximum rate of 4" per hour.
   3. Ice loads up to 2" measured radially to exposed surfaces.
   4. Wind loads as indicated on the Drawings.
   5. Sleet with wind: 55 mph, maximum.
   6. Snow cover: 2' maximum, measured vertically.
   7. Humidity: 0% to 100% RH.
   8. Temperature:-30°F to 150°F.

1.11 SPACE CONDITIONS

A. Verify dimensions of equipment, equipment arrangements, space availability (including any millwork or cabinetry provided by others) and provide systems that work within the constraints of the space available. Notify the Architect of any situation where space constraints are a problem, prior to the ordering or purchase of equipment. The Contractor shall bear the expense of providing alternate equipment which will work within the available space if space availability problems are discovered after equipment is ordered.

B. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of equipment and components. Changes in the location, and offsets, of same which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made prior to initial installation, without additional cost to the Owner.

C. Provide access to equipment and components requiring operation, service, or maintenance within the life of the system.

1.12 WARRANTY

A. Equipment shall be free of faulty workmanship and defects for a period of 1 year from date of Substantial Completion and as specified in General Conditions, unless otherwise noted.

B. Replace defective materials and repair faulty workmanship within 3 days of notification at no cost to the Owner during warranty period.

C. In addition to warranty, provide maintenance service for the warranty period, including at least 2 semi-annual visits to site for checking and adjustment of equipment. During this period, answer service calls within 24 hours. During this period, maintenance calls shall be completed within 5 days of notification and at no cost to the Owner.

D. Software/firmware maintenance: new releases or updates of hardware, software, applicable user manuals, technical and alert bulletins released by the security systems manufacturers shall be applied to the system at no cost to the Owner during the warranty period.

PART 2 PRODUCTS

2.1 GENERAL

A. Licenses and Licensing Requirements:
   1. Provide all software and hardware licenses required for complete and functional systems as indicated on the Security System Drawings and herein, whether specifically called out or not.

2.2 EQUIPMENT ENCLOSURES

A. General:
   1. Enclosures shall be rated and certified to seismic applications based on seismic criteria shown on the drawings and information specified herein under “Seismic and Wind Restraints”.

B. Exterior Equipment Enclosures:
   1. Outdoor, above grade:
      a. NEMA 250 4, with 19" mounting rails.
      b. Minimum 14-gauge thick mild steel, stainless steel, or aluminum with seams continuously welded and ground smooth and an outdoor grade polyester powder white paint finish.
      c. Continuous hinge with 3-point latching mechanisms and keyed locking handles.
      d. Heat exchanger or air conditioning where required to maintain an internal temperature of 125°F or less. Cooling capacity shall meet or exceed heat load generated due to internal components, maximum ambient air temperature, and direct sunlight.
      e. Size as required to contain the equipment and accommodate the heat load.
      f. Basis of Design: Hoffman CSD20168SS
      g. Manufacturer: Hoffman, Omega, or Purcell Systems.

C. Interior Equipment Enclosures:

1. Security Consoles:
   a. General Description:
      1) The contractor shall supply a system capable of supporting specified electronics.
      2) The console shall be comprised of end frames and/or intermediate frames with horizontal stringers and decorative end panels. The system shall include a hinged dual-channel duct cover with an integrated aluminum mounting system with articulating monitor support arms for the LCD monitor arrays.
   b. Standards:
      1) All rack rails for lower storage compartment shall comply with Electronic Industry Association specifications for rack mounting EIA/ECA-310.
      2) All monitor mounts used with the articulating arm mounting system shall be compliant with the Mounting Interface Standard established by the Video Electronics Standards Association (VESA).
   c. Modular Pre-engineered Construction: All components within the system shall be:
      1) Of a pre-engineered modular construction (constructed from a series of independent sectional compartments).
      2) Free from alterations to the design either prior to or following installation. The assembly of the console shall be accomplished without the need for either welding or carpentry work.
      3) Constructed of a steel super-structure framework consisting of end frames connected by a curved horizontal modesty panel.
   d. Self-Supporting Skeleton Framework: The self-supporting skeleton framework shall:
      1) Be installed at the site in advance of any external finishing panels. The framework shall be fully capable of supporting all specified electronics without the need for attachment of any external panels.
      2) Be capable of being supplied to site in knockdown (flat packed) form and be capable of assembly without welding or carpentry work.
      3) Include front and rear horizontal stringers constructed of 12-gauge formed sheet metal. Stringers shall connect, and span, 14-gauge end frames and/or intermediate frames to form a complete structure.
   e. Components:
      1) Intermediate and End Frames: 14-gauge intermediate and end frames shall be a minimum of 1-5/8” width and capable of supporting fully loaded console Intermediate and end fames shall incorporate 3/8" diameter threaded adjustable glides and 2" vertical slots for mounting two and four gang electrical boxes. End frames shall feature an anti-tip extension and the intermediate frames shall feature four grommet holes.
      2) Horizontal Stringers: 12-gauge formed sheet metal horizontal stringers with quick fastening system shall be 2" high and available in 24", 48", and 72" widths.
      3) Bottom Shelf: 16-gauge stationary steel shelf shall extend 17-5/8" from the front of the console to the rear. The shelf shall have four grommet holes and a load capacity of 200 pounds.

4) Lower Doors: Vented double-panel doors with of set face design and spring hinges for easy removal without the use of tools. Doors shall be supplied with a keyed-alike locking lever latch and integrated cable management. Doors shall be able to accept an optional CPU shelf or file/storage bin for convenient swing-out access.
5) Duct Cover: 18-gauge steel hinged duct cover conceals, and allows easy access to, dual cable raceway so signal and power cords can be separated.
6) Data/Power Rail: minimum 14-gauge angled data/power rail shall include cable grommets and openings for a universal data mounting plate and/or duplex power box. The data/power rail shall incorporate quick fastening system and combined with minimum 14-gauge shelf brackets, shall support the work surface.
7) Work Surfaces The console shall be provided with a minimum 1 1/8" thick MDF core PVC work surface. The work surface shall be one piece, not less than 22-3/4" deep overall, and should include a minimum 1-3/4" deep beveled edge covering the work surface's entire front width.
8) Monitor Support System with Articulating Arms: Fully integrated black anodized aluminum track system capable of supporting a wide variety of monitor arrays while providing simple horizontal adjustment. Constructed of extruded 6105-T5 aluminum with a T-slot profile. Monitor array support posts shall be available in 15", 28-1/2", and 42" heights. The support posts shall be minimum 1.9" in diameter with a minimum wall thickness of 0.110". Monitor arrays shall be mounted to the articulating arms with ball spring drop-in T-nuts.

f. Finish and Color:
1) All exterior and frame steel components including end frames, modesty panels, and optional CPU pedestal shall be zinc oxide wash primer with a black powder coat textured finish.
2) Work surface finish and color shall be as selected by the Architect from finish samples provided during the submittal process.

g. Accessories:
1) Each equipped with 6 electrical outlets and 6 outlet 15' cord.
2) Equipped with sufficient CPU pedestals to support equipment shown on the Drawings.

h. Mounting Hardware:
1) Provide mounting hardware for the specified electronics.
2) Provide all hardware needed for assembly.
3) Provide articulating arms as required to support the quantity of monitors shown on the Drawings.

i. Configuration and dimensions as indicated on the Drawings.
j. Basis of Design: Winsted Vue C 75 Open Dual Sit/Stand Console.

2.3 FIBER OPTIC TRANSMISSION AND SIGNAL EQUIPMENT:

A. Fiber Optic Transmission Systems:
   1. System shall operate between 1250 nm and 1350 nm wavelength.
   2. Full range automatic gain control.
   3. Signal-to-noise ratio: 54 dB minimum.
   4. Bandwidth: 5 Hz to 10 MHz.
   5. Components shall utilize LC type connectors.
   6. Operating temperature: -40ºF to 165ºF.
   7. Storage temperature: -40ºF to 185ºF.
   8. UL listed.
   9. Surface or rack mount.
   10. Distance up to 3.5 miles without repeaters.
   11. Manufacturer: American Fibertek, Comnet, or Interlogix (formerly IFS).

B. Rack or Wall Mount Fiber Enclosures:
   1. Fiber enclosures shall be a complete modular system of components and shall provide the following:
      a. Splicing.
      b. Termination.
      c. Routing.
      d. Strain relief.
      e. Radius limiting.
      f. Cable fastening: Panduit VWS106-C.
      g. Storage.
      h. Direct-connection, UON.
   2. Splice modules shall be fully equipped for required quantity of splices with:
      a. Cable strain relief hardware.
      b. Sliding splice trays.
      c. Routing guides.
   3. Fiber enclosures shall be equipped with either lockable or screw clamp doors.
   4. Fiber enclosures shall be sized to accommodate the required quantity and type of fibers.
   5. Fiber enclosures shall be complete with double-sided female LC Duplex couplers in each and every position.
   6. Fiber enclosures shall have panel front jumper and cross-connect cable management.

2.4 AC POWER

A. General:
   1. AC power equipment shall have LED or lamp status devices to provide indication that the systems are on.

B. AC Power Strips:
   1. AC power receptacles, 125 V, 20 A capacity.
   2. Outlets shall have integral transient suppression in accordance with UL 1449.
   3. Manufacturer: Emerson Network Power, Leviton, Lowell, or Middle Atlantic Products.

C. Power Supply Equipment:

1. Power Supplies:
   a. Power supplies shall be provided for detectors, panels, and accessories.
   b. Power supplies shall meet or exceed the manufacturer's recommendations for the individual devices served.
   c. Devices requiring common voltages shall be powered from a common power supply at the locations indicated on the Drawings. Provide power distribution modules with individually fused or PTC outputs.
2. Battery back-up:
   a. Standby batteries with charger shall power microprocessor-based units and panels in the event of a primary power failure.
   b. Batteries shall be sized to provide 125% capacity for 15 minutes.
   c. Standby batteries shall be sealed lead-calcium, lead-acid, or nickel-cadmium. Power supplies shall be solid state.
   d. Controls shall be designed to maintain full battery charge when primary power is available.
   e. Batteries shall be recharged to 85% capacity within 24 hours from battery use.
   f. Microprocessor-based units and panels shall be automatically transferred to battery power upon loss of primary power and return to primary power upon restoration.
   g. Alarms shall not be initiated during switchover. An alarm shall be initiated upon failure of battery and/or primary power.

2.5 GROUNDING AND SURGE PROTECTION

A. Low voltage surge protection devices (SPDs): SPDs shall incorporate silicon avalanche technology, shall operate bidirectionally, and have a turn-on and turn-off time of less than 5 nanoseconds. Additional minimum requirements include:
   1. Non-coaxial SPDs shall be UL listed in accordance with UL 497. Coaxial cable SPDs shall be designed in accordance with NFPA 780.
   2. Maximum single impulse current conductor-to-conductor or conductor-to-ground: 10000 A, 8 x 20 µs waveform, or 200 A, 10 x 1000 µs waveform.
   3. Pulse life rating: 3000 A, 8 x 20 µs waveform, 2000 occurrences, or 50 A, 10 x 1000 µs waveform, 200 occurrences.
   4. Maximum clamping voltage at 100 A, 10 x 1000 µs waveform, with the peak current not to exceed the normal applied voltage by 150%, except for coaxial cable suppressors with peak current, the maximum clamping voltage shall not exceed the normal applied voltage by 200%.
   5. Failure mode: fail short.
   6. Manufacturer: Advanced Protection Technologies, Ditek, Emerson, Lightning Eliminators & Consultants, or Transtector.

B. Ground Bus Bars:
   1. Solid copper, minimum 6" x 0.75" x 0.25".
   2. Free from surface corrosion.
   3. Drilled and tapped 1/4-20 and 10-24 to terminate incoming conductors individually.

2.6 UNINTERRUPTIBLE POWER SUPPLY (UPS):

A. Pole-Mounted or Wall-Mounted UPS:
   1. 350 W capacity, compact, integrated UPS system designed for operation in extreme environments.
   2. System shall be a self-contained wall mountable unit designed for the support of critical loads.
   3. Outputs: 120 V AC, 24 V AC, 24 V DC, and 12 V DC.
   4. Audible noise shall not exceed 45 dBA at 3'.
   5. Wide range automatic voltage regulation (AVR).
   6. Batteries: hot swappable 12 V/9 Ah lead-acid, maintenance free type, sized to sustain the UPS at full rated load for 3 minutes, and half rated load for 9 minutes.
   7. The UPS shall provide the following characteristics:
      a. Nominal input voltage: 120 V AC.
      b. Integral automatic current and overvoltage protection.
      c. Transfer time: 1 to 4 ms.
      d. Efficiency: 95%.
      e. Local and remote monitoring and control via USB port and Ethernet SNMP interface.
   8. Basis of Design: Alpha Technologies Micro 350 series.

2.7 SEISMIC AND WIND RESTRAINTS

A. Provide restraints devices as required for vibration isolated and nonvibration isolated systems and equipment components. Provide calculations to determine restraint loadings for specific equipment to be installed resulting from seismic forces on equipment. Seismic restraint calculations shall be signed by a licensed engineer in the employ of the seismic restraint device manufacturer.

B. For roof-mounted equipment and components both the seismic acceleration and wind loads shall be calculated, and the highest load shall be utilized for the design of the seismic restraints and vibration isolators.

C. Exceptions for components listed within the applicable project building code may be utilized. However, use of exceptions shall be noted with submitted seismic restraint calculations.

D. Seismic restraints and vibration isolators provided with integral seismic restraint capacity shall have Anchorage Preapproval "R" Number from OSHPD in the State of California listing minimum certified horizontal and vertical load ratings.

E. Floor-Mounted Restraints:
   1. Restraints for neoprene vibrations isolators shall consist of Type DN isolators with the addition of welded steel housings to resist seismic forces.
   2. Manufacturer: Kinetics Noise Control, Mason Industries, VMC Group, Vibration Eliminator, or Vibro-Acoustics.

F. Suspended Restraints:
   1. Restraints for vibration isolated suspended systems or equipment shall consist of galvanized or stainless-steel aircraft cables with end connection fittings designed to swivel to ensure proper cable alignment and avoid bending of cable.

2. Restraints for nonvibration isolated suspended equipment or raceways shall consist of steel angle or unistrut with anchor bolts and end connection fittings designed to swivel to the final installation angle.
3. Manufacturer: International Seismic Application Technology, Kinetics Noise Control, Mason Industries, Tolco, VMC Group, Vibration Eliminator, or Vibro-Acoustics.

2.8 MISCELLANEOUS EQUIPMENT

A. Identification materials: nameplates shall be white core plastic laminate with engraved lettering. Nameplates for individual devices shall have 0.25" high letters.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide incidental equipment or devices to provide a complete and operable system.

B. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.

C. Equipment shall be installed in accordance with the manufacturer's instructions.

D. Equipment, except portable equipment, shall be held in place. This shall include equipment, enclosures, components, and cables. Fastenings and supports shall support their loads with a safety factor of at least 3 unless otherwise specified herein.

E. Prevent and guard against electromagnetic and electrostatic hum and install the equipment to provide safety for the operator.

F. Repair or replace any equipment or materials damaged during the construction period.

G. Provide power connections from panels to specialty equipment.

3.2 CYBERSECURITY REQUIREMENTS:

A. Change all default passwords upon setup. Provide unique passwords for each device type. Provide passwords to Owner upon turnover of the system. Create strong passwords:
1. Include numbers, symbols, uppercase and lowercase letters.
2. Password shall be more than eight characters long.
3. Avoid any password based on repetition, dictionary words, letter or number sequences, usernames, relative or pet names, or biographical information (birthday).

B. Two factor authentication (network, server, and client only).

C. Enable encryption, if not already enabled.

D. Where supported, configure the systems to provide alerts upon multiple failed login attempts.

E. Restrict access to open USB ports to prevent malicious agents or malware from being injected into the security network.

F. Configure the system to provide automated alert process if foreign devices (e.g., non-authorized devices like laptops, rogue APs, etc.) are attached to the security network.

G. Configure the system to provide automated alerts if unauthorized file deletions or modifications occur (network only).

H. Configure the systems to provide automated checking of drivers and firmware to detect if the drivers and firmware are up to date (network, server, and client only).

I. Configure the system to provide automated alerts if a camera or other device is tampered with (the lens is covered, the power removed, scene changes, etc.).

3.3 EQUIPMENT ENCLOSURES

A. Where controls or equipment are specified herein or indicated on the Drawings for future installation, space shall be provided in the control console and the equipment racks, and on the control panels.

B. Provide ventilation according to equipment manufacturer's recommendations.

C. Provide unused equipment enclosure panel space with blank or ventilating panels.

D. Mount an AC enclosure wiring diagram in each enclosure with the following information:
   1. The number of AC power circuits within the enclosure.
   2. A schematic diagram showing the incoming AC circuits and the location and quantity of outlets fed by each circuit.
   3. The current capacity of each circuit.
   4. The location of the breaker panel and the number of various breakers.
   5. Indicate that the enclosure and equipment are on an isolated ground system (if applicable).

3.4 FIBER OPTIC TRANSMISSION AND SIGNAL EQUIPMENT

A. Bond fiber optic enclosures, exposed building steel, cabinets, service boxes, and framework to the building grounding system in accordance with TIA-607 and local codes.

3.5 IDENTIFICATION

A. General:
   1. Identification shall consist of upper-case letters.
   2. Where identification is applied to surfaces which require a finish, identification shall be installed after the surface has been finished.

B. Equipment:
   1. Provide and install engraved labels for each item rack-mounted equipment.
   2. Except where otherwise specified herein, label switches, controls, and receptacles. Labeling material shall be engraved plastic laminate or metal plates. Labels shall be placed on coverplates or directly adjacent to switches, controls, and receptacles to facilitate service and replacement.
   3. Signs shall not cause interference with operation and maintenance of equipment. Attach signs with rustproof screws.

3.6 EQUIPMENT AND EQUIPMENT ROOMS

A. Remove dust, dirt, rust, stains, and temporary covers.

B. Foreign matter shall be blown, vacuumed, or cleaned out of and from new equipment, devices, switches, controls, and panels.

C. Clean and polish identification plates.

D. In equipment rooms, clean equipment, conduit, and room surfaces form dust and dirt and maintain in a clean condition from date of Substantial Completion until final completion of work and corrective work.

E. Remove excess material from the Project site.

3.7 SEISMIC AND WIND RESTRAINTS

A. Restraints shall be installed after the equipment is mounted, connected, and operating to ensure that no contact occurs during normal equipment operation.

B. Installation of seismic restraints shall not cause any change of position of equipment, or raceways resulting in stress and misalignment.

C. No rigid connections between equipment, conduit, or raceways and the building structure shall be made that degrade the vibration isolated system specified herein.

D. Do not brace a system to two different structures, such as a wall and a ceiling.

E. After installation, manufacturer shall verify that seismic and wind restraints are installed and operating properly and shall submit a certificate so stating.

3.8 GROUNDING AND SURGE SUPPRESSION

A. Equipment shall be grounded as specified herein, and in accordance with the equipment supplier's recommendations.

B. A single primary specialty system ground shall be established for the specialty systems in each area as follows:
   1. In each enclosure install a copper bus bar mounted to the enclosure to act as the ground unipoint for the connection of ground conductors used within that enclosure.
   2. A single #6 AWG insulated grounding conductor from each enclosure shall be run back to the ground bus bar located in the IDF.

C. Surge Protective Device Grounding:
   1. Connect each surge protective device to the local ground bus in the terminal cabinet with wiring sized as recommended by the manufacturer.
   2. Coordinate to ensure that the 120 V AC power source/supply suppressor is also grounded to the same local ground bus as surge protective devices provided in this Section for the same system.

D. Surge Protective Devices:
   1. Install on low voltage signal or communications conductors entering the building from exterior locations, including those conductors from devices mounted on the exterior of the building.
   2. Provide AC power SPDs on microprocessor-based specialty system rack-mounted equipment.

3.9 AC POWER AND POWER SUPPLY EQUIPMENT

A. Provide power connections from existing panels to specialty equipment.

B. Components connected to power supplies shall be connected to individually fused or PTC outputs.

C. Components specified below shall be provided with battery back-up:
   1. Card access readers, reader interface devices, electric lock power supplies, and control panels.
   2. Intrusion detection system panels and components.
   3. Cellular alarm transmission back-up system.

D. Components specified below shall be connected in their respective locations to the UPS provided under this section:
   1. Equipment and devices located in security equipment racks in the Telecom Spaces and Site Camera Enclosures.
   2. Servers: Access Control System (ACS) servers, Security Communications System (SCS) servers, and Network Video Recorders (NVRs) or Video Surveillance System (VSS) servers and storage media.
   3. Workstations: ACS Workstations, SCS Workstations, and VSS Workstations.
   4. Storage: Direct Attached Storage (DAS) used for ACS, SCS, and VSS storage.
   5. Communications components: rack mounted fiber optic transmission system components and security network (S-LAN) switches.

3.10 MISCELLANEOUS EQUIPMENT

A. Permanently identify with metal tags.

B. Turn over keys, along with manufacturer's certificate stating the quantity of each key made, to the Owner and obtain a signed receipt acknowledging receipt of same.

3.11 OPERATION AND MAINTENANCE DOCUMENTATION PACKAGE

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the specialty systems.

C. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 3 weeks before systems acceptance testing, and shall be updated, revised and completed during, and at completion of, performance verification.

D. Documentation shall be type written and shall contain, at a minimum, the following information.
   1. Contact Information: Contractor's emergency contact information during the warranty period.
   2. Operating Manual: Provide manufacturers' supplied user, programming, maintenance, and trouble-shooting manuals.
   3. Copies of software configuration files and/or programming files, as applicable, on USB drives.
   4. Test Reports and Certifications.
   5. Construction Documents:
      a. As-built drawings (shop drawings updated to reflect field installed conditions). This should include cable numbers, controller designations, wiring diagrams …)
      b. Approved submittals.

E. An electronic copy of Construction Documents shall be included on CD-ROM within each operation and maintenance binder. Close-out materials provided in electronic format shall include As-built drawings, approved submittals, warranty certificates, and test reports.

F. Submit a receipt signed by the Owner acknowledging receipt of the operation and maintenance documentation package.

G. Provide metal cabinets mounted on the wall of the Add Room Name to house the operation and maintenance documentation package. Cabinets shall be approximately 12" wide x 18" high x 6" deep constructed of 18-gauge sheet metal with hinged door with latch. Cabinets shall be painted black and shall be labeled with 0.5" stenciled letters.

3.12 RECORD DRAWINGS

A. Refer to Section 017839, Project Record Documents.

B. A record of field and as-installed conditions shall be maintained at the site, shall be kept current throughout the Project, and shall be used in the preparation of the final record drawings. Field and as-installed conditions shall be recorded on design drawings and shall be marked to indicate addenda, change orders, field changes and selections made during construction.

C. Concurrent with the Substantial Completion, submit 2 sets of prints indicating field and as-installed conditions of wiring and equipment, and incorporating changes made during construction.

D. Upon completion of the Project, submit marked-up design drawings indicating field and as-installed conditions, and shop drawings incorporating changes made during construction for wiring and equipment. Submit the following:
   1. 2 set(s) of bound prints.
   2. Full size PDFs on CD(s).

3.13 MAINTENANCE

A. Equipment operated prior to the date of Substantial Completion shall be maintained in accordance with manufacturers' recommendations.

3.14 INSTRUCTION OF OPERATING PERSONNEL

A. Conduct formal instruction sessions for operating personnel. Conduct 2 similar sessions. The first session shall be conducted at the time of start-up and check-out, and the second session shall be approximately 2 months later. Sessions shall be conducted at the site.

B. Prepare and submit a syllabus describing an overview of the program, describing how the program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Owner on which operating personnel shall be instructed in each system.

C. Sessions shall include:
   1. General familiarization and operating procedures for each specialty systems installation.
   2. Routine maintenance procedures for equipment.
   3. User level programming of programmable systems.

D. Factory-trained technicians shall give operating and maintenance instructions on the specialty systems and equipment.

E. Provide DVD format video of training sessions and a complete record copy of training materials, handouts, and other printed materials used in each training session. Obtain receipt from the Owner acknowledging completion of each item of instruction.

END OF SECTION

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers security conductors and cables.

B. Cable for the interfacing of power and grounding provisions with work provided under these Sections is covered under these Sections.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 271116 - Communications Cabinets, Racks, Frames, And Enclosures.

C. 271323 - Communications Optical Fiber Backbone Cabling.

D. 271513 - Communications Copper Horizontal Cabling.

E. 280500 - Common Work Results for Electronic Security Systems.

F. 280528 - Pathways for Electronic Security.

G. 280800 - Commissioning of Electronic Security.

H. 281000 - Access Control.

I. 281353 - Security IP Network Compatible Intercom Systems.

J. 282000 - Video Surveillance.

K. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

1.4 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.5 SUBMITTALS

A. Action Submittals:
   1. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.
   2. Product Data: For each type of product.

B. Information Submittals:
   1. Qualification Data: For installer, installation supervisor, and field inspector.
   2. Source quality-control reports.
   3. Field quality-control reports.

C. Closeout Submittals:
   1. Operations and Maintenance Documentation Package: As defined in Section 280500 - Common Work Results for Electronic Security Systems.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installation Supervision: Installation shall be under the direct supervision of a Technician, who shall be present at all times when Work of this Section is performed at Project site.

PART 2 PRODUCTS

2.1 CABLES, CONNECTORS AND MISCELLANEOUS EQUIPMENT

A. General:
   1. Cable construction, insulation, and jacket shall comply with the requirements for the application for which it is used. Provide type CM or CMG for general use; type CMP for plenum use; and CMR for riser use.
   2. Cables installed in plenum spaces shall be plenum-rated. Plenum-rated cable shall comply with NFPA 262.
   3. Cables and conductors installed in enclosures or raceways underground or in slabs on grade shall be UL listed for use in wet locations.
   4. Provide all labor, equipment, materials, and supervision to install, calibrate, adjust, document, and test the total system as required herein and on the drawings.

B. Power and Grounding Cables:
   1. Except as otherwise specified herein, or indicated on the Drawings, grounding conductors shall be insulated. Insulation shall be rated 600 V. Conductors shall be continuous from connector to connector with no splices. Grounding connectors shall be solid bronze, compression type, designed for use intended.
   2. Power wiring for the extension of power circuits shall be #12 AWG THWN/THHN or XHHN, 600 V, rated at 194°F.

2.2 SECURITY CABLES AND CONDUCTORS

A. Alarm Cabling:
   1. Two unshielded twisted pair, #22 AWG or larger cable (sized for voltage drop) for cabling between addressable alarm or sensor devices.
   2. Unshielded 4-conductor, #20 AWG or larger cable (sized for voltage drop) for cabling to motion detection devices.
   3. Unshielded 2-conductor, #20 AWG or larger cable (sized for voltage drop) for cabling to door contacts.
   4. Manufacturer: Alpha, Belden, CommScope, West Penn, and Windy City Wire.

B. RS-485 Cables:
   1. Two unshielded twisted pairs, #22 AWG, stranded (7x30) tinned copper conductors with overall 100% foil shield.
   2. Flame resistance: nonplenum-rated cable shall comply with UL 1581.
   3. Manufacturer: Alpha, Belden, CommScope, and West Penn.

C. Control Cables:
   1. Multiconductor, color-coded type, #22 AWG or larger conductors (sized for voltage drop), stranded tinned copper for energy limited control circuits. Multiconductor, color-coded type, #14 AWG or larger conductors (sized for voltage drop), stranded tinned copper for other control circuits.
   2. Flame resistance: nonplenum-rated cable shall comply with UL 1581.

D. Access Control Composite Cable:
   1. Four separately jacketed cables for Lock Power, Card Reader, Door Contacts, REX under one yellow plenum rated jacket.
      a. Lock Power: #18 AWG 4-Conductor – stranded bare copper, PVC insulation with a Plenum jacket.
      b. Card Reader: One pair #22 AWG shielded, low-capacity, tinned copper, RS-485, 120 ohms: plus #18 AWG two conductor non-shielded, bare copper PVC insulation with a Plenum jacket..
      c. Door Contacts: #22 AWG 2-Conductor - stranded bare copper, PVC insulation with a Plenum jacket.
      d. REX/PIR: #22 AWG 2-Conductor - stranded bare copper, PVC insulation with a Plenum jacket.
      e. Manufacturer: Windy City Wire, or equal by Belden or West Penn.

2.3 PATCH PANELS, CONNECTORS AND MISCELLANEOUS EQUIPMENT

A. Provide network patch panels, fiber optic cabinets, patch cords, and connectors in accordance with 271513 - Communications Copper Horizontal Cabling and 271523 - Communications Optical Fiber Horizontal Cabling.

PART 3 EXECUTION

3.1 CONDUCTORS AND CABLES

A. General:
   1. Cables and conductors installed in enclosures or raceways underground or in slabs on grade shall be UL listed for use in wet locations.
   2. Install plenum rated cables where cables are not installed in conduits or enclosed wireways.
   3. As a general practice, power cables, and high-level signal cables shall be run on the left side of an equipment rack as viewed from the rear. Other cables shall be run on the right side of an equipment rack, as viewed from the rear.
   4. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.
   5. Unused cables shall be dressed at each end in heat-shrink tubing and marked as unused.
   6. Heat-shrink tubing shall be used to insulate and dress the ends of outdoor wires and cables, including a separate tube for the ground or drain wire.
   7. No cables shall be wired with a polarity reversal between connectors, at either end. Special care shall be taken when wiring to ensure that constant polarity is maintained.
   8. Remove abandoned cable and dispose of it.

3.2 IDENTIFICATION

A. Identification shall consist of upper-case letters.

B. Cables, regardless of length, shall be marked with preprinted, wrap-around number or letter cable markers at both ends. Markers shall be permanently affixed with heat-shrink tubing. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall be indicated on the record drawings.

3.3 FIELD QUALITY CONTROL:

A. Tests and Inspections:
   1. Provide testing of cable testing and inspections is accordance with 271513 - Communications Copper Horizontal Cabling and 271523 - Communications Optical Fiber Horizontal Cabling.

END OF SECTION

SECTION 280528 - PATHWAYS FOR ELECTRONIC SECURITY

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers the Security Pathways (security infrastructure such as conduit, back boxes, etc.).

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 280500 - Common Work Results for Electronic Security Systems.

C. 280513 - Conductors and Cables for Electronic Security.

D. 280800 - Commissioning of Electronic Security.

E. 281000 - Access Control.

F. 281353 - Security IP Network Compatible Intercom Systems.

G. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Action Submittals: None.

B. Informational Submittals: As defined in Section 280500 - Common Work Results for Electronic Security Systems.

C. Closeout Submittals: None.

PART 2 PRODUCTS

2.1 PATHWAYS IN ACCORDANCE WITH DIVISION 26

A. Conduit shall be in accordance with Section 260533.13 - Conduit for Electrical Systems.

B. Boxes shall be in accordance with Section 260533.16 - Boxes for Electrical Systems.

C. J-Hooks:
   1. J-hooks shall be designed to support a minimum of 80 category 5 communications cables, shall be steel, UL listed for a maximum static load of 50 lbs, and shall be rated for use in plenum environments.

2.2 SLEEVES

A. Wall sleeves shall be galvanized rigid metal conduit or electrical metallic tubing.

B. For floor slabs above grade, plastic core form block-outs shall be used.

2.3 PENETRATION SEALS

A. Firestops:
   1. Firestops shall consist of an asbestos-free fill material, forming/backing/damming materials, and accessories needed to complete a UL classified through-penetration firestopping system. Fill material shall not slump or sag and shall be the required thickness in the fully cured state.
   2. Firestops shall be designed to seal through-penetrations against flame, heat, smoke, and water in compliance with ASTM E84, ASTM E119, ASTM E814, and UL 723.UL 723
   3. Firestops shall be specifically designed and rated for the individual application, including movement, materials, moisture, penetrating item material, and fire and smoke ratings of the penetrated construction.
   4. Manufacturer: 3M, GE, Flammadur, Hilti, Nelson, Rectorseal, or Thomas & Betts.

B. Expansion Seals:
   1. Waterproof, modular, mechanical expansion type consisting of synthetic rubber grommets or interlocking links shaped to continuously fill the annular space between the penetrating item and the opening. Sizing of links and sleeve shall be determined by the manufacturer.
   2. Manufacturer: Calpico Pipe Linx, Metraflex MetraSeal, or Thunderline Link Seal.

C. Seal Assemblies:
   1. Seal assemblies shall consist of a frame, compression mechanism, and insert modules. Assemblies shall be waterproof and shall be designed to allow easy addition or deletion of penetrating items.
   2. Seal assemblies for multicable penetrations of fire- and smoke-rated construction shall comply with the requirements of firestops as specified herein.
   3. Basis of Design: Nelson Multi-Plug.

2.4 HIGH TRAFFIC SLEEVES

A. Rated for walls and above grade floor slabs.

B. A self-contained firestop system that automatically adjusts to cable load.

C. UL classified for use in wall and floor systems rated for up to 3 hours.

D. Manufacturer: Hilti Speed-Sleeve or Specified Technologies EZ-Path.

2.5 UNDERGROUND DUCTS, MANHOLES, AND HANDHOLES

A. Underground ducts, manholes, and handholes shall be in accordance with 270543 - Underground Ducts and Raceways for Communications Systems.

PART 3 EXECUTION

3.1 GENERAL

A. Equipment, except portable equipment, shall be held in place. This shall include equipment, enclosures, components, and cables. Fastenings and supports shall support their loads with a safety factor of at least 3 unless otherwise specified herein.

B. Remove abandoned conduit, back boxes, and other raceways and dispose of them.

C. Patch, paint, and otherwise restore to original condition walls, floors, and ceilings cut, modified, or damaged in the process of implementing this Work.

3.2 PATHWAYS IN ACCORDANCE WITH DIVISION 26

A. General:
   1. Install raceways and boxes in accordance with 260533.13 - Conduit for Electrical Systems, 260533.16 - Boxes for Electrical Systems, and
   2. Install wiring or cables in raceways where wiring or cables are installed underground, in concrete, and concealed in walls or in inaccessible ceilings, unless otherwise specified herein.
   3. Install wiring or cables in raceways where wiring or cables are otherwise exposed, including open ceiling spaces.

B. J-Hooks:
   1. Install maximum 5' on center.
   2. Attach J-hooks to the structure as recommended by the manufacturer, except that J-hooks shall not be installed using drop wires or ceiling support wires. J-hooks shall not be connected to ceiling supports, utilities, or equipment.

3.3 SLEEVES

A. Provide where conduits pass through elevated floor slabs if conduits are not a part of the slab pour and for future cable or conduit risers.

B. Install in raised foundations at least 2" high.

C. Provide where cables pass through walls and elevated floor slabs.

D. Wall sleeves shall extend 4" from each side of the walls.

E. Openings through slabs for busway risers shall be finished with a 4" wide x 2" high curb around the opening.

F. Sleeves shall be secured in place. Provide insulating bushings on both sides of sleeves for cables.

G. Provide ground bushings on both sides of sleeves containing separate ground conductors.

3.4 PENETRATION SEALS

A. General:
   1. Install in accordance with the manufacturer's published instructions to achieve ratings and classifications specified herein. A copy of these instructions shall be maintained and available on site.

B. Firestops:
   1. Close and firestop abandoned penetrations and penetrations through fire- and smoke-rated construction. Materials used to seal these penetrations shall continue the construction’s fire and smoke resistance ratings uninterrupted and shall maintain an effective barrier against the spread of flame, smoke, water, and hot gases.
   2. Install after installation of raceways and cable tray.

C. Expansion Seals:
   1. Install to seal single conduit or cable penetrations of walls below grade.

D. Seal Assemblies:
   1. Install to seal the penetration of walls below grade by multiple cables in the same opening.
   2. Install to seal cable penetrations _____ and as indicated on the Drawings.

3.5 HIGH TRAFFIC SLEEVES

A. Provide where cables pass through walls or elevated floor slabs within voice and data communications rooms.

B. Provide where cable trays pass through rated walls or elevated floor slabs. Install 4 sleeves at each penetration, minimum.

C. Install associated rating information decal on both sides of sleeve. Sign and date the decal.

D. Install sleeve systems with flanges and fire-rated caulk as recommended by the manufacturer.

3.6 UNDERGROUND DUCTS, MANHOLES, AND HANDHOLES

A. Underground ducts, manholes, and handholes shall be in accordance with Section 270543 - Underground Ducts and Raceways for Communications Systems.

END OF SECTION

SECTION 280533 - SECURITY NETWORK COMMUNICATIONS EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers local area networks (LAN) and similar equipment necessary to support the security systems specified under other sections of Division 28.

1.2 RELATED REQUIREMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 280500 - Common Work Results for Electronic Security Systems.

C. 280513 - Conductors and Cables for Electronic Security.

D. 280528 - Pathways for Electronic Security.

E. 280800 - Commissioning of Electronic Security.

F. 281000 - Access Control.

G. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS:

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

B. IEEE 802.1Q - IEEE Standard for Local and Metropolitan Area Networks – Bridges and Bridged Networks; 2018.

C. IEEE 802.1X - IEEE Standard for Local and Metropolitan Area Networks--Port-Based Network Access Control; 2020.

D. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

E. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2024, with Amendment (2025).

F. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Provide product data sheets for equipment, materials, and cables in PDF format.
   2. Shop Drawings:
      a. Include site and floor plans indicating equipment locations. Plans shall include equipment identification that corresponds to the same label on the network diagram referenced below.
      b. Provide elevations of rack-mounted equipment, showing the location of all specified electronics and include enlarged, to scale plan (top), and front views.
      c. Network diagrams indicating the connections to the internet, workstations, servers, network video recorders (NVR), and cloud managed video recorders (CMVR) IP video cameras, and other IP-enabled security components shown on the Drawings. The diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
      d. Provide a detailed loading schedule for each security network switch and patch panel.
   3. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

B. Informational Submittals:
   1. As required in Section 280500 - Common Work Results for Electronic Security Systems.
   2. Resumes of key personnel that documents the qualifications required. Include certificate of training or certifications.

C. Close-out Submittals:
   1. Functional Test Reports: Provide a spreadsheet with all security network devices and major components listed in the first column by device designator (e.g., camera number) with each test parameter listed by name (or code) in the remaining columns.
   2. Operations and Maintenance Documentation Package: As defined in Section 280500 - Common Work Results for Electronic Security Systems.
   3. Instruction of Operating Personnel:
      a. The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.
      b. Obtain receipt from the Owner acknowledging completion of each item of instruction.
   4. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

1.5 QUALITY ASSURANCE:

A. The video surveillance system contractor, the contractor’s supervisors, and technicians shall meet the qualifications as defined in Section 280500 - Common Work Results for Electronic Security Systems.

B. Installation of the Security LAN (S-LAN) shall be under the direct supervision of a person or persons having completed, as a minimum, the factory training recommended by the network switch manufacturer, the network switch manufacturer's highest available certification program, and have

direct field experience in the installation of local area networks for a minimum of 3 projects of similar scope and size within the past 5 years.

C. The installation company shall assign a project manager with a minimum of 5 years field experience in installation of LANs and professionally certified by the switch manufacturer (such as an APDS, if Avaya switches are provided, or as a CCNP, if Cisco switches are provided). The project manager shall be assigned for the duration of the project and shall not be replaced without written approval from the Owner.

D. In addition, the installation company shall have at the minimum 2 permanently employed persons with current manufacturer's network certification in their field office directly responsible for the installation and ongoing maintenance of the Project. The office shall be located within 100 miles of the project site.

E. The installation company shall be a currently listed as an authorized dealer or business partner by the manufacturer of the system and shall have been listed as such for a minimum of 3 years.

F. The security LAN contractor shall engage the manufacturer for onsite professional services.

PART 2 PRODUCTS

2.1 NETWORK SWITCHES:

A. Network Switches:
1. Physical, Electrical and Reliability:
   a. Mounting: 19" EIA rack for interior rack-mounted switches.
   b. Operating power: 120 V AC 60 Hz with redundant power supply.
   c. Mean time between failures: 150,000 hours minimum at 122º F.
2. Configuration:
   a. Ports as required to support the topology indicated on the Drawings, but no less than 4 RJ45 ports or 2 Gigabit SFP fiber ports per switch.
   b. Provide sufficient IEEE 802.3 compliant PoE to serve the PoE devices provided.
   c. Uplink media type: multimode or single-mode fiber.
3. Minimum Switch Capacities:
   a. Switching fabric: 20 Gbps.
   b. Forwarding rate (packets per second per box): 4.76 Mpps.
   c. MAC addresses supported: 4000.
4. Features:
   a. Auto-sensing (10/100/1000 Mbps) and auto-negotiation (full or half duplex and flow control).
   b. Port mirroring.
   c. Rate limiting on a per port basis.
   d. Link aggregation control protocol (LACP) between switches.
   e. Security:
      1) Port security requiring the port to validate the MAC address against a known list of MAC addresses.

2) Terminal access controller access control system (TACACS).
3) Remote authentication dial in user service (RADIUS) protocol as defined in IEEE 802.1X (AMD 802.1wck-2018).

f. Password protected with multiple user levels of access.
g. Web browser-based administration, secured with HTTPS and command line interface (CLI) via SSH.

5. Protocols Supported:
   a. Protocol support: IEEE 802.3, 100Base-TX, and 1000Base-T.
   b. Simple network management protocol (SNMP) with management information base (MIB) support, as well as support for SNMP v1, v2, and v3 commands.
   c. Remote network monitoring (RMON I) for history, statistics, alarm, and events.
   d. IGMP snooping (multicast filtering).
   e. Domain name service (DNS).
   f. Network time protocol (NTP).
   g. Dynamic host configuration protocol (DHCP).
   h. Fault recovery in less than 0.5 s via rapid spanning tree protocol (RSTP) as defined in IEEE 802.1D-2004 (R2011).
   i. Differentiated service (context-aware service).
   j. Quality of service (QoS) as defined in IEEE 802.1D-2004 (R2011).
   k. Virtual local area network (VLAN) trunking as defined in IEEE ISO IEC 8802.1Q-2019/AMD 7
6. Manufacturer: Allied Telesis, Avaya, Cisco, Dell, Dynics, Extreme, and HPE Aruba .

B. Managed Ethernet Fiber Aggregation Switches:
1. Physical, Electrical and Reliability:
   a. Mounting: 19" EIA rack for interior rack-mounted switches.
   b. Operating power: 100-240VAC (on the front) or 24/48VDC, 60 Hz.
2. Configuration:
   a. Connectors: quanitiy to support the topology indicated on the Drawings, with no less than two (2) 1G/10G SFP+ slots.
   b. Uplink media type: multimode or single-mode fiber.
3. Technology: Store-and-Forward switching architecture.
4. Features:
   a. Supports IPv6.
   b. Support Jumbo Frame up to 9K bytes.
   c. Authentication – RADIUS, TACACS+.
   d. IEEE 802.1X: RADIUS authentication, authorization and accounting, MD5 hash, guest VLAN, single/multiple host mode and single/multiple sessions.
   e. DHCP Relay, DHCP Snooping.
   f. L2/L3/L4 ACLs Support MAC, VLAN ID or IP, protocol, port, DSCP/IP precedence/TCP.UDP, Ether Type, ICMP, TCP flag.
   g. LLDP (Link Layer Discovery Protocol).
   h. IEEE 802.3az Energy Efficiency.
   i. IP Source Guard, Port Security.

j. Syslog.

5. IEEE 802.3 Standards Supported:
   a. IEEE 802.3
   b. IEEE 802.3u
   c. IEEE 802.3z
   d. IEEE 802.3ae
   e. IEEE 802.3x
   f. IEEE 802.3ad
   g. IEEE 802.1D
   h. IEEE 802.1w
   i. IEEE 802.1s
   j. IEEE 802.1Q
   k. IEEE 802.1p
   l. IEEE 802.1ad
   m. IEEE 802.1AB
   n. IEEE 802.1X
   o. IEEE 802.3az
6. Basis of Design: Lantronics SM12DP2XA-OZ.

C. Hardened Network Switches:
   1. Physical, Electrical and Reliability:
      a. Mounting: 19" EIA rack for interior rack-mounted switches.
      b. Operating power: 120 V AC 60 Hz with redundant power supply.
      c. Mean time between failures: 150,000 hours minimum at 185º F.
      d. Resiliency: switches mounted in exterior enclosures shall be IEEE 1613a-2011 compliant (environmentally hardened) to operate under extremes in temperature, vibration, and humidity.
   2. Configuration:
      a. Ports as required to support the configuration indicated on the Drawings, but no less than 4 RJ45 ports and 2 duplex Gigabit SFP fiber ports (2 send and 2 receive) per switch.
      b. Provide sufficient 25 W IEEE 802.3-2018/(AMD 2018) compliant PoE to serve the PoE devices provided.
      c. Uplink media type: multimode or single-mode fiber.
   3. Minimum Switch Capacities:
      a. Switching fabric: 1.6 Gbps.
      b. Forwarding rate (packets per second per box): 4.76 Mpps.
      c. VLANs per switch: 255.
   4. Features:
      a. Auto-sensing (10/100 Mbps) and auto-negotiation (full or half duplex and flow control).
      b. Port mirroring.
      c. Rate limiting on a per port basis.
      d. Port trunking/link aggregation control protocol (LACP) between switches.
      e. Security:

1) Port security requiring the port to validate the MAC address against a known list of MAC addresses.
2) Terminal access controller access control system (TACACS).
3) Remote authentication dial in user service (RADIUS) protocol as defined in IEEE 802.1X-2018 (AMD 802.1xck-2018).

f. Password protected with multiple user levels of access.
g. Web browser-based administration, secured with HTTPS and command line interface (CLI).

5. Protocols Supported:
a. Protocol support: IEEE 802.3-2018/(AMD 2018) 10Base-T, 100Base-TX, and 1000Base-T.
b. Simple network management protocol (SNMP) with management information base (MIB) support, as well as support for SNMP v1, v2, and v3 commands.
c. Remote network monitoring (RMON I) for history, statistics, alarm, and events.
d. IGMP snooping (multicast filtering).
e. Domain name service (DNS).
f. Simple network time protocol (SNTP).
g. Dynamic host configuration protocol (DHCP), and DHCP client.
h. Fault recovery in less than 0.5 s via rapid spanning tree protocol (RSTP) as defined in IEEE 802.1D-2004 (R2011).
i. Differentiated service (context-aware service).
j. Quality of service (QoS) as defined in IEEE 802.1D-2004 (R2011).
k. Virtual local area network (VLAN) trunking as defined in IEEE ISO IEC 8802.1Q-2019/(AMD 7)

6. Switch Administration:
a. Multicast routing by port.
b. Per port broadcast storm control.

7. Manufacturer: Comnet Environmentally Hardened Series, GarrettCom Magnum, N-TRON, or Transition Networks.

D. Self-Contained Hardened Switches in Outdoor Enclosures:
1. Physical, Electrical and Reliability:
a. Enclosure: NEMA 4/4X, IP66 rated.
b. Pole mount kit: accommodates 2”- 8” diameter or 5” square poles.
c. Battery Back-up: four 12VDC/7AH batteries and 2 rack unit rack mount battery enclosure to accommodates four 12VDC/7AH sealed lead acid or gel type batteries.
d. Power output: 120 W total power, 4 PoE+ IEEE 802.3 (30 W) ports or 2 Hi-PoE (60 W) ports.
e. Operating temperature: -40º F to 113º F (-40º C to 85º C).
f. Listings: UL60950-1-2007 (Information Technology Equipment) and UL60950-22-2017 (Information Technology Equipment to be installed Outdoors).

2. Configuration:
a. Ethernet ports: four 10/100/1000 ports (RJ45 connectivity), auto-crossover, half/full duplex, auto negotiation.

b. Fiber ports: two gigabit SFP ports.
c. Uplink media type: multimode or single-mode fiber.

3. Basis of Design: _____

2.2 PERIPHERAL EQUIPMENT:

A. Fire Wall:
1. Physical, Electrical and Reliability:
a. Mounting: 19" EIA/ECA-310 rack for interior rack-mounted switches.
b. Operating power: 120 V AC 60 Hz, with redundant power supply.
c. Mean time between failures: 150,000 hours minimum at 185º F.
d. Resiliency: switches mounted in exterior enclosures shall be IEEE 1613a-2011 compliant (environmentally hardened) to operate under extremes in temperature, vibration, and humidity.
2. Throughput:
a. UTM (full scan): 631 Mbps (measured using HTTP traffic with AV, IPS, and Application Control enabled. Does not account for all security services available on the appliance.
b. Firewall (IMIX): 1.32 Gbps.
c. VPN (IMIX): 416 Mbps.
d. HTTPS (IPS enabled, full scan) 344 Mbps.
e. Antivirus: 1.15 Gbps
f. IPS (full scan): 909 Mbps.
g. Firewall (UDP 1518): 4.7 Gbps.
h. VPN (UDP 1518): 1.4 Gbps.
3. Capacities:
a. Interfaces 10/100/1000: 8.
b. I/O interfaces: 1 Serial/2 USB.
c. Concurrent connections: 500,000.
d. Concurrent connections (proxy): 200,000.
e. New connections per second: 25,000.
f. VLANs: 75.
g. TDR Host Sensors included: 50.
4. VPN:
a. VPN Tunnels - Branch Office VPN: 60.
b. VPN Tunnels - Mobile VPN: 60.
c. Site to Site VPN: IKEv2, IPSec, Policy and Route Based Tunnels, TLS hub and spoke.
d. Remote Access VPN: IKEv2, IPSec, L2TP, TLS.
5. Security Features:
a. Firewall Stateful packet inspection, TLS decryption, proxy firewall.
b. Application proxies: HTTP, HTTPS, FTP, DNS, TCP/UDP, POP3S, SMTPS, IMAPS and Explicit Proxy.
c. Threat protection: DoS attacks, fragmented & malformed packets, blended threats.
d. Filtering options: Browser Safe Search, Google for Business.

6. Visibility:
    a. Logging and notifications: WatchGuard Cloud & Dimension, Syslog, SNMP v2/v3.
    b. Reporting: WatchGuard Cloud includes over 100 pre-defined reports, executive summary and visibility tools.
7. Certifications:
    a. Security: Pending: CC, FIPS 140-2.
    b. Safety: NRTL/CB.
    c. Network IPv6 Ready Gold (routing).
    d. Hazardous substance control: WEEE, RoHS, REACH.
8. Networking:
    a. SD-WAN: Multi-wan failover, dynamic path selection, jitter/loss/latency measurement.
    b. Dynamic Routing: RIP, OSPF, BGP.
    c. High Availability: Active/passive, active/active
    d. Quality of Service: IEEE 802.1Q, DSCP, IP Precedence.
    e. Traffic Management: By policy or application.
    f. IP address assignment: Static, DHCP (server, client, relay), PPPoE, DynDNS.
    g. NAT: Static, dynamic, 1:1, IPSec traversal, policy-based.
    h. Link aggregation: IEEE 802.3ad dynamic, static, active/backup.
9. Manufacturer: WatchGuard Firebox T80 with 3-yr Basic Security Suite or equal.

B. Wireless Network Access Points:
1. RF interface: IEEE 802.11 physical layer with proprietary MAC protocol or WPA2 standard compliant mode.
2. Frequencies: 2.40 GHz to 2.4835 GHz (ISM).
3. Support data rates for IEEE 802.11.
4. Protocols:
    a. Transmission control protocol/internet protocol (TCP/IP).
    b. User datagram protocol/internet protocol (UDP/IP).
    c. Real-time transmission protocol/internet protocol (RTP/IP).
    d. Internet protocol (IP) multicast.
    e. Domain name service (DNS).
    f. Dynamic host configuration protocol (DHCP), and DHCP client.
5. Security: SSL-based authentication and 128-bit AES encryption.
6. Manufacturer: Aerohive, Aruba, Avaya, Cisco, Extreme (Enterasys), or Meru.

C. Network Attached Storage:
1. Raw capacity: 24TB.
2. Minimum usable capacity: 18 TB.
3. Transfer rate: up to 300 MB/s.
4. Disk interface: 3.0 Gb Serial ATA II with NCQ and SMART.
5. RAID level: 6 + hot spare.

D. Network Attached Storage with Integrated Tape Drives:
1. Raw capacity: 9 TB.
2. Minimum usable capacity: 6 TB.
3. Integral tape drive capacity: 400 GB up to 800 GB.

4. Tape format: integrated LTO tape drive.
5. Transfer rate: up to 300 MB/s.
6. Disk interface: 3.0 Gb Serial ATA II with NCQ and SMART.
7. RAID level: 0 + hot spare.

E. Fiber Optic to Ethernet Media Converters:
1. Ethernet media converters shall be IEEE 802.3 compliant, designed to transmit and receive 10/100 Mbps data over multimode or singlemode optical fiber.
2. The Ethernet Media Converter shall Auto-Negotiate to a 10 Mbps or 100 Mbps Ethernet rate without any adjustments.
3. Mean Time Between Failure (MTBF) shall be 100,000 hours or more.
4. Full Duplex or Half Duplex Electrical Port/Full Duplex Optical Port.
5. Optical Power Budget: Multimode 10 dB, Singlemode 15 dB.
6. Connectors: Optical - SC, 1 or 2 Fibers, Electrical Signal – RJ45, and Electrical Power – Terminal Block.
7. Operating temperature shall be -40°F to 160°F or better.
8. Power Supply: DC Plug-in Power Supply, 90-264 VAC, 50/60 Hz.
9. Basis of Design: Comnet CNFE100(X) Series or equal.

F. Fiber Optic to Ethernet with POE+ Media Converters:
1. Wall mount, DIN Rail, or tabletop.
2. External AC/DC power supply included.
3. 2-port 10/100/1000 copper to fiber media conversion with IEEE 802.3at PoE+ on the copper port. Supports full 30 Watts of power to each twisted pair port.
4. 3-port with (1) RJ-45 PoE+ port and (2) open SFP slots such that the device can be configured as a 3-port switch or as a 2-port media converter with redundant fiber links. With redundant fiber enabled, supports a 50ms fail-over time.
5. 4-port with (2) RJ-45 PoE+ ports and (2) open SFP slots such that the device can be configured as a 4-port switch (with or without redundant fiber) or as two independent PoE+ media converters in one housing. With redundant fiber enabled, supports a 50ms fail-over time.
6. Shall support fixed LC connectors and open SFP.
7. SFP slots shall support 100Base-FX, 1000Base-X, or SGMII based (MSA compliant) SFP modules.
8. Supports Auto-Negotiation, Auto-MDI/MDIX, Active Link Pass Through (ALPT), and Remote Fault Detection
9. Jumbo frame support.
10. LEDs indicators for power status; per port link, duplex, and activity status; and PoE status.
11. Legacy PoE Detection.
12. Twisted pair ports support IEEE 802.3az Energy Efficient Ethernet for power saving.
13. Dip switch control of basic feature configuration.
14. RJ-45 serial port for Command Line Interface (CLI) of advanced port configuration (115200 baud).
15. Basis of Design: Transition Networks SGPAT Series or equal.

G. Network-Power Over Ethernet Extender and Midspan Power Injector:
1. The network-power over Ethernet (PoE) extender shall provide the capability to extend the maximum Ethernet cable length by 295', from the standard 90' to 590'.
2. The network-PoE extender shall be fitted in line with the cable and act as a repeater allowing network cables to be joined.

3. The network-PoE extender shall provide the capability to provide power over the Ethernet (PoE) to remote devices.
4. The network-PoE extender shall be powered from the network cable via PoE as an IEEE 802.3-2018(AMD 2018) class 0 device.
5. The network-PoE extender shall be fully transparent with no restriction on network traffic.
6. It shall be possible to connect multiple network-PoE extender and cable combinations in a daisy chain to form an extension of up to 2950'.
7. Network-PoE extenders shall comply with the universal IEEE 802.3-2018/(AMD 2018) PoE standard, and shall supply PoE to Altronix NetWay Spectrum Series Hardened POE Switches IEEE 802.3-2018/(AMD 2018) class 1 and 2 devices.
8. Network-PoE extenders shall provide the following features:
    a. Transmission rates: 100BaseTX, full duplex only with auto negotiation.
    b. Cable type: straight through or cross over (auto detected).
    c. Range (when used with a #24 AWG category 5, category 5e, or category 6 cable):
        1) Minimum range without midspan power injector; 2065' with no PoE, 1180' with PoE Class 1, and 885' with PoE Class 2.
        2) Minimum range with midspan power injector; 2950' with no PoE, 2065' with PoE Class 1, 1475' with PoE Class 2, and 885' with PoE Class 3.
    d. Device power (when used with a #24 AWG category 5, category 5e, or category 6 cable); 3.84 W for PoE Class 1, 6.49 W for PoE Class 2, and 12.95 W (using midspan power injector) for PoE Class 3.

PART 3 EXECUTION

3.1 NETWORK CONFIGURATION REQUIREMENTS:

A. A master list of IP addresses for both LAN and LAN user components shall be compiled for both network equipment and end user equipment. End user systems using DHCP are exempt from this requirement and shall be identified as DHCP systems.

B. The network shall be configured as indicated on the Drawings and in cooperation with the Owner's IT department. Configuration shall not be limited to the equipment provided but shall also include the existing switches and other equipment, as necessary.

C. Configuration Workshops:
1. Prior to installation, the on staff CCNE shall meet with the Owner's IT department in weekly workshops for a minimum of 2 sessions.
2. Workshops shall define the process of installation and configuration of the network components.
3. The CCNE shall configure and test the network expansion prior to installation.

D. Configure the VLANs, network IP addresses, Quality of Service (QoS), security settings, and other parameters per the Owner's requirements and as recommended by the manufacturer to support the system indicated on the Drawings.

3.2 INSTALLATION REQUIREMENTS:

A. Provide cable troughs for each side of network racks. Between 2 racks two 6" troughs are required.

B. Bond network enclosures, cabinets, service boxes, and framework to the building grounding system in accordance with TIA-607 and local codes.

3.3 CYBERSECURITY REQUIREMENTS:

A. Change all default passwords upon setup. Provide unique passwords for each device type. Provide passwords to Owner upon turnover of the system. Create strong passwords:
   1. Include numbers, symbols, uppercase and lowercase letters.
   2. Password shall be more than eight characters long.
   3. Avoid any password based on repetition, dictionary words, letter or number sequences, usernames, relative or pet names, or biographical information (birthday).

B. Two factor authentication.

C. Enable encryption, if not already enabled.

D. Where supported, configure the systems to provide alerts upon multiple failed login attempts.

E. Configure the system to prevent virtual private network (VPN) access.

F. Restrict access to open USB ports to prevent malicious agents or malware from being injected into the security network.

G. Configure the system to provide automated alert process if foreign devices (e.g., non-authorized devices like laptops, rogue APs, etc.) are attached to the security network.

H. Configure the system to provide automated alerts if unauthorized file deletions or modifications occur.

I. Configure the systems to provide automated checking of drivers and firmware to detect if the drivers and firmware are up to date.

J. Firewall Policy:
   1. No externally open ports to devices on the inside network, unless a specific use case is required to be met; then ports or mapping may be performed in a cyber-secure fashion (e.g., remote viewing of video is required from local NVR platform). A certificate would need to be procured from a Trusted Certificate provider and installed on the NVR to serve a secured interface prior to allowing an external mapping to the inside NVR interface.
   2. If multiple subnets are managed by the firewall providing segmentation between device types, (e.g., cameras and NVR subnet and an access control system subnet or other technology), communications should be restricted using least privilege methodologies so that inter-subnet device communications are restricted to only what is necessary, if necessary. Should there be no interaction required between devices on different subnets, then no communications should be allowed.
   3. Limit Internet access for inside devices to be allowed only if necessary (e.g., firmware and or software updates from manufacturer). Ideally, no security technology would be allowed access to the Internet at any time, only allowed times for specific reasons.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Connect a laptop directly to a network source (a modem or router) using an Ethernet cable. Open a Web browser to see if you can access the Internet. If you are successful, your modem or router is working properly.
   2. Connect one Ethernet cable from the modem or router to the WAN port on the Ethernet switch. Connect the other Ethernet cable from a laptop to the LAN 1 port on your Ethernet switch.
   3. Press the "Reset" button on the back of your modem or router to reboot the device. Plug the Ethernet switch's power adapter into a wall outlet once the modem or router has finished rebooting.
   4. Check for blinking green lights above the "WAN" and "LAN 1" ports on the Ethernet switch. A blinking green light represents an active connection. Open a Web browser on the laptop to confirm that the connection is active.
   5. Disconnect the Ethernet cable from "LAN 1" and plug it in to each of the remaining ports on the Ethernet switch. When testing each port, look for a blinking green light, and then test the connection by opening a Web browser on your laptop.

B. Tests and Inspection Reports:
   1. Security Network Communications Equipment Functional Report.

3.5 INSTRUCTION OF OPERATING PERSONNEL

A. Factory-trained technicians shall give operating and maintenance instructions on the security network equipment. The duration of each session for each system type shall be a minimum of hours _____.

B. Provide instruction of operating personnel as required in Section 280500 - Common Work Results for Electronic Security Systems.

END OF SECTION

SECTION 280800 - COMMISSIONING OF ELECTRONIC SECURITY

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers security systems performance verification, as required to demonstrate that the equipment and systems of the following sections, are ready for safe and satisfactory operation.

B. Performance verification is an ongoing process and shall be performed throughout construction. Performance verification verifies that systems are operating in a manner consistent with the Construction Documents.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 280500 - Common Work Results for Electronic Security Systems.

C. 280513 - Conductors and Cables for Electronic Security

D. 281000 - Access Control.

E. 281353 - Security IP Network Compatible Intercom Systems.

F. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 0.2 - Commissioning Process for Existing Systems and Assemblies; 2015.

B. ASHRAE Guideline 4 - Preparation of Operations and Maintenance Documentation for HVAC&R Systems; 2019.

1.4 QUALITY ASSURANCE

A. Provide a Security Systems Performance Verification Supervisor for the security systems. The Security Systems Performance Verification Supervisor shall have 10 years of experience in security systems contracting. The Security Systems Performance Verification Supervisor shall become familiar with the Owner's project requirements and the requirements of the performance verification process as defined in this Section. The Security Systems Performance Verification Supervisor shall coordinate and execute the required performance verification activities.

B. The Security Systems Performance Verification Supervisor shall review submittal data for conformance with the requirements of the Project, shall monitor compliance with the requirements specified herein for storage and protection of equipment during construction, shall oversee testing, and shall document that the scheduled and specified performance requirements of each system have been accomplished.

C. Refer to ASHRAE Guideline 0.2, Commissioning Process for Existing Systems and Assemblies, and ASHRAE Guideline 4, Preparation of Operating and Maintenance Documentation for HVAC&R System for the commissioning process and preparation of the O&M documents.

1.5 SUBMITTALS

A. CLOSEOUT SUBMITTALS
1. Operation and Maintenance Documentation Package - The Security Systems Performance Verification Supervisor shall compile and prepare documentation for equipment and systems covered in these Security Specifications and deliver this documentation for inclusion in the operation and maintenance manuals prior to the training of the Owner's personnel. The Architectshall receive a copy of the operation and maintenance manuals for review.

1.6 PERFORMANCE VERIFICATION

A. The Security Systems Performance Verification Supervisor shall be responsible for scheduling, supervising, coordinating, and executing the testing and performance verification activities as specified herein.

B. Security systems performance verification shall take place in three phases. Performance verification requirements for each phase are as follows:
1. Construction Phase:
a. During the construction phase of the Project, transmit a status update report upon request to the Architect (via e-mail). The status update report shall include digital photographs of areas where significant progress has been made. Digital photographs shall be minimum 1200 x 1600 pixels in resolution. Both the detail in the report and the detail in the photographs shall be sufficient for the Engineer to assess the progress made to date and respond appropriately to pay request. Periods of inactivity will require only a retransmission of the most recent form (via e-mail), updated to reflect the new date, and that "no significant progress has been made since the last status report was submitted". Status reports will not be requested more than once every 2 weeks.
b. Provide documentation of installed systems and equipment and develop functional testing procedures, prior to normal operation and maintenance manual submittals. This documentation shall include detailed manufacturer installation, operating, troubleshooting and maintenance procedures; full factory testing reports, if any; and full warranty information, including responsibilities of the Owner to keep the warranty in force. In addition, the installation, check-out materials that are actually shipped inside the equipment, and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Architect.

c. Develop and submit to the Architect for review and comment, prior to system functional testing, a complete functional testing plan using manufacturer's testing procedures and functional testing checklists for the performance of the equipment to be verified.
d. Assist in clarifying the proposed operation and control of equipment in areas where the specifications, drawings or equipment documentation is not sufficient for writing detailed testing procedures.
e. Review the proposed functional test procedures to ensure feasibility, safety, and equipment protection. Obtain approval from the Architect for proposed functional test procedures.
f. Prepare a preliminary schedule for performance verification activities, including equipment testing and adjusting from start to completion, and update the schedule during the construction period, as appropriate. Notify the Architect immediately when performance verification activities not yet performed, or not yet scheduled, will delay construction.
g. Provide functional testing for equipment and execute the security systems related portions of the functional checklists for the verification of the performance of all the equipment during the testing process.
h. Perform and document functional tests results, providing a copy to the Architect.
i. Correct noncompliance items before beginning acceptance testing. Discrepancies and problems shall be remedied before acceptance testing.

2. Acceptance Phase:
   a. Place equipment and systems into operation and continue their operation during each working day of the acceptance testing and performance verification activities, as required.
   b. Provide skilled technicians to execute acceptance testing of each system. Technicians shall be available and present during the agreed upon scheduled acceptance tests and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
   c. Perform acceptance testing for specified systems and equipment as directed by the Engineer and interpret the test data as necessary.
   d. Correct deficiencies (differences between specified and observed performance) as identified and interpreted by the Engineer and retest the equipment, as required to demonstrate proper operation and performance.
   e. Prepare operation and maintenance manuals as specified, including clarifying, and updating the original sequences of operation to as-built conditions.
   f. Maintain marked-up record drawings and produce final record drawings of project drawings and contractor-generated coordination drawings.
   g. Provide specified training of the Owner 's operating personnel.
   h. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
3. Warranty Period:
   a. Correct deficiencies and make necessary adjustments to operation and maintenance manuals, and as-built drawings system or equipment modifications made during the warranty period.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Standard testing equipment required to perform the required testing shall be provided by the Contractor for the equipment or system being tested.

B. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request. Accuracy of sensors shall be at least twice that of the instrumentation being tested.

PART 3 EXECUTION

3.1 SUBMITTALS

A. Submit additional documentation as required to support the performance verification process. This additional submittal documentation shall include, at a minimum, the proposed functional testing plan, and functional testing checklists.

3.2 FUNCTIONAL TESTING

A. General:
   1. Functional testing shall be performed as required to ensure that the equipment and systems are properly installed and ready for operation, so that acceptance testing may proceed without delays. Follow the approved functional testing procedures. Sampling strategies shall not be used for functional testing. The functional testing for equipment and subsystems of a given system shall be successfully completed and documented prior to acceptance testing of the system.
   2. Functional testing plan: develop the detailed functional testing plans for equipment and systems that are to be verified as specified herein. Review the proposed procedures and functional testing documentation to ensure that there is written documentation that each of the manufacturer-recommended procedures has been completed.
   3. The functional testing plan shall include the manufacturer's standard written check-out procedures copied from the installation manuals and manufacturer’s normally used field check-out sheets. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the tests recommended by the equipment manufacturer, and as specified herein. Each checklist shall include a summary statement with a signature block at the end of the plan.

3.3 ACCEPTANCE TESTING

A. Before obtaining permission from the Architect to schedule the acceptance test, provide written certification that each system has been calibrated, tested and is ready to begin the 14-day burn-in period and acceptance testing.

B. Conduct final acceptance test after a period of not less than 14 consecutive normal working days of trouble- free operation.

C. During this burn-in period, each system shall operate continuously for 24 hours per day. During the acceptance test, demonstrate the correct operation of features and capabilities specified herein.

D. The Owner reserves the right to witness the acceptance tests. Notify the Owner at least 10 days prior to the date scheduled for the tests.

3.4 RETESTING OF EQUIPMENT AND/OR SYSTEMS

A. Provide labor and materials required for retesting of any functional test found to be deficient.

B. Prior to retesting, submit required data indicating that the deficient items have been completed and/or corrected to the Architect for approval and rescheduling of the functional test. If during the retesting it becomes apparent that the deficient items have not been completed and/or corrected as indicated in the data provided by the Contractor, the retesting shall be stopped. Costs for the design team to further supervise the retesting of a functional test shall be the responsibility of the Contractor.

3.5 TESTING DOCUMENTATION, NONCONFORMANCE, AND APPROVALS

A. Functional Test Reports: For each subsystem, provide a spreadsheet with all devices listed in the first column by device designator (name/number) with each test parameter listed by name (or code) in the remaining columns.

B. Work to repair, replace, or otherwise resolve issues that result in a failed test until all devices pass all test parameters.

C. Upon the completion of Functional Testing, provide the Architect with the functional test reports. The Architect will then review the Contractor's functional testing reports and submit either a noncompliance report or available dates for the scheduling of the Acceptance Testing. Where items are found to be deficient during the acceptance testing, the Contractor shall correct items in a timely manner and notify the Architect that the items have been corrected. Resubmit an updated report and a statement of correction of each non-compliance item. When requirements are completed, the Architect will schedule follow-up acceptance testing or recommend acceptance of the electronic security systems.

END OF SECTION

SECTION 281000 - ACCESS CONTROL

GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers access control and alarm monitoring systems (ACAMSs).

B. This Section covers wiring electric door hardware furnished and installed under Division 8.

C. The ACAMS shall consist of head-end servers, multiple workstations and a hierarchy of access controllers that communicate utilizing a TCP/IP based Ethernet network. The system shall be capable of routing individual alarms to select workstations based on event type and time of day.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. 280500 - Common Work Results for Electronic Security Systems.

C. 280513 - Conductors and Cables for Electronic Security.

D. 280528 - Pathways for Electronic Security.

E. 280800 - Commissioning of Electronic Security.

F. 281353 - Security IP Network Compatible Intercom Systems.

G. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

A. BHMA A156.23 - Electromagnetic Locks; 2022.

B. BHMA A156.24 - Delayed Egress Locking Systems; 2022.

C. BHMA A156.25 - Electrified Locking Devices; 2023.

D. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.

E. FIPS 201-3 - Personal Identity Verification (PIV) of Federal Employees and Contractors; Current Edition.

F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

G. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

I. NFPA 101-2018 - Life Safety Code; 2018.

J. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

K. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

L. UL 603 - Standard for Power Supplies for Use with Burglar-Alarm Systems; 18 February 2008.

M. UL 1034 - Standard for Safety Burglary-Resistant Electrical Locking Mechanisms; Current Edition, Including All Revisions.

N. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

B. Action Submittals:
   1. Product Data:
      a. Provide product data sheets for equipment, materials, and cables in PDF format.
   2. Shop Drawings:
      a. Include floor plans indicating equipment locations. Plans shall include equipment identification and either direct references to wiring details for each specific installation and wiring condition or a schedule that references the same.
      b. Wiring diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
      c. Provide elevations of console or rack-mounted equipment, showing the location of all specified electronics and include enlarged, to scale plan (top), and front views.
      d. Provide project specific manufacturer shop drawings of fabricated or modified units, if any.
      e. Provide riser diagrams indicating components of the system and proposed cabling between these components.
      f. Provide block diagrams indicating the proposed interface between the access control system and the video surveillance system. Provide a written description of the proposed sequence of operation to describe the operation of the interfaces.
      g. Provide block diagrams indicating the proposed interface between the access control system and the intercom system. Provide a written description of the proposed sequence of operation to describe the operation of the interfaces.

h. Provide detailed project specific mounting diagram for each type of device including raceway and back box requirements. These details shall be referenced on the floor plans or schedules.

i. Provide a detailed loading schedule for each access control system panel indicating card readers by Door Number, card reader modules, and input/outputs (I/O) modules identifying each device connected to the I/O modules.

C. Informational Submittals:
1. Resumes of key personnel that documents the qualifications required. Include certificate of training or certifications.
2. As required in Section 280500 - Common Work Results for Electronic Security Systems.

D. Close-out Submittals:
1. Functional Test Reports: Provide a spreadsheet with all access control system devices and major components listed in the first column by device designator (e.g., door number) with each test parameter listed by name (or code) in the remaining columns.
2. Operations and Maintenance Documentation Package: As required in Section 280500 - Common Work Results for Electronic Security Systems.
3. Instruction of Operating Personnel:
   a. The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.
   b. Obtain receipt from the Owner acknowledging completion of each item of instruction.
   c. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

1.5 QUALITY ASSURANCE

A. The access control system contractor, the contractor's supervisors, and technicians shall meet the qualifications as defined in Section 280500 - Common Work Results for Electronic Security Systems.

B. Qualifications of the Access Control System Contractor:
1. The access control system installation company shall have field office located within a 100-mile radius of the Project with a minimum of two permanently employed persons with current access control system certification directly responsible for the installation and ongoing maintenance of the project.
2. Installation of the access control system shall be provided by a person or persons having completed, as a minimum, the factory training recommended by the access control system manufacturer and have direct field experience in the installation of a minimum of 3 projects of similar scope and size within the past 5 years.
3. The access control system Project Manager or Project Supervisor shall have direct field experience in the installation of a minimum of 3 access control systems projects of similar scope and size within the past 5 years.
4. Programming and configuration of the access control system shall be provided onsite by a person or persons having completed the access control system manufacturer's highest available certification program and have direct field experience in the programming and configuration of a minimum of 3 projects of similar scope and size within the past 5 years.

5. The access control system installation company shall be currently listed as an authorized dealer or business partner by the manufacturer of the access control system and shall have been listed as such for a minimum of 3 years.

PRODUCTS

2.1 ACCESS CONTROL AND ALARM MONITORING SYSTEMS

A. General:
1. The access control System shall consist of products approved for use by the Federal Government under Federal Information Processing Standards FIPS 201-3 Evaluation Program (FIPS 201-3 Approved Products List - Physical Access Control System Components (idmanagement.gov) https://www.idmanagement.gov/fips201/). Before ordering system components, confirm that the components do not appear on the FIPS 201 Removed Product List (FIPS 201-3 Removed Product List (idmanagement.gov) https://www.idmanagement.gov/fips201/).
2. The system (hardware and software) shall support the quantity and types of devices specified herein and indicated on the Drawings, including software licenses for 1 user per workstation.
3. The ACAMS shall be modular in nature, allowing system capacities to be easily expanded without the replacement (or rendering obsolete or non-usable) any hardware in the system or requiring major changes to system operation. All defined system data as well as historical information shall be maintained.
4. Provide the quantity and type of software licenses required to support the readers, servers, and workstations at the levels of functionality specified herein, and as indicated on the Drawings.
5. Provide spare licenses and hardware to support 5% additional reader and I/O capacity.
6. Cybersecurity requirements for the access control system are specified in Section 280500 - Common Work Results for Electronic Security Systems.

2.2 APPLICATION SOFTWARE:

A. Manufacturer: Lenel S2 OnGuard (no substitutions)

B. General: The existing Lenel S2 server is located at the Long Hill Administration Building. New door controllers shall be configured, and be integrated with, the existing Lenel S2 system serving the school district.

2.3 SYSTEM HARDWARE:

A. Access control panels: each cabinet shall incorporate the following operational features:
1. Manufacturer: Lenel S2 Onguard.
2. Distributed intelligence architecture with each controller operating independently.
3. Database information shall be stored at the panel level. Decision making shall be performed at the field panel and upon loss of power the panel shall not revert to a degraded mode.
4. In the event of communications failure with the host, the controller shall provide complete control, operation, and supervision of monitored and controlled points. In the communications failure mode, the system shall store transactions in a first-in first-out buffer until the panel is brought back online at which time the data shall be uploaded to the server.

5. Field panels shall be flash ROM upgradeable.
6. Field panels shall support communications via RS-485, and TCP/IP.
7. Field panels shall hold a minimum of 50,000 cardholders in memory.
8. Field panels shall be mounted inside equipment enclosures with key lockable doors and tamper switches.
9. Communications lines to the server shall be supervised. In the event of failure, the system shall detect failure within 2 seconds and report the failure as an alarm condition.
10. Field panels shall report cabinet tamper, reader communications loss, AC power loss, and low battery.
11. The controller shall support the Security Industry Association's (SIA) Open Supervised Device Protocol (OSDP) compatible card readers or smart card readers.
12. The controller shall support Wiegand compatible card readers.
13. The controller shall support the Security Industry Association's (SIA) Open Supervised Device Protocol (OSDP) compatible card readers or smart card readers, as well as Wiegand compatible card readers.

2.4 ACCESS CONTROL PERIPHERAL EQUIPMENT

A. Card and RFID Readers:
   1. Prox Card Readers:
      a. 125 KHz technology.
      b. Color: as selected by the Owner.
      c. Manufacturer: Allegion AptiQ, Farpointe Pyramid, or HID.
   2. Smart Card Readers:
      a. Communication signals between the reader and the access control panel shall be encrypted and transmitted via RS-485 using the Security Industry Association's Open Supervised Device Protocol (SIA 2012 OSDP) .
      b. Standard readers: surface-mounted style, combination 125 KHz proximity and 13.56 MHz contactless smart card readers designed for mounting into a single-gang back box.
      c. Mullion readers: Card readers indicated to be mounted on mullions (whether single or dual technology) shall be designed for mounting onto window and door mullions.
      d. Reader firmware shall be flash upgradeable.
      e. Readers and cards shall conform to the Transportation Worker Identification Credential (TWIC) Program.
      f. RF data transmission between cards and readers shall be encrypted using a secure algorithm.
      g. Readers shall be potted, polycarbonate material, sealed to a NEMA 4X or IP65 rating.
      h. Readers shall provide the ability to change operational features in the field using a factory-programmed command card. Command card operational options shall include:
         1) Output configurations.
         2) LED and audio configuration.
         3) Keypad configurations.
      i. Card readers shall provide the following programmable audio-visual indication:
         1) An audio transducer shall provide various tone sequences to signify; access granted, access denied, power up, and diagnostics.

2) A high-intensity LED light bar shall provide clear visual status (red/green/amber) that is visible even in bright sunlight.
3) Contactless smart card read range shall be 2" to 3" using cards, 1" using key fobs, 1" using stickers (tags), 1" to 1.5" using smart + 125 kHz proximity cards, and 1" to 2" using MIFARE cards (card serial number only).

j. Manufacturer: Lenel S2.

2.5 DETECTION DEVICES

A. Magnetic Contacts:
1. For hinged doors:recessed switches for door head installation. Switches shall be magnetic, single-pole, double-throw type, providing dual circuit operation, designed for line supervision. Switches shall be tested and proven capable of initiating an alarm signal when the protected door is opened 2" on the latch side. Color of exposed portions of the door contacts (brown, grey, or white) shall be that which most closely matches the door frame color.
2. Switches shall be UL 634 Level 1 high security balanced magnetic switches.
3. Switches shall be UL 634 Level 2 high security balanced magnetic switches.
4. For overhead doors: extra heavy duty, aluminum bar stock construction, floor-mounted contact, single-pole, double-throw type, providing dual circuit operation, for use on roll-up doors and rolling gates. Contacts shall have 3' stainless steel armored cables.
5. Alarm contacts shall be designed for 12 V to 30 V DC, nonpolarized service.
6. Manufacturer: Amseco (a Potter Brand), Bosch, Honeywell, Magnasphere, Potter Electric Signal Company, or United Technologies Company (UTC) Fire & Security.

2.6 OTHER ACCESS CONTROL SYSTEM RELATED HARDWARE

A. Request-to-Exit Push Buttons:
1. Single-gang box mounting.
2. Normally open/normally closed, 1 A rated contacts.
3. Illuminated push button.
4. Tamperproof mounting screws.
5. Access and secure LEDs integral with the faceplate or the push button.
6. Coverplate finish: stainless steel.
7. Time delay module in compliance with NFPA 101-2018.
8. Manufacturer: Allegion, Assa Abloy, or Dortronics.

B. Emergency Door Release Pull Stations:
1. Single-gang box mounting.
2. Normally open/normally closed, 1 A rated contacts.
3. Tamperproof mounting screws.
4. Coverplate finish: stainless steel.
5. Manufacturer: Allegion, Assa Abloy, or Dortronics.

C. Egress Delay Controllers:
1. Comply with NFPA 101-2018.
2. Adjustable delay time from 1 s to 30 s.
3. Fire alarm system interface to allow instant lock release upon alarm initiation.

4. Auxiliary power output to drive keypads and local alarm devices.
5. Alarm output.
6. Alarm shunt input.
7. Battery back-up.
8. Manufacturer: Allegion, Assa Abloy, or Dortronics.

D. Request-to-Exit Motion Detectors:
1. Passive infrared type. Dual technology type, range-controlled radar (RCR) and active passive infrared (PIR).
2. Walk-test light.
3. Form C, double-pole double-throw output relay rated for 30 V (AC/DC), 0.5 A.
4. UL listed.
5. Service: 12 V to 24 V DC.
6. Color: White.
7. Basis of Design: Interlogix Aritech RCR-REX.
8. Manufacturer: Bosch DS160, Securitron XMS, or Interlogix Aritech RCR-REX.

2.7 POWER SUPPLY EQUIPMENT

A. Power Supplies:
1. Mounted in a NEMA 1 hinged enclosure with power indicator integral with door.
2. Rated at 1.2 times the current draw for devices served. For door locking hardwar with current draw under 0.75 amperes, coordinate with Division 8 for electrical power requirements.
3. Individually fused or PTC outputs to each device.
4. For lock power supplies provide input for connection to a UL listed fire alarm panel output, which upon initiation shall disconnect power to selectable lock outputs.
5. Power Supplies shall have UL listing marks for the intended categories:
   a. UL 294 Access Control Systems
   b. UL 603 ULBurglar Alarm Power Supplies
   c. UL 1076 Proprietary Burglar Alarm Systems
6. Power Supplies shall be Class 2 power limited with correct accessory boards.
7. System Health and Performance Monitoring:
   a. Total System Health: Faults, output draw, battery state and temperatures.
   b. Output Condition: Current draw, voltage level and output status.
   c. Battery Activity: Charging current, discharge level, time to service.
   d. Power History: AC outages, time stamped faults, and enclosure tampering
   e. Fire Alarm activation.
8. System Controls
   a. Independent output control for remote reset functions
   b. Scheduled or manual battery checks
9. Web based service functions:
   a. AC loss or trouble faults.
   b. Connected devices shall be able to be independently power cycled
   c. Live monitoring of status.
   d. Remote manual battery testing.
   e. Basis of Design: Insert Make and Model.

f. Manufacturer: Alarm-Saf, Allegion, Altronix, Assa Abloy/Securitron, or Life Safety Power.

2.8 MISCELLANEOUS EQUIPMENT

A. Door Hardware and Locking Devices:
1. Wiring of electric door hardware furnished and installed under Division 8.
2. Wiring of electric door hardware furnished and installed under this Section.
a. General:
1) Electrified locking devices shall comply with:
a) BHMA A156.25.
b) ICC A117.1.
c) NFPA 80.
d) NFPA 101-2018.
e) UL 1034.
f) Hardware on fire rated doors and frames as listed and classified by UL as suitable for the purpose specified and indicated.
2) Lock Voltage: 24V DC.
3) Manufacturer: Allegion, Assa Abloy or Dorma.
b. Electromagnetic Locks:
1) Electromagnetic locks shall meet BHMA A156.23.
2) Electromagnetic locks shall have been manufactured by an ISO 9001 certified manufacturer.
3) Locks shall hold against a minimum of 1500 lbf applied to the door.
4) Electromagnetic locks shall be equipped with an SPDT magnetic bond sensing device to monitor whether sufficient magnetic holding force exists to ensure adequate locking. The bond sensor shall be fully concealed within the electromagnet to resist tampering or damage.
5) Electromagnetic locks shall be equipped with a concealed adjustable time delay option to re-lock the door within one to 90 seconds.
6) Electromagnetic locks shall include mounting hardware compatible with the doors to which they are applied.
c. Electric Strikes:
1) Electric strikes shall meet BHMA A156.31.
2) Electric strikes shall be heavy duty, tamper resistant, fail secure, reversible type.
3) Electric strikes shall be constructed of stainless steel.
4) Mortise electric strikes shall have been tested to withstand a forcing strength of 3,000 lbf and a minimum of two million cycles.
5) Surface electric strikes shall have been tested to withstand a forcing strength of 1,900 lbf and a minimum of one million cycles.
6) Strikes shall be listed UL 10C as a fire door accessory.
7) Electric strikes shall have a five-year limited warranty.
d. Electric Locksets:

1) Electric locksets shall be heavy duty, mortise type locksets.
2) Electric locksets shall contain an integral request-to-exit switch.

e. Delay Egress Locks:
1) Delay egress locks shall meet BHMA A156.24.

f. Lock and Key-Lock Switches:
1) Switches shall be UL listed.
2) Locking mechanism shall be round-key type with 3 dual, 1 mushroom, and 3 plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of 5 cylinder pins and 5-point 3-position side bars in the same lock.

g. Electric Hinges:
1) Provide electric hinges with standardized wire colors and concealed plug connectors to accommodate up to 12 wires.
2) Coordinate plug connectors so they plug directly into a wiring harness for connection to electric locking devices and power supplies.
3) Hinges shall be by original manufacturer.

h. Electric Power Transfers:
1) Ball-and-socket joint construction for cut and pinch protection for wiring.
2) Ten 24-gauge wires, up to 1 AMPS @ 24VDC, with a 16 AMPS maximum surge.

B. Local door alarm:
1. Features:
a. Local Warning Alarm.
b. Door Held Alarm.
c. Forced Door Alarm.
d. Supervised Door Contact Monitoring.
e. Remote Alarm Bypass.
f. Request to Exit.
g. Request to Enter.
h. Adjustable Time Delays.
i. Automatic Alarm Reset Delay.
j. Access and Secure LED's.
2. Power: 12 - 24 VAC/VDC @ 250 ma. max.
3. Inputs:
a. 1 Normally Closed fully supervised door input.
b. 3 Access Control inputs: Remote N/O alarm bypass, N/O or N/C request to exit shunt, and fail-safe or fail secure lock voltage monitoring (12 - 24 VAC/VDC).
4. Outputs:
a. 1 Normally Closed Entry Alarm Relay rated @ 0.5 A. Opens with forced door alarm or door held alarm after lock voltage shunt.
b. 1 Normally Closed Exit Alarm Relay rated @ 1/2 A. Opens with door held alarm after request to exit shunt.
5. Alarm sounder: 85 dB minimum. Pulsing tones indicate warning alarm, and constant tone indicates door violation alarm.
6. Green LED indicates access mode, Red indicates armed.

7. Time Delays:
   a. Access delay - adj. 0 - 60 sec. Shunts the alarm function for the duration of the delay.
   b. Warning delay - adj. 0 - 60 sec. Sets the duration of the warning alarm.
   c. Alarm automatic reset delay - adj. 0 - 60 sec. Sets the duration of an alarm if the automatic reset feature is enabled.
8. Field Configurable Options:
   a. Forced door alarm disable.
   b. N/O or N/C request to exit monitoring.
   c. Fail-safe or fail secure lock voltage monitoring.
   d. Alarm automatic reset disable.
9. Mortise cylinder mounting bracket with momentary 2 position switch with SPDT output.
10. Mounting 2 Gang, 2-½ inch deep electrical box.
11. Manufacturer: Detex, Dortoronics, DSI, or Kouba Systems.

EXECUTION

3.1 GENERAL

A. Configure field panel communications as indicated on the Drawings.

B. Programming Requirements, Development, and Deliverables:
   1. Produce fill-in-the-blank forms to the Owner to solicit user input for programming the system. The questionnaires shall identify each programming item that requires user input to configure the ACAMS along with recommendations for responses. These questionnaires shall be finalized in a series of meetings with the Owner's designated agent until such time that the questionnaires are completed, and the Owner has authorized the information to be inputted into the ACAMS.
   2. The questionnaires shall include three series
      a. The first shall be to the Owner's IT Department for network connectivity requirements.
      b. The second shall be devoted to controller, alarm input and door programming, or hardware related programming and shall include:
         1) Controller naming schemes.
         2) Door and alarm input naming.
         3) Door unlock time and relock time.
         4) Door held open time.
         5) Door unlock and relock schedules.
      c. The third shall be devoted to alarm responses and related interface programming with associated action and reaction requirements to include:
         1) Video surveillance system call-up and switching requirements.
         2) Security Communication System interface requirements.
         3) External alarm signaling requirements.
         4) Graphic map development and door and alarm display.
      d. The fourth shall be related to display of alarm messaging, map development and any requirements for alarm responses and reporting.

3. Upon completion, the programming questionnaires and associated programming database sheets shall be included in the operation and maintenance documentation.

C. Minimum Programming Requirements:
1. Program the alarm bypass or shunt time (the time period the door can remain open before an alarm event is created) for 30 seconds, unless directed otherwise by the Owner's representative.
2. Program the door relock time (the time period after which the door will relock unless opened) for 5 seconds.
3. Program alarm response fields, door names, and any other user-defined fields with terminology and descriptions provided by the Owner.
4. Program access rights, password protection, system integration interfaces, holidays, area control, inputs and outputs, schedules, and elevator control.

D. Graphics:
1. Develop graphic maps that detail the facility and display inputs and outputs dynamically.
2. Maps shall be nested according to the following levels:
   a. Global.
   b. Country.
   c. City.
   d. Overall campus.
   e. Building.
   f. Floors.
   g. Further subdivided in alarm device location.
3. Utilize AutoCAD architectural floor plans that show walls, doors, windows, room names, and room numbers.

E. Control Panel Cybersecurity Configuration Requirements:
1. The following are minimum requirements:
   a. Place the access control system components on a private network, in a secured enclosure, and with updated firmware with firmware matching the existing installation.
   b. Enable HTTPS.
   c. Remove default user login, create a unique user account with a strong password.
   d. Add authorized IP Addresses.
   e. Disable web service, unless specifically required for operation.
   f. Disable discovery and SNMP services, unless specifically required for operation.
   g. Disable unused USB and SD interfaces.
   h. Enable AES or TLS encryption.
   i. Provide additional configuration changes per manufacturer’s requirements.
2. Provide report manufacturer’s certification that cybersecurity requirements have been met.

F. System Integration and Interfaces:
1. Upon an alarm condition or event to include but not limited to, an access point, duress button or other alarm input, intercom call, emergency phone call, the ACAMS shall cause the video surveillance system to:
   a. Automatically call up the associated video camera image on the designated video surveillance monitor or multi-display monitor segment.

b. The video signal for the associated video camera shall be transmitted to the roving security officer's smartphone or tablet.
c. Where remotely positionable video cameras are associated with the alarm, the camera shall be panned and tilted, and the lens zoomed to provide an acceptable (Owner approved) view of the event scene.
d. Where remotely positionable video cameras are associated with the alarm, the video camera shall be automatically selected for local control via the video management systems command keyboard.
e. The recorded video signal for the associated video camera shall be tagged or linked to the event in the access control system database.
f. An alarm event message shall be transmitted to the associated workstations or consoles causing an audible and visual alarm signal.
g. Where a local door sounder is located adjacent to the door, the sounder alarm shall be activated until reset at the workstation or console.
h. A graphical representation of the alarm scene (site or floor plan) with icons representing the open door, video camera, and other local devices shall be displayed on the graphical user interface (GUI). Icons representing active devices shall change color to indicate their state change (inactive to active).
i. The system shall be programmed with at least one video camera call-up for each event where there are cameras covering the location of the device causing the event.

G. Cardholder Enrollment:
1. Provide fill-in-the-blank forms to the Owner requesting needed information.
2. Based on the information provided, enter sample cards for each card holder type/category into the system to be used as a template by the Owner.

3.2 MISCELLANEOUS EQUIPMENT

A. Fire/Life Safety Interface:
1. Locking devices controlling emergency exits connected to the building fire alarm system, if locked in the direction of egress, shall unlock upon initiation of an alarm signal at the building fire alarm control panel or upon loss of primary power to the building.
2. The use of battery or emergency power shall not be used to keep emergency exits locked in the direction of egress.

B. End-of-Line Supervision:
1. Provide end-of-line resistors to monitor 4-state supervision (cut-line, short-circuit, switch open, switch closed) at each intrusion detection input device.
2. Resistors shall be installed at the monitored device location, not in the control panel.
3. Provide pre-manufactured resistor packs, or devices with integral resistor networks.

C. Request-to-exit pushbuttons: mount flush, in single-gang box on the secured side of the door, not greater than 48" above the finished floor. Signage shall be integral to each button "Push to Exit", or "Exit". Wire such that one pole provides the request-to-exit signal to the access control system and the other pole breaks power to the lock until the time delay period expires.

D. Emergency door release pull stations: Mount in single-gang box on the secured side of the door, not greater than 48" above the finished floor. Signage shall be integral to each button "Emergency Door Release", Wire such that one pole provides the signal to the access control system to notify of the emergency door release being activated, and the other pole breaks power to the lock.

E. Egress delay controllers: configure (wire and program) such that those doors with card readers will immediately release upon use of a valid credential without generating a local or remote alarm signal. The doors shall also be configured to relock once the door closes. The local siren shall be silenced by the closing of the door. Wire to report an alarm upon delay egress sequence activation and a second alarm upon the door opening.

F. Electric hinges shall be installed at the middle hinge location, unless otherwise noted.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Program an access card to open all doors in the system. Program a second access card to open all doors in the system, but then classify the card as lost or stolen. Attempt to access each door using the valid card first, and the card classified as lost or stolen card second.
   2. For access-controlled doors, test the following parameters or functions:
      a. Valid card read of an authorized user unlocks the door.
   3. Valid card read of an authorized user shunts or bypasses door forced alarm.
      a. Valid card read of a card reported lost or stolen creates an unauthorized use of lost card event in the system.
      b. Door forced open (or unlocked with a key) without the use of a valid card creates a “door forced” event and displays event on security workstation with operator instructions.
      c. Door held open beyond the door alarm shunt time creates a “door propped” event and displays event on security workstation with operator instructions.
      d. Where a local door sounder is located adjacent to the door, the event activates the sounder alarm until reset at the workstation or console.
      e. On the GUI, the event causes icons representing active devices to change color to indicate their state change (inactive to active).
      f. Door forced or door prop event automatically calls up the associated video camera image(s) (if any) on the designated video surveillance monitor(s).
      g. The event causes the video signal for the associated video camera(s) (if any) to be transmitted to the roving security officer's smartphone or tablet.
      h. Where remotely positionable video cameras are associated with the alarm, the event causes the camera to be panned and tilted, and the lens zoomed to provide an acceptable (Owner approved) view of the event scene.
      i. Where remotely positionable video cameras are associated with the alarm, the event causes the video camera to be automatically selected for local control via the video management systems command keyboard.
      j. The event causes the recorded video signal for the associated video camera(s) (if any) to be tagged or linked to the event in the access control system database.

B. Test Reports:
   1. Print a report showing the activity of the valid card during the test period, as well as the alarm activity for the test period. Confirm that the report shows a valid access for each door in the system for the valid card, and that the card classified as lost or stolen generated an appropriate alarm or exception report for each door in the system. Present this report to the Architect.
   2. Access control system functional test reports.

3.4 INSTRUCTION OF OPERATING PERSONNEL

A. Factory-trained technicians shall give operating and maintenance instructions on the access control systems. The duration of each session for each system type shall be a minimum of quantity hours.

B. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

END OF SECTION

SECTION 281353 - SECURITY IP NETWORK COMPATIBLE INTERCOM SYSTEMS

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers the security intercom systems. The security intercom shall be an IP-based audio and video intercom system shall be provided to support intercom communications from selected areas of the facility

B. Audio-Visual door intercom stations and master stations shall be integrated with the Milestone VMS.

1.2 RELATED SECTIONS

A. 280500 - Common Work Results for Electronic Security Systems.

B. 280513 - Conductors and Cables for Electronic Security.

C. 280528 - Pathways for Electronic Security

D. 280800 - Commissioning of Electronic Security.

E. 281000 - Access Control.

1.3 REFERENCE STANDARDS

A. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

1.4 QUALITY ASSURANCE

A. Installation of the security intercom systems shall be under the direct supervision of a person or persons having completed, as a minimum, the factory training recommended by the system manufacturer.

B. Manufacturer Qualifications: Manufacturers shall be companies specializing in manufacturing the type of products specified in this Section with minimum 3 years of documented experience.

C. Supplier qualifications: the supplier shall be a company authorized by the manufacturer and specializing in supplying products specified in this Section with minimum 3 years of documented experience.

D. Installer qualifications: the installer shall be a company specializing in installing the products specified in this Section with minimum 3 years of documented experience.

1.5 SUBMITTALS

A. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

B. Action Submittals:
   1. Product Data:
      a. Provide product data sheets for equipment, materials, and cables in PDF format.
   2. Shop Drawings:
      a. Include floor plans indicating equipment locations. Plans shall include equipment identification and either direct references to wiring details for each specific installation and wiring condition or a schedule that references the same.
      b. Wiring diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
      c. Provide elevations of console or rack-mounted equipment, if any, showing the location of all specified electronics and include enlarged, to scale plan (top), and front views.
      d. Provide project specific manufacturer shop drawings of fabricated or modified units, if any.
      e. Provide riser diagrams indicating components of the system and proposed cabling between these components.
      f. Provide block diagrams indicating the proposed interface between the security IP network compatible intercom system and the access control system.
      g. Provide block diagrams indicating the proposed interface between the security IP network compatible intercom system and the video surveillance system.
      h. Provide a written description of the proposed sequence of operation to describe the operation of the interfaces.
      i. Provide detailed project specific mounting diagram for each type of device including raceway and back box requirements. These details shall be referenced on the floor plans or schedules.

C. Informational Submittals: As required in Section 280500 - Common Work Results for Electronic Security Systems.

D. Close-out Submittals:
   1. Functional Test Reports: Provide a spreadsheet with all security IP network compatible intercom system devices and major components listed in the first column by device designator (e.g., intercom station number) with each test parameter listed by name (or code) in the remaining columns.
   2. Operations and Maintenance Documentation Package: As required in Section 280500 - Common Work Results for Electronic Security Systems.
   3. Instruction of Operating Personnel:
      a. The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.
      b. Obtain receipt from the Owner acknowledging completion of each item of instruction.
      c. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. The intercom system shall consist of IP-based audio-video master stations and substations as indicated on the Drawings.

B. The intercom system shall be provided with all hardware, software, and software licenses, to support the devices shown on the drawings and provide fully functional systems as required herein.

C. System wide function requirements include:
   1. The intercom system shall provide a minimum speaker frequency response of 200 Hz to 3400 Hz, loudness of 85 dB sound pressure level ±3 dB.
   2. The intercom system shall provide active or dynamic background noise suppression.

D. Integration:
   1. The intercom system shall support integration with the video surveillance system provided under Section 282000 - Video Surveillance to the level of functionality described herein.

E. Manufacturer: Axis (no substitutions)

2.2 MASTER STATIONS:

A. General:
   1. Master stations shall have the capability to selectively call any master station or remote station in the system.
   2. Master stations shall allow the operator to selectively release any door or open any gate in the system where communication is established.
   3. Calls to a master station shall cause a tone to sound and display the location of the call.
   4. Master stations shall be able to forward calls to another master station in the system.

B. Video Intercom Master Stations:
   1. Desktop style master station.
   2. Displays: minimum 3.5" color-LCD or TFT display for graphical menu navigation and display of video from selected station camera. Minimum display resolution shall be 320 x 240 pixels with 65,000 colors.
   3. Video Codec: H.264 or MJPEG.
   4. Integral jack for handset operation. Provide 1 handset per master station.
   5. Integral jack for headset operation. Provide 1 compatible headset per master station.
   6. Integral jack for connection of gooseneck microphone. Provide one compatible gooseneck microphone.
   7. Power supply: Powered from IEEE 802.3 POE IEEE 802.3af class 0.

2.3 SUBSTATIONS:

A. General:

1. Provide IoIP (Intercom over IP) substations that connect directly to IP networks with Static IP or DHCP.
2. Provide VoIP telephone system SIP compatible substations that connect to the existing VoIP telephone switch. The VoIP telephone switch will be provided by the Owner. provided under a separate contract. provided under Division 27.
3. Substations shall be tamper resistant, vandal resistant, and ADA Standards for Accessible Design-2010 compliant. Intercom substations located in outdoor or environmentally uncontrolled areas shall be weather resistant.

B. Video Intercom Substations:
1. Video Intercom substations shall be equipped with integral microphone, loudspeaker, integral camera, in-use LED, and push-to-call button, all housed in one-unit. Stations shall be flush mounted unless otherwise noted on the drawings.
2. Integral camera:
   a. Image sensors: 0.25" or larger progressive scan RGB CMOS.
   b. Lens: minimum 80º horizontal field-of-view.
   c. Light sensitivity: 0.5 fc (5 lux).
   d. Video compression: H.264 or MJPEG.
   e. ONVIF Profile S compliant.
   f. Camera shall be compatible with the video management system provided under Section 282000 - Video Surveillance ms.
3. Inputs: minimum 1 input.
4. Outputs: minimum 1 relay outputs rated for 30 V at 500 mA.
5. Operating temperature: -4º F to 140º F.
6. Relative humidity: up to 95% non-condensing.
7. Power supply: IEEE 802.3 POE IEEE 802.3af class 0.

PART 3 EXECUTION

3.1 GENERAL

A. Cables:
1. Size power conductors as required to ensure voltage drop does not exceed 10% of the source voltage of the load.
2. Data cables shall be as recommended by the manufacturer.

B. Programming:
1. Produce questionnaires to solicit user input for programming the system. The questionnaires shall identify each programming item that requires user input to configure the intercom system along with recommendations for responses. These questionnaires shall be finalized in a series of meetings with the Owner's designated agent until such time that the questionnaires are completed, and the Owner has authorized the information to be inputted into the intercom system.
2. Configure and program the system per the completed questionnaires. Program master station and substation names and any other user-defined fields with terminology and descriptions provided by the Owner.
3. Program access rights and password protection.

4. Upon completion, the programming questionnaires and associated programming database sheets shall be included in the operation and maintenance documentation.
5. Program and configure the ACAMS interface such that each security intercom call event shall result in the following actions:
    a. The intercom call shall be logged as an event in the ACAMS.
    b. Where an access-controlled door is associated with the intercom station, the door control command screen shall be selected and displayed on the security management system monitor, provided the officer with appropriate clearance is logged onto the workstation.
6. Program and configure the video surveillance system interface, such that each security intercom call event shall result in the following actions:
    a. The video signal for the associated video camera shall be switched to the first available event monitor of the associated workstation or console.
    b. Where remotely positionable video cameras are associated with the intercom, the camera shall be panned and tilted, and the lens zoomed to provide an acceptable (Owner approved) view of the intercom station.
    c. Where remotely positionable video cameras are associated with the intercom, the video camera shall be automatically selected for local control via the video surveillance system command keyboard.
    d. The associated video recording shall be tagged in the software to the intercom event and recorded on a NVR at a frame rate of 15 frames per second at the camera's highest available resolution for the duration of the event.
    e. The audio signal of the intercom selected shall be switched to the master intercom station in the same location.
    f. A graphical representation of the intercom location (site or floor plan) with icons representing the intercom, video camera, and any doors or other devices shall be displayed on the graphical user interface. Icons representing active devices shall change color to indicate their state change (inactive to active).

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
    1. Provide a screenshot of the integral video monitor display of a live call during business hours and after dark. Test the following parameters or functions:
        a. Each intercom substation shall provide clear noise-free communications with each master station as specified herein and indicated on the Drawings.
        b. Each intercom substation call status LEDs shall operate as designed.
        c. Each intercom substation integral camera shall functions as designed.
        d. Each master station shall provide clear and noise-free communications with each remote station as specified herein and indicated on the Drawings.
        e. Each master intercom station call status LEDs shall operate as designed.
        f. Each master station shall provide clear and noise-free communications with every other master station as specified herein and indicated on the Drawings.

g. Initiation of an intercom call causes the recorded video signal for the associated video cameras to be tagged or linked to the event in the access control system database.

B. Test Reports:
1. Security IP Compatible Intercom System Functional Test Report.

3.3 INSTRUCTION OF OPERATING PERSONNEL

A. Factory-trained technicians shall give operating and maintenance instructions on the security IP network compatible intercom system and equipment. The duration of each session for each system type shall be a minimum of 1 hour.

B. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

END OF SECTION

SECTION 282000 - VIDEO SURVEILLANCE

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers video surveillance systems.

B. The video surveillance system shall consist of IP video cameras, video servers and digital storage media, and security system workstations, all connected to a local area network.

1.2 RELATED REQUIREMENTS

A. 280500 - Common Work Results for Electronic Security Systems.

B. 280513 - Conductors and Cables for Electronic Security.

C. 280528 - Pathways for Electronic Security.

D. 280800 - Commissioning of Electronic Security.

E. 281000 - Access Control.

F. 281353 - Security IP Network Compatible Intercom Systems.

G. 283100 - Intrusion Detection.

1.3 REFERENCE STANDARDS

A. FIPS 140-2 - Security Requirements for Cryptographic Modules; Current Edition.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

C. IEC 62262 - Degrees of Protection Provided by Enclosures for Electrical Equipment Against External Mechanical Impacts (IK Code); 2002, with Amendment (2021).

D. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

E. NEMA 250 - Enclosures for Electrical Equipment; 2020.

1.4 SUBMITTALS

A. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

B. Action Submittals:
   1. Product Data:
      a. Provide product data sheets for equipment, materials, and cables in PDF format..
   2. Shop Drawings:
      a. Include site and floor plans indicating equipment locations. Plans shall include equipment identification and either direct references to wiring details for each specific installation and wiring condition or a schedule that references the same.
      b. Wiring diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
      c. Provide elevations of console or rack-mounted equipment, showing the location of all specified electronics and include enlarged, to scale plan (top), and front views.
      d. Provide project specific manufacturer shop drawings of fabricated or modified units, if any.
      e. Provide riser diagrams indicating components of the system and proposed cabling between these components.
      f. Provide block diagrams indicating the proposed interface between the video surveillance system and the access control system.
      g. Provide block diagrams indicating the proposed interface between the video surveillance system and the intercom system.
      h. Provide a written description of the proposed sequence of operation to describe the operation of the interfaces.
      i. Provide detailed project specific mounting diagram for each type of device including raceway and back box requirements. These details shall be referenced on the floor plans or schedules.
      j. Provide a detailed loading schedule for each video surveillance network switch, patch panel, network video server recorder, and other head-end equipment identifying each device connected to it.

C. Informational Submittals:
   1. Resumes of key personnel that documents the qualifications required. Include certificate of training or certifications.
   2. As required in Section 280500 - Common Work Results for Electronic Security Systems.

D. Close-out Submittals:
   1. Functional Test Reports: Provide a spreadsheet with all video surveillance system devices and major components listed in the first column by device designator (e.g., camera number) with each test parameter listed by name (or code) in the remaining columns.
   2. Operations and Maintenance Documentation Package: As defined in Section 280500 - Common Work Results for Electronic Security Systems.
   3. Instruction of Operating Personnel:
      a. The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.
      b. Obtain receipt from the Owner acknowledging completion of each item of instruction.
      c. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

1.5 QUALITY ASSURANCE

A. The video surveillance system contractor, the contractor's supervisors, and technicians shall meet the qualifications as defined in Section 280500 - Common Work Results for Electronic Security Systems.

B. Qualifications of Contractor:
   1. The video surveillance system installation company shall have field office located within a 100-mile radius of the Project with a minimum of two permanently employed persons with current video management system certification directly responsible for the installation and ongoing maintenance of the project.
   2. Installation of the video surveillance system shall be provided by a person or persons having completed, as a minimum, the factory training recommended by the video management system manufacturer and have direct field experience in the installation of a minimum of 3 projects of similar scope and size within the past 5 years.
   3. The video surveillance system Project Manager or Project Supervisor shall have direct field experience in the installation of a minimum of 3 video surveillance systems projects of similar scope and size within the past 5 years.
   4. Programming and configuration of the video surveillance system shall be provided onsite by a person or persons having completed the video management system manufacturer's highest available certification program and have direct field experience in the programming and configuration of a minimum of 3 projects of similar scope and size within the past 5 years.
   5. The video surveillance system installation company shall be a currently listed as an authorized dealer or business partner by the manufacturer of the video management system and shall have been listed as such for a minimum of 3 years.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise specified herein, quantities of equipment are indicated on the Drawings.

B. Provide compatible components. Provide IP cameras that are manufacturer certified compatible with the video management system software provided herein.

C. The video surveillance system shall be compatible with the access control and alarm monitoring system software provided under Section 281000 - Access Control.

D. Cybersecurity requirements for the video surveillance system are defined in Section 280500 - Common Work Results for Electronic Security Systems.

2.2 VIDEO CAMERAS AND ACCESSORIES

A. Video cameras shall have the following minimum features:
   1. Image sensor: progressive scan CCD or CMOS sensor, 0.33" or larger.
   2. Provide day/night (color/monochrome with IR filter removal) type cameras for outdoor areas.
   3. Digital processing with automatic white balance, automatic gain control, electronic shutter control, and backlight compensation.
   4. Event triggers: video motion detection (internal), active tampering alarm, and external input.

5. Event actions: pre- and post-alarm video buffering.
6. Dynamic range: minimum 65 dB., except camera types specified to have wide dynamic range shall have a minimum of 100 dB dynamic range.
7. Network interface: IEEE 802.3 Ethernet 100 BaseT.
8. Supported protocols: TCP/IP, UDP/IP, DHCP, HTTP, Multicast, PPPoE, RTP, and RTSP.
9. Security: SSL-based authentication.
10. FIPS140-2 compatibility with FIPS 140-2 compliant NVR.
11. ONVIF Profile S compliant (www.onvif.orgwww.onvif.org).
12. Compression: H.265, H.264 Baseline and Main Profile (MPEG-4 Part 10/AVC), and Motion JPEG, each stream independently selectable and capable of being transmitted to separate locations.
13. VBR (variable bitrate) or CBR (constant bitrate) encoding format selectable to correspond with various network conditions.
14. Audio: bidirectional audio with line input and line level output.
15. Lens: varifocal, remote focus and control, auto-iris control, IR corrected, and designed for camera's megapixel resolution.
16. Minimum illumination sensitivity requirements (50 IRE):
    a. Non-low-light cameras: using wide angle lens (3-9 mm); 0.4 lux (F1.2) in color mode, 0.03 lux (F1.2) in monochrome mode; using telephoto lens; 0.6 lux (F1.2) in color mode, 0.06 lux (F1.2) in monochrome mode.
    b. Low light cameras: minimum illumination: 0.04 lux (F1.2) in color mode; 0.008 fc (F1.2) in monochrome mode.
    c. For IR capable cameras: 0.0 lux (F1.2) when infrared illuminators are switched on.
17. Frame rate at maximum resolution: capable of 30 frames or images per second.
18. External I/O terminals: alarm input, alarm output.
19. Event triggers: video motion detection (internal), active tampering alarm, and external input.
20. Analytics integral to the camera (cameras and VMS shall be from the same manufacturer):
    a. Objects in Area: The event is triggered when the selected object type moves into the region of interest.
    b. Object Loitering: The event is triggered when the selected object type moves into the region of interest and then stays for an extended amount of time.
    c. Objects Crossing Beam: The event is triggered when the specified number of selected objects have crossed the directional beam that is configured over the camera’s field of view. The beam can be unidirectional or bidirectional.
    d. Object Appears or Enters Area: The event is triggered by each selected object that enters the region of interest. This event can be used to count objects.
    e. Object Not Present in Area: The event is triggered when no selected objects are present in the region of interest.
    f. Objects Enter Area: The event is triggered when the specified number of selected objects have entered the region of interest.
    g. Objects Leave Area: The event is triggered when the specified number of selected objects have left the region of interest.
    h. Object Stops in Area: The event is triggered when a selected object moves into a region of interest and then stops moving for the specified threshold time.

i. Direction Violated: The event is triggered when a selected object moves in the prohibited direction of travel.
j. Tamper Detection: The event is triggered when the scene unexpectedly changes.

21. Supported Classified Object Types:
    a. Object Types in Outdoor Mode: Vehicle, sub-types: Car, Truck, Bicycle, Motorcycle, Bus, and Person.
    b. Object Types in Indoor Mode: Person.
22. Where required on Drawings, provide built-in 850 nm LED infrared (IR) illuminator with 100' range for wide angle lens, and 200’ range for telephoto lens.
23. Integral memory card for edge storage, minimum capacity 32 GB.
24. Power: IEEE 802.3 8) or compliant PoE. Pan-tilt-zoom type cameras shall also be capable of operation via 24 V AC power.

B. Camera Enclosures and Mounting Hardware:
1. Style: Minidome, microdome, or bullet, as indicated on the Drawings.
2. Color: Color of non-transparent portions of the camera housing (normally black or white) shall be coordinated with the Architect. Transparent portion of dome or bullet shall be smoked glass or polycarbonate.
3. For cameras located in environmentally controlled areas (indoors) enclosures and mounting hardware shall have the following minimum features:
    a. Compatible with the camera and lens provided.
    b. Operating range from 14ºF to 100ºF
    c. IK10 rated for impact resistant.
    d. Enclosures and mounting hardware of the style and type indicated on the Drawings.
4. For each camera located in an environmentally uncontrolled area (outdoors), enclosures and appropriate mounting hardware shall have the following minimum features:
    a. Compatible with the camera and lens provided.
    b. Operating range from -22ºF to 140ºF.
    c. IEC 60529 IP66 or NEMA 250 4X rated enclosure.
    d. IEC 62262 IK10 rated for impact resistant.
    e. Sunshield where the video camera is exposed to direct sun.
    f. Enclosures and mounting hardware of the style and type indicated on the Drawings.

C. Manufacturer: Axis (no substitutions)

2.3 NETWORK VIDEO SURVEILLANCE SYSTEMS SOFTWARE

A. The NVMS shall be the latest enterprise version of the video management software.

B. The NVMS shall be scalable from one client, server, and camera to more than a thousand clients, servers, and cameras.

C. The NVMS shall consist of server software applications and client software applications.

D. The NVMS shall include a gateway software application that connects mobile devices to the NVMS.

E. The English language version of the NVMS shall be provided.

F. Compatibility Requirements:
1. The NVMS shall support recording and management of video and audio sources including:
   a. ONVIF compliant IP devices.
   b. Third-party IP devices, including Axis .

G. NVMS Architecture:
1. The NVMS shall support edge-based storage and processing of video and audio.
2. The NVMS shall require no proprietary recording hardware, no hardware multiplexer or time-division technology for video and audio recording or monitoring. The NVMS shall permit server and client software applications to be installed and run on either the same computer or on separate computers.
3. The NVMS shall support receiving digital input triggers and triggering digital outputs.

H. Security Requirements:
1. The NVMS shall digitally sign recorded video and audio using 256-bit encryption so video can be authenticated for evidentiary purposes.
2. The NVMS shall provide the ability to add privacy zones to a video source to block unwanted areas in the image field of view.
3. The NVMS shall authenticate users before granting access to the system.
   a. Basic access rights shall be defined individually for each user, and shall include; viewing live images, using PTZ controls, locking PTZ controls, triggering manual recording, triggering digital outputs, listening to microphones, broadcasting to speakers, viewing recorded images, exporting images, backing-up recorded images, managing user sessions, connecting and disconnecting cameras, viewing the system log, and accessing individual video and audio sources.
   b. Administration access rights shall be defined individually for each user, and shall also include the ability to configure or adjust camera general settings, camera network settings, camera image and display settings, camera compression and image rate, camera image dimension settings, camera motion detection settings, camera privacy zone settings, camera manual recording settings, camera digital input and output settings, camera microphone settings, camera speaker settings, general server settings, server schedule settings, server recording and bandwidth settings, server user and group settings, server alarm management settings, server scheduled backup settings, server rule engine settings, and server e-mail settings.
4. The NVMS shall provide the ability to import members of active directory groups as users in the NVMS. Changes made to members in the active directory shall be automatically synchronized with the NVMS.
5. The NVMS shall support using Windows credentials to authenticate users.

I. Event Logging Requirements:
1. The NVMS shall maintain an event log for critical server hardware and software events, device events, user events, and alarm events.
2. The NVMS shall have the capability to schedule and execute any of the following user notification actions in response to any of the events listed above:
   a. Start live streaming video.

b. Trigger an output.
c. Go to PTZ preset, run a PTZ pattern, set auxiliary, and clear auxiliary.
d. Trigger an alarm and acknowledge an alarm.
e. Provide a maintenance log and audit trail of all system errors and events.

J. The NVMS shall provide the following setup and administration capabilities:
1. The ability to discover all VMS server instances running on computers connected to the same network as the VMS client.
2. The ability to discover VMS server instances running on computers connected on a different network segment than the VMS client by using IP addresses or hostnames.
3. The ability to discover video and audio sources that are connected to the same network as the VMS server.
4. The ability to discover video and audio sources that are connected on a different network segment than the VMS server.
5. The ability to provide administration of all system connections from a single window.
6. The ability to detect video or audio signal loss and alert the system administrator.
7. The ability to rename all video and audio sources and NVRs.
8. The ability to schedule the monitoring of alarm inputs.
9. The ability to schedule backups of recorded video of associated events to a local folder or mapped network drive.
10. The ability to email users and system administrators when an event or system health error occurs.
11. The ability to schedule when e-mail notifications are sent.
12. The ability to include camera images in e-mail notifications.

K. The NVMS shall provide the following display and viewing capabilities:
1. The ability to save and restore the window layout.
2. The ability to control the system using a PC keyboard or joystick.
3. The ability to import and export client settings such as maps, views, and web pages.
4. The ability to display the following live video overlays: camera name, camera location, timestamp, record indicator, PTZ controls, motion activity, and license plate.
5. The ability of supporting an unlimited number of monitors for monitoring video and audio streams.
6. The ability to monitor live and recorded video and audio streams simultaneously on the same monitor.
7. The ability to view the same live or recorded video stream at different zoom levels.
8. The ability to view live or recorded video of 1 to 36 video streams simultaneously on a single monitor with the following standard layouts: full screen, 2 x 2, 3 x 3, 4 x 4, and 6 x 6.
9. The ability to switch from live to recorded video on demand for an instant replay of recently recorded video.
10. The ability to save views.
11. The ability to drag and drop a view from a tree of views into a window for live or recorded video and audio monitoring.
12. The ability to configure how the tree of video sources and views is displayed.
13. The ability to designate one or more regions in a window for displaying video directly linked to triggered alarms and rules.
14. The ability to save a link to a web page and view the web page in a window.
15. The ability to digital zoom and pan within live and recorded video streams.
16. The ability to playback (forward and reverse) recorded video and audio at variable speeds.

L. The NVMS shall provide the following recording and playback capabilities:
   1. The ability to playback recorded video and audio from selected video sources.
   2. The ability to record video and audio streams based on a recording schedule that can be defined individually for each video source. The schedule shall be created with the following parameters: recording mode (continuous, motion, alarms, digital inputs) and time and date settings (daily and weekly).
   3. The ability to manually trigger recording.
   4. Pre-event and post-event recording.
   5. Reference frame recording in the absence of events.
   6. Motion detection on each individual video source with adjustable sensitivity, threshold and detection zones.
   7. The ability to reduce the image rate of recorded video over time as a means of increasing record time. The image rate of non-event recorded video shall be able to be reduced to one half or one quarter of the original image rate. This setting can be configured separately for each video source.
   8. The ability to set a maximum recorded video retention time for each video source.

M. The NVMS shall provide the following general control capabilities:
   1. The ability to manually trigger digital output.
   2. The ability to change image quality and image rate parameters for a video source without affecting the settings on the other video sources.
   3. The ability to enable a secondary stream for live viewing.
   4. The ability to change the exposure, iris, IR filter, backlight compensation, gain, sharpening, saturation, focus, and white balance settings for a video source.
   5. The ability to rotate the image 90°, 180° or 270° for a video source.
   6. The ability to set a maximum recording duration for manually triggered recording for a video source.

N. The NVMS shall provide the following audio capabilities:
   1. The ability to change the input, output, gain and volume for an audio source.
   2. The ability for full-duplex two-way audio communication.
   3. The ability to link any independent audio source to any video source.

O. The NVMS shall provide the following alarm monitoring capabilities:
   1. The ability to prioritize alarms.
   2. The ability to assign alarms to users.
   3. The ability to acknowledge alarms.

P. The NVMS shall provide the following search and navigation capabilities:
   1. The ability to navigate recorded video and audio via calendar, timeline, or events.
   2. The ability to display a timeline of connected video sources and the corresponding motion and recording events.
   3. The ability to display a timeline of the entire time range down to one second of recorded video and audio.
   4. The ability to create bookmarks for recorded video and audio from multiple sources, displaying the bookmarks on the timeline, and searching for bookmarks based on various search criteria including bookmark name, notes, and linked camera names.

5. The ability to search through recorded video and audio based on various search criteria including time, date, video source, events, and image region, and have the results displayed as a series of thumbnail images.
6. The ability to search through recorded video based on point-of-sale transaction events.
7. The ability to search through recorded video based on license plates detected in the images of the video source.

Q. The system shall provide the following map support capabilities:
1. The ability to create a map that represents the physical location of cameras and other devices throughout the surveillance system. Maps shall be created from images stored in JPEG, BMP, PNG, or GIF image formats. Maps shall have the ability to contain links so as to create a hierarchy of interlinked maps.
2. The ability to create a map that has a link to a section of the entire image region.
3. The ability to drag and drop a video source from a map into a window for live or recorded video and audio monitoring.
4. The ability to highlight a camera on a map when an alarm linked to the camera is triggered.
5. The ability to highlight a linked map that contains a camera when an alarm linked to the camera is triggered.

R. The system shall provide the following exporting capabilities:
1. The ability to export recorded video in the following formats: native, MJPEG, and AVI.
2. The ability to export recorded audio in WAV or ASF format.
3. The ability to take a snapshot of a live or recorded image and export it from the system.
4. The ability to export a user selected series of images in JPEG bitmap, or other Windows format.
5. The ability to review video and audio that was exported in the native format.
6. The ability to include the camera properties and time zone in video exported in native format.
7. The ability to authenticate video that was exported in the native format to validate that it was not tampered with.
8. The ability to convert video that was exported in the native format to an industry standard format.

S. The NVMS shall provide the following NVR Management capabilities:
1. The ability to automatically log in to an NVR.
2. The ability to automatically log out of an NVR when the application is left idle.

T. Intercom System Integration Requirements:
1. The NVMS shall support integration with the intercom system provided herein.
2. Provide the license necessary for integration with the intercom system provided herein.

U. Manufacturer: Milestone Systems (no substitutions)

2.4 VIDEO ANALYTICS APPLICATION SOFTWARE

A. The applications software shall be designed for the automated detection of targeted behaviors based on fully scalable, rules-based video content analytics with the following minimum features:
1. The video analytics engine shall be able to distinguish between moving foreground objects and moving background objects. Examples of moving background objects include leaves and trees blowing in the wind, water fountains, or ocean waves.

2. The video analytics engine shall be able to adapt to changes in the environment automatically, such as lighting changes (clouds passing in front of the sun), weather, changes in the seasons, or the camera being aimed in a different direction without any manual adjustments. The video analytics engine shall be able to automatically adapt to lighting changes due to auto-iris adjustments, or changes from day mode to night mode in the camera, within 6 seconds or less without creating false alarms. The video analytics engine shall continue to accurately detect with low false alarm rates even in conditions of bad weather, such as snow, rain, hail, fog, as long as objects can be seen.
3. The video analytics engine shall include self-learning capabilities, so that it can automatically learn the scene environment in less than 2 minutes after being powered on, and then begin detecting immediately afterwards. The video analytics engine shall automatically learn highly dynamic backgrounds, such as water rippling, leaves blowing in the wind, water fountains and escalators.
4. The video analytics engine shall use pattern matching, rather than pixel differentiating techniques, to identify objects of interest.
5. The video analytics engine shall compensate for camera vibration.
6. The video analytics engine shall be able to track objects of interest accurately even when there is highly dynamic background motion in the scene. The video analytics engine shall not lose track of objects when they cross paths with other moving objects. The video analytics engine shall continue to track objects when they change from side views to front views, or vice versa.
7. Management and configuration of cameras shall be done through a GUI-based configuration. The video analytics engine shall send alerts to client workstations as well as the ability to push alerts to mobile devices.
8. The video analytics engine shall create and store a metadata record of all the objects it sees, so that video can quickly and easily be searched later by object’s appearance, or other rule violations determined later.

B. The video analytics engine shall include the licenses and analytics necessary to detect the following behaviors on the cameras indicated to have the behavior on the Drawings:
1. Movement-in-zone: detection of human or vehicular movement in sterile/secure zones where no movement is expected, with filters for direction of movement.
2. Directional line crossing: virtual line crossing (tripwire) for human and vehicular movement.
3. Crowd size detection: alarm shall be generated upon crowd size reaching a user-defined threshold.
4. Loitering: detection of person sojourning within a defined zone for a user-defined period of time.
5. Tailgating: detection of person or vehicle crossing entry/access-point line within a user-defined time interval after another person or vehicle. Integrated with access control systems.
6. Grouping: event generated upon number of persons in a defined zone exceeding exact threshold.
7. Moving water vessel: detection of water vessel movement, filtering out waves, sun reflections and typical waterscape phenomena.
8. Stopped vehicles: detection of vehicles stopped in one or more no-stopping zones beyond a configurable time threshold.
9. Object removal: detection of the removal of an object from a customer-defined region in a video camera's field of view. Event shall be reported whenever an object is moved from the region.
10. Asset protection: detection of the removal of up to 20 objects from a camera's field of view. Event shall be reported when an object is removed or hidden for more than the specified amount of time.
11. Two-man rule alerts: detection if less than 2 people are present at any time.

12. Fallen person (slip and fall): detection within seconds of transition from a person's vertical position to horizontal/angled position.
13. Road obstacles: detection of obstacles in an area of interest that remain stationary for more than the predefined amount of time, filtered for size of obstacle and duration.
14. Suspicious (abandoned) objects: detection of abandoned objects in an area of interest with filters for size and length of time object is present.
15. Object counting: directional counting of moving people and/or vehicles, with database storage of results and various statistics reports including overall daily traffic, traffic density hot spots, comparison between specific hours and days and more.
16. Stickiness: counts people that remain in a field of interest for more than the user-specified dwell time.
17. Video Search: Ability to quickly locate a specific person or vehicle of interest across an entire site using a sophisticated deep learning AI search engine.
18. Facial Recognition: Ability to detects matches from managed watchlists to alert operators of people of interest.
19. License Plate Recognition (LPR): Ability to capture accurate license plate information at a range of distances and speeds.

2.5 VIDEO SURVEILLANCE SYSTEM HARDWARE

A. Network Video Recorders (NVRs) or servers and video storage media:
   1. The video archival system shall include sufficient network video recorders (NVRs) or servers and video storage media to record or archive video from each camera as indicated on the drawings.
   2. NVRs or servers shall be configured for no more than 75% utilization of total recording and playback bandwidth or processing capacity supported.
   3. The NVMS shall not limit the storage capacity and shall allow for upgrades of recording capacity.
   4. The system shall provide redundancy and support camera failover to secondary server.
   5. Storage shall be provided in a RAID 6 configuration.
   6. The NVRs or servers shall be loaded with video management system software as described above, and sufficient site, server or NVR and camera licenses provided to support the configuration and cameras quantities indicated on the Drawings. The server/storage systems shall be connected via a virtual video surveillance system local area network (VLAN) to the IP based video cameras that are specified herein.
   7. Hardware Health Monitoring: The system shall monitor the health of the network switches, network video recorders, servers, hard drives, and power supplies and provide notifications as follows:
      a. The system shall monitor system issues, environmental characteristics and performance from a single screen, and provide high level status view of system, storage, network and cameras. Key components shall be monitored including:
         1) Processor (for performance and temperature).
         2) Memory.
         3) Cooling.
         4) Power Supply.
         5) Chassis.
      b. The system shall provide instant notification via email for the following:

1) Video loss when a camera becomes disconnected.
2) For critical issues with network video recorders.
3) Notification of drive failure and location within the system.
4) For potential performance impact on the recording server when issues are identified while monitoring network throughput.
5) Power supply failure.
6) Fan speed exceeds an alarm threshold.

8. NVRs or Servers System Minimum Requirements:
   a. Pre-configured with the video management system software, optimized and provisioned to use Federal Information Processing Standards FIPS 140-2 compliant cryptography for secure network video recording and video encryption. Video data encrypted at rest to FIPS 140-2 L2, secured with onboard TPM, via Windows BitLocker, OS drive encrypted to FIPS 140-2 L2, secured with TPM. Server 2016 STIG-compliant Windows OS.
   b. Pre-configured with the video management system NVR or server software and optimized for video surveillance.
   c. Operating system: latest 64-bit version of Windows Server compatible with the VMS .
   d. Processor: Dual Intel Xeon Series CPU recommended by the VMS manufacturer.
   e. System RAM: The NVMS manufacturer's recommended RAM to support the configuration provided.
   f. Network interface: two 1 Gbps (1000Base-T) RJ45 ports.
   g. Redundant power supply.
   h. RAID controller: storage shall be configured as RAID 5.
   i. Operating System Drives:
      1) Two M.2 Solid State Drives SSD, RAID 1.
   j. Video Storage Drives:
      1) Hot-Swappable, Enterprise Class Hard Drives
      2) Interface: SATA 6Gb/s or SAS 6Gb/s.
      3) Spin speed: 7200 rpm.
      4) RAID controller: storage shall be configured as RAID 6.
      5) Cache: 64 MB.
      6) Mean time between failures (MTBF): 1 million hours.
      7) Manufacturer: Dell or HP
   k. The NVMS shall be installed on hardware which meet or exceed the manufacturer's requirements as well as the requirements specified herein.

B. Security Workstation (with NVMS and ACS Clients) Minimum Requirements:
   1. Pre-configured with the access control and video management system client software and optimized for access control and video surveillance.
   2. Processors: The Intel processor recommended by the NVMS manufacturer for the client software.
   3. RAM: The NVMS manufacturer's recommended RAM to support the configuration provided.
   4. Graphics Card: Provide graphics card recommended by the NVMS manufacturer to support the quantity of monitors indicated on the Drawings.

5. Video Card or Graphics Processor:
   a. Support for full 4K video streaming.
   b. Support for four 4K monitors (2 DVI ports and 1 mini HDMI port).
6. Display interface: 2 HDMI ports, DP ports with HDMI adapters, or mDP with DP and HDMI adapters.
7. Monitors: Support for Two 4K (3840x2160 pixels) monitors. Provide 4K monitors, quantity and nominal sizes as shown on Drawings.
8. Operating System: The NVMS manufacturer's recommended version of Microsoft Windows for support of the NVMS client software.
9. OS Drive: 256GB Solid State Drive (SSD).
10. SATA II or SATA III controller as recommended by the manufacturer.
11. Internal storage: 1 TB hard drive, 7200 rpm SATA.
12. Optical drive: 16x DVD +/ R/W.
13. Network card: 10/100/1000Base-T.
14. Other components required for a complete and operational system, including optical mouse and keyboard.
15. Where the system manufacturer's recommendations exceed these requirements, workstations shall meet the video management system and access control system software manufacturers' recommendations, as defined in this section and in Section 281000 - Access Control 2.
16. Manufacturer: Dell or HP .

2.6 VIDEO MONITORS

A. General: monitors provided shall be designed for continuous operation.

B. Provide wall mounted flat panel monitors with the following minimum features:
   1. Commercial monitor designed for continuous operation (24 hours/day, 7 days/week, and 365 days/year).
   2. Screen Size: nominal diagonal measurement as indicated on the Drawings.
   3. Panel technology: 60 Hz direct-lit LED technology, 16:9 aspect ratio.
   4. Native resolution: 3840 x 2160 (4K or Ultra HD).
   5. Brightness: 350 cd/m2(350 nits).
   6. Contrast ratio: 4000:1.
   7. Viewing angle (horizontal/vertical): 178º/178º.
   8. Response time: 8 ms (gray to gray), or better.
   9. Computer/video input support: DVI-D and HDMI.
   10. Audio input: stereo mini jack.
   11. Audio output: stereo mini jack.
   12. Other: Built-in tuner and audio amplifier and speakers.
   13. Power requirements: 100 V to 240 V AC.
   14. Manufacturer: Mitsubishi, NEC, Samsung, Sharp, or Sony .

C. Provide desktop flat panel monitors with the following minimum features:
   1. Commercial monitor designed for continuous operation (24 hours/day, 7 days/week, and 365 days/year).
   2. Screen Size: nominal diagonal measurement as indicated on the drawings.
   3. Panel technology: direct-lit LED, 16:9 aspect ratio.
   4. Native resolution: 3840 x 2160 (4K or Ultra HD).

5. Brightness: 250 cd/m2.(250 nits).
6. Contrast ratio: 1000:1.
7. Viewing angle (horizontal/vertical): 178º/178º.
8. Response time: 8 ms (gray to gray).
9. Computer/video input support: DVI-D (24-pin digital DVI) and VGA (15-pin HD D-Sub (HD-15)).
10. Audio input: stereo mini jack.
11. Audio output: stereo mini jack.
12. Other: Built-in tuner and audio amplifier and speakers.
13. Power requirements: 100 V to 240 V AC.
14. Manufacturer: Acer, ASUS, Dell, HP, Samsung, or Viewsonic.

2.7 MISCELLANEOUS EQUIPMENT

A. Infrared Illuminators:
   1. Configuration: 1, 2, or 3 illuminators in a common mount.
   2. Construction:
      a. Each illuminator shall contain a matrix of surface mount infrared LEDs inside an environmentally sealed housing.
      b. External housing and hardware of aluminum, stainless steel, or alloy construction.
   3. IP66 rated enclosure with vandal-resistant polycarbonate lens.
   4. Wavelength: 850 nm semi-covert.
   5. Maximum power consumption: 100 W.
   6. Performance:
      a. Illumination distance: as indicated on the Drawings.
      b. Angle of coverage: as indicated on the Drawings.
   7. Manufacturer: Axton, Bosch, or Raytec .

B. Power supplies: 12/24 VDC, sized to accommodate video cameras and devices indicated on the Drawings with a 25% margin for future expansion, and shall have the following features:
   1. Compliance with UL 2044-2019
   2. 120 V AC input.
   3. One individually fused output per camera.
   4. Contained in a hinged and lockable NEMA 1 enclosure.
   5. Cabinet tamper switch.
   6. Battery back-up.
   7. Manufacturer: Alarm-Saf or Altronix .

PART 3 EXECUTION

3.1 GENERAL

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Provide programming for complete systems integration with the access control and alarm monitoring systems and the intercom systems as specified herein and in Section 281000 - Access Control.

E. Provide programming for complete systems integration with the access control and alarm monitoring systems and the intercom systems as specified herein and in 281353 - Security IP Network Compatible Intercom Systems.

F. Systems shall be installed by skilled craftsmen in a manner conforming to industry standards for the craft.

G. The NVMS shall provide the ability to import members of active directory groups as users in the NVMS. Changes made to members in the active directory shall be automatically synchronized with the NVMS.

H. The NVMS shall support using Windows credentials to authenticate users.

I. Occupancy Adjustments: When requested within 12 months of date of Architect's Final Certificate, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
   1. Check cable connections.
   2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
   3. Adjust all preset positions; consult Owner's personnel.
   4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
   5. Provide a written report of adjustments and recommendations.

3.2 WIRING

A. Wiring Method: Install cables in raceways unless otherwise indicated.
   1. Except raceways are not required in accessible indoor ceiling spaces and attics.
   2. Except raceways are not required in hollow gypsum board partitions.
   3. Conceal raceways and wiring except in unfinished spaces.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO CAMERAS AND ACCESSORIES

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with 84-inch minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance

C. Video cameras: connect camera video analytics alarm output to the access control system alarm input module as required for alarm event logging and response.

D. Pan-tilt drives: program presets as required for coverage of the detection devices, sensors, and alarm zones indicated on the Drawings.

E. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.

F. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

G. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

H. Identify system components, wiring, cabling, and terminals according to Section 270533 - Identification for Communications Systems.

3.4 NETWORK-BASED VIDEO SURVEILLANCE SYSTEMS

A. Configure network addresses, security settings, and other parameters per the Owner's requirements and as recommended by the manufacturer.

3.5 VIDEO MONITORS

A. Provide support structure where needed to support wall-mounted flat panel monitors.

B. Configure monitor settings as appropriate for the operation of the system as configured.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Provide a screen shot of each video camera taken during normal business hours and after dark. Place each screenshot on a PDF. Label each screen shot with the camera designator (name/number). Submit the document to the Architect for review and approval of the camera coverage area (aiming and lens setting).
   2. Test the following functions or parameters of the video management and storage systems:
      a. VMS is the specified edition/version.
      b. VMS servers meet the specifications.
      c. VMS workstations meet the specifications.

d. An alarm event causes the recorded video signal for the associated video camera to be tagged or linked to the event in the access control system database.
e. If available, a camera is associated with each access-controlled door, each intercom call, and each intrusion detection point.
f. The event automatically calls up the associated video camera images on the designated video surveillance monitors.
g. The video storage system is operational and recording the appropriate video camera at the initiation of each intrusion detection or duress alarm event, valid and invalid access card read, and the initiation of an intercom call.
h. Video from all cameras is retained for 30 days.
i. Video is recorded continuously at 1 frame per second.
j. Video is recorded on motion at 15 frames per second.
k. Loss of video generates an alert to system administrator.
l. The system emails users and system administrators when an event or system health error occurs.
m. Video analytics are functioning properly.

3. Test the following functions or parameters of the VSS cameras:
   a. Camera is correct type.
   b. Mounting is correct type.
   c. Camera coverage is approved by the Owner .
   d. Camera is auto-iris/auto-focus.
   e. Lens and dome are clean.
   f. Image quality is good.
   g. After dark IR illuminators switch on and provide sufficient lighting levels.
   h. Camera name, camera location, timestamp, record indicator, PTZ controls, and motion activity are displayed overlaid on the video.
   i. Assigned video analytics function properly.

B. Test Reports:
   1. Video management and storage systems functional test reports.
   2. Camera functional test reports.
   3. Point of Sale Camera functional test reports.
   4. LPR Camera functional test reports.

3.7 INSTRUCTION OF OPERATING PERSONNEL

A. Factory-trained technicians shall give operating and maintenance instructions on the video surveillance systems and equipment. The duration of each session for each system type shall be a minimum of 2 hours.

B. Additionally, provide instruction of operating personnel as required in Section 280500 - Common Work Results for Electronic Security Systems.

END OF SECTION

SECTION 283100 - INTRUSION DETECTION

PART 1 GENERAL

1.1 SUMMARY DESCRIPTION

A. This Section covers intrusion detection systems, including IDS panels, control keypads, detection devices, and communication devices.

1.2 RELATED REQUIREMENTS:

A. 280500 - Common Work Results for Electronic Security Systems.

B. 280513 - Conductors and Cables for Electronic Security.

C. 280528 - Pathways for Electronic Security.

D. 280800 - Commissioning of Electronic Security.

E. 281000 - Access Control.

1.3 REFERENCE STANDARDS

A. UL 365 - Police Station Connected Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

B. UL 609 - Local Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

C. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems; Current Edition, Including All Revisions.

D. UL 636 - Holdup Alarm Units and Systems; Current Edition, Including All Revisions.

E. UL 639 - Intrusion-Detection Units; Current Edition, Including All Revisions.

F. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

G. UL 1610 - Central-Station Burglar-Alarm Units; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 280500 - Common Work Results for Electronic Security Systemsfor additional requirements.

B. Action Submittals:

1. Product Data:
   a. Provide product data sheets for equipment, materials, and cables in PDF format.
2. Shop Drawings:
   a. Include floor plans indicating equipment locations. Plans shall include equipment identification and either direct references to wiring details for each specific installation and wiring condition or a schedule that references the same.
   b. Wiring diagrams shall indicate proposed connections of equipment, model numbers, and designations for cables and termination points.
   c. Provide elevations of console or rack-mounted equipment, showing the location of all specified electronics and include enlarged, to scale plan (top), and front views.
   d. Provide project specific manufacturer shop drawings of fabricated or modified units, if any.
   e. Provide riser diagrams indicating components of the system and proposed cabling between these components.
   f. Provide block diagrams indicating the proposed interface between the intrusion detection system and the access control system.
   g. Provide block diagrams indicating the proposed interface between the intrusion detection system and the video surveillance system.
   h. Provide a written description of the proposed sequence of operation to describe the operation of the interfaces.
   i. Provide detailed project specific mounting diagram for each type of device including raceway and back box requirements. These details shall be referenced on the floor plans or schedules.
   j. Provide a detailed loading schedule for each intrusion detection panel, identifying each device connected to it.

C. Informational Submittals: As required in Section 280500 - Common Work Results for Electronic Security Systems.

D. Close-out Submittals:
1. Functional Test Reports: Provide a spreadsheet with all intrusion detection system devices and major components listed in the first column by device designator (e.g., device number) with each test parameter listed by name (or code) in the remaining columns.
2. Operations and Maintenance Documentation Package: As defined in Section 280500, Common Work Results for Electronic Security.
3. Instruction of Operating Personnel:
   a. The Security Systems Performance Verification Supervisor shall schedule, coordinate, assemble and deliver the documentation of the training required by this section.
   b. Obtain receipt from the Owner acknowledging completion of each item of instruction.
   c. See Section 280500 - Common Work Results for Electronic Security Systemsfor additional requirements.

1.5 QUALITY ASSURANCE:

A. Installation of the intrusion detection system shall be under the direct supervision of a person or persons having completed the factory training recommended by the system manufacturer.

B. The installation company shall be a currently listed as an authorized dealer or business partner by the manufacturer of the system and shall have been listed as such for a minimum of 3 years.

PART 2 PRODUCTS

2.1 DETECTION DEVICES:

A. Magnetic Contacts:
1. For hinged doors:recessed switches for door head installation. Switches shall be magnetic, single-pole, double-throw type, providing dual circuit operation, designed for line supervision. Switches shall be tested and proven capable of initiating an alarm signal when the protected door is opened 2" on the latch side. Color of exposed portions of the door contacts (brown, grey, or white) shall be that which most closely matches the door frame color.
2. Switches shall be UL 634 Level 1 high security balanced magnetic switches.
3. Switches shall be UL 634 Level 2 high security balanced magnetic switches.
4. For overhead doors: extra heavy duty, aluminum bar stock construction, floor-mounted contact, single-pole, double-throw type, providing dual circuit operation, for use on roll-up doors and rolling gates. Contacts shall have 3' stainless steel armored cables.
5. Alarm contacts shall be designed for 12 V to 30 V DC, nonpolarized service.
6. Manufacturer: Amseco (a Potter Brand), Bosch, Honeywell, Magnasphere, Potter Electric Signal Company, or United Technologies Company (UTC) Fire & Security.

B. Duress Devices:
1. Push-for-Help Buttons:
   a. Designed for mounting under counter or desk.
   b. Latching call-placed indicator.
   c. UL 636 Holdup Alarm Units and Systems.
   d. Basis of Design: Honeywell 269R/270R Holdup Switch.
   e. Manufacturer: Ademco, Bosch, Honeywell, or Potter.

C. Glass Break Detectors:
1. Sensors shall use microprocessor-based digital signal processing to convert sound into mathematical sequences and perform analysis on signal variables to accurately identify the signal pattern of breaking glass.
2. Signal variables shall include flex/audio thresholds, ratios and durations, time coincidence, attack thresholds, and microphone overloads.
3. Detectors shall be configured with 2 microphones, 180º opposed, and time-of-arrival processing to eliminate glass break signals arriving from other than the protected area.
4. Detectors shall also provide the following minimum features:
   a. Form C (SPDT) alarm relay rated for 25 V DC, 125 mA maximum.
   b. Combination cover and wall tamper switch rated for 24 V DC, 25 mA maximum.
   c. LED indication for detection of sound events and alarm condition.
   d. Minimum range: 25'.
   e. Radio frequency interference (RFI) immunity from 10 MHz to 1000 MHz, up to 30 Vm.

f. Capable of detecting the breaking of single-pane plate, laminated, tempered, wired, and film-coated glass up to 0.25" thick.
g. Supervision circuitry with trouble output rated for 16 V DC, 20 mA maximum.
h. UL 639 Standard for Intrusion-Detection Units.

5. Manufacturer: Bosch, Honeywell, or United Technologies Company (UTC) Fire & Security.

D. Wall Mount Interior Motion Detectors:
1. Dual technology microwave and infrared motion type with the following minimum features:
a. Walk-test light.
b. Microwave noise adaptive processing to adjust for background disturbances.
c. Anti-masking.
d. Tamper alarm switch.
e. Digital fluorescent light interference filter.
f. RFI immunity: 27 MHz to 825 MHz.
g. White light immunity up to 650 fc.
h. Dual slope temperature compensation.
i. Form C output relay rated for 3 W.
j. UL 639 Standard for Intrusion-Detection Units.
k. Self-test: microwave supervision, end-to-end PIR, and temperature compensation.
l. Integrated end-of-line resistor.
m. FCC certified and UL listed.
n. Service: 10.5 V DC to 14 V DC.
o. Coverage Pattern: 40' x 40'.
2. Basis of Design: Blue Line Gen2 TriTech Motion Detectors.
3. Manufacturer: Bosch, Honeywell, Interlogix, or Visonic.

E. Wall Mount Interior Curtain Motion Detector with Curtain Pattern Coverage:
1. Dual technology microwave and infrared motion type with the following minimum features:
a. PIR Signal Processing: Motion analyzing of multiple thresholds and timing windows to analyze timing, amplitude, duration, and polarity of signals to make an alarm decision. The microprocessor shall analyze and compare sensor data to make alarm decisions.
b. Range Adaptive Radar: The microwave transceiver shall automatically adjusts its detection thresholds based on input from the PIR sensors. Integrating the target distance information from the PIR significantly reduces false alarms from the microwave Doppler radar.
c. Active White Light Supression: An internal light sensor shall measure the level of light intensity directed at the face of the detector. Sensor data fusion technology uses this information to eliminate false alarms from bright light sources.
d. Dynamic Temperature Compensation: The detector shall automatically adjusts PIR sensitivity to identify human intruders at critical temperatures. Dynamic temperature compensation detects human body heat accurately, avoids false alarms, and delivers consistent catch performance at all operating temperatures.
e. Tamper: Normally-closed (NC) contacts (with cover on) rated at 25 VDC, 125 mA maximum.

f. Trouble: Solid state relay normally-closed (NC) contacts.
g. Alarm: Solid state relay, normally-closed (NC) contacts, power supervised. 3 W, 125 mA, 25 DC, resistance < 10 Ω.
h. UL 639 Standard for Intrusion-Detection Units.
i. Coverage: curtain coverage 100' x 8.6'.
j. Basis of Design: Bosch Professional Series TriTech Curtain Motion Detector.
k. Manufacturer: Bosch, C&K Systems, Honeywell, or Visonic.

F. Ceiling Mount Interior Motion Detectors:
1. Dual technology microwave and infrared motion type with the following minimum features:
a. Signal Processing: Provide a detector that uses passive infrared and microwave Doppler radar technologies to provide an alarm condition when both fields of protection are simultaneously activated. Alarm signals must meet the signaling requirements of both technologies to activate an alarm.
b. Microwave Signal Processing: Adaptive processing to adjust to background disturbances. Designed to reduce false alarms while maintaining catch performance.
c. Self-test supervision systems: Two high output tri-color alarm LEDs visible from any angle, flash to indicate a trouble condition.
d. Height Range: 8 ft to 20 ft mounting height. Mounts directly to ceiling or to standard 3.5" rectangular electrical box.
e. Tamper alarm: Normally closed (with cover in place) tamper switch. Contacts rated at 28 VDC, 100 mA, 3W maximum.
f. RFI immunity: 26 MHz to 950 MHz at 50 V/m.
g. Alarm: Form C reed relay rated at 3.0 W, 100 mA at 28 VDC for resistive loads.
h. UL 639 Standard for Intrusion-Detection Units.
i. FCC compliant.
j. Voltage: 9 VDC to 15 VDC.
k. Current: 12 mA standby, 20mA in alarm. Max 24mA.
l. Coverage Pattern: Provides PIR and microwave, 46' diameter 360° panoramic coverage.
2. Basis of Design: Bosch DS9360 Motion Detector.
3. Manufacturer: Bosch, C&K Systems, Honeywell, or Visonic.

2.2 INTRUSION DETECTION SYSTEMS (IDS):

A. General:
1. Provide a microprocessor-based control/digital communicator that can provide intrusion, duress, and critical equipment monitoring. The system shall have a minimum of 48 individually addressable points that can transmit signals to a central station receiver. The system shall have the capability of controlling up to 16 outputs.
2. The system shall have arming stations with a touch pad through which users control security functions. Arming stations shall also have a minimum 16-character alphanumeric display. Displays shall show system status and give prompts to system operation. Arming stations shall display the status of 48 separate protection zones.

3. The system shall accommodate up to 4 microprocessor-based arming stations. All system operations shall be accomplished at any arming station.
4. UL 609 Standard for Local Burglar Alarm Units and Systems and UL 1076 Proprietary Burglar Alarm Units and Systems.

B. Initiation Circuits:
1. Protective inputs shall consist of points designated burglary and/or hold-up-duress and/or fire and/or supervisory. Each point shall be monitored by a protective circuit and shall accommodate normally opened and normally closed devices with end-of-line resistor supervision, or encrypted communication supervision.
2. Point programming: each of the points shall be programmable as to whether they are controlled versus 24 hours, interior versus perimeter, instant versus delayed, silent versus audible, and local or reporting. Additionally, each point shall be programmable to report to three separate telephone numbers.

C. Output Circuits:
1. Alarm power outputs: shall power audible alarms. Alarm circuits shall be supervised. There shall be 4 distinct audible patterns from which to select.
2. Additional relay outputs: capacity to expand to 16 additional relays. These relays shall be programmable to activate on alarms or other selected system events.

D. System Partitioning:
1. Point assignment: points shall be assignable to 1 of a minimum of 4 areas of protection.
2. Area arming: each area shall be separately armed and disarmed from any of the arming stations.

3. Keyswitch arming inputs: shall be programmable as either maintained or momentary contact.

E. Miscellaneous:
1. Programming: system functions shall be programmable at the system site or remotely via the use of the dial-up telephone network. Minimum programmable system passcode shall be used to prevent unauthorized remote programming attempts. Telephone access to the system shall be a ring counter or user-initiated access.
2. Printer interface: an optional printer interface to a parallel printer shall be available. The parallel printer shall record alarms and troubles by point, openings and closings by user code, and other system events.
3. Remote keypads: shall allow arming and disarming of the system, shunting of individual zones, and adjusting any delay periods.

F. Manufacturer: Bosch, Digital Monitoring Products (DMP), Tyco Digital Security Controls (DSC), or Honeywell.

2.3 INTRUSION DETECTION SYSTEM PERIPHERAL EQUIPMENT:

A. Digital communicators shall have the following minimum features:
1. Programmable delay before dialing.
2. Programmable dial attempts.
3. AC failure and AC restoral reporting.
4. Low battery and battery restoral reporting.

5. Listen-in capabilities (central station monitoring).

B. Cellular Alarm Transmission Back-up:
1. UL 365 Police Station Connected Burglar Alarm Units and Systems; and UL 1610 Central Station Burglar Alarm Units; Line Security Services compliant cellular alarm transmission back-up.
2. LTE Bands: AT&T: 2, 4, 5, and 17, Verizon: 4 and 13.v
3. Antenna Port: SMA, 50-Omh.
4. FCC part 15, 22, 24, 27 and 68 compliant.
5. Minimum transmit Power: 200 mW in all bands.
6. Full data reporting.
7. AES encryption.
8. Support for multiple alarm formats.
9. Automatic self-test and system trouble reporting outputs (5 or 60 minute, and daily).
10. Two programmable supervisory trip outputs
11. Alarm format support for SIA2, Contact ID, pulse (3x1, 4x2), modem IIe, & IIIa2, DMP.
12. Telephone line monitor built-in, with Standard Line Security.
13. Locking, metal enclosure.
14. Battery back-up.
15. Antenna, and cable.
16. Basis of design: TELGUARD AMETEK TG-7 or equal.

2.4 MISCELLANEOUS EQUIPMENT:

A. Local door alarm management system: audible range shall be minimum 85 dBA at 3', 12 V DC to 24 V DC. Sirens shall have an integral keyswitch and mount in a double-gang junction box. Sirens shall be keyed alike.
1. Manufacturer: Ademco, Detex, or Kouba Systems.

B. Exterior sirens: audible range shall be minimum 115 dBA at 3', 12 V DC to 24 V DC. Sirens shall have waterproof construction or be mounted in a weather resistant enclosure.

PART 3 EXECUTION

3.1 GENERAL:

A. Programming:
1. Program alarm response fields, door names, and any other user-defined fields with terminology and descriptions provided by the Owner.
2. Program access rights, password protection, video surveillance system interface, holidays, area control, inputs and outputs, and schedules.

B. Graphics:
1. Develop graphic maps that detail the facility and display inputs and outputs dynamically.
2. Utilize AutoCAD 2016 architectural floor plans that show walls, doors, windows, room names, and room numbers.

C. System Integration and Interfaces:

1. Interface with the video surveillance system: the IDS shall interface with the video surveillance system to cause automatic camera call-up utilizing ASCII text string commands. Upon an alarm condition at but not limited to, an access point, vehicle post, duress button or other alarm input, the IDS shall cause the video surveillance system to automatically call up the associated video camera image. The system shall be programmed with at least one video camera call-up per access control point.
2. Interface with the Insert Text here.

D. Programming Requirements and Deliverables:
1. Produce questionnaires to solicit user input for programming the system. The questionnaires shall identify each programming item that requires user input to configure the ACAMS along with recommendations for responses. These questionnaires shall be finalized in a series of meetings with the Owner's designated agent until such time that the questionnaires are completed, and the Owner has authorized the information to be inputted into the ACAMS.
2. The questionnaires shall include three series. The first shall be devoted to alarm input related programming. The second shall be devoted to interface programming and associated action and reaction requirements including the video surveillance system call-up and switching requirements. The third shall be related to display of alarm messaging, mapping and any requirements for alarm responses and reporting.
3. Upon completion, the programming questionnaires and associated programming database sheets shall be included in the operation and maintenance documentation.

E. Each alarm event shall result in the following actions:
1. The video signal for the associated video camera shall be switched to the first available event monitor of the associated workstation or console.
2. The video signal for the associated video camera shall be transmitted to the roving security officer's smartphone or tablet.
3. Where remotely positionable video cameras are associated with the alarm, the camera shall be panned and tilted, and the lens zoomed to provide an acceptable (Owner approved) view of the alarm scene.
4. Where remotely positionable video cameras are associated with the alarm, the video camera shall be automatically selected for local control via the video management systems command keyboard.
5. The archived or recorded video signal for the associated video camera shall be tagged or linked to the alarm event in the access control system database.
6. A supervised and coded alarm signal shall be transmitted to the associated workstations or consoles causing an audible and visual alarm signal.
7. Where a local door sounder is located adjacent to the door, the sounder alarm shall be activated until reset at the workstation or console.
8. A graphical representation of the alarm scene (site or floor plan) with icons representing the open door, video camera, and other local devices shall be displayed on the graphical user interface (GUI). Icons representing active devices shall change color to indicate their state change (inactive to active).

3.2 CELLULAR ALARM TRANSMISSION BACK-UP:

A. Submit cost and terms of cellular service contract to the Owner prior to installation. Owner reserves the right to seek independent cellular service provider with no penalty.

B. Make connections and verify proper operation with the alarm monitoring service provider.

3.3 ALARM MONITORING SERVICE:

A. Provide 1 year of alarm monitoring service with a UL listed central station. Include fees associated with connection, subscription, and termination so that no other costs shall be incurred if the service is terminated at the end of the year.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. One at a time breach each device in each zone that makes up the intrusion detection system. Where the intrusion detection system is designed to detect multiple types of breaches, test each zone or device using each type of breach that is practical without damaging the system or system components. Provide a Honeywell Model FG701 glass break simulator for testing glass break detectors. For each intrusion point, test the following parameters or functions:
      a. Event is logged and displayed on the keypad/controller and the security workstation with operator instructions.
      b. The event automatically calls up the associated video camera images on the designated video surveillance monitors.
      c. The event causes the video signal for the associated video cameras to be transmitted to the roving security officer's smartphone or tablet.
      d. Where remotely positionable video cameras are associated with the alarm, the event causes the camera to be panned and tilted, and the lens zoomed to provide an acceptable (Owner approved) view of the event scene.
      e. Where remotely positionable video cameras are associated with the alarm, the event causes the video camera to be automatically selected for local control via the video management systems command keyboard.
      f. The event causes the recorded video signal for the associated video cameras to be tagged or linked to the event in the access control system database.
      g. Where a local door sounder is located adjacent to the door, the event activates the sounder alarm until reset at the workstation or console.
      h. On the GUI, the event causes icons representing active devices to change color to indicate their state change (inactive to active).

B. Test Reports:
   1. Print a report showing the alarm activity for the test period. Confirm that the report shows an alarm or exception appropriate for the zone and breach for each intrusion detection or duress alarm zone or device in the system. Present this report to the Architect.

3.5 INSTRUCTION OF OPERATING PERSONNEL

A. Factory-trained technicians shall give operating and maintenance instructions on the intrusion detection system equipment. The duration of each session for each system type shall be a minimum of 2 hours.

B. See Section 280500 - Common Work Results for Electronic Security Systems for additional requirements.

END OF SECTION

SECTION 285129 - EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: This section includes labor, material, and equipment to furnish, install and test a complete and operating In-Building Emergency Responder Communication Enhancement System for the purpose of amplifying and distributing throughout the entire building. The radio signals and frequency bands shall be those in use by the Emergency Responders serving this facility. Signal strength levels and coverage in 90% of all areas each floor and 99% of critical areas in accordance with the Fire Code shall be provided.

B. This specification is a performance-based specification. Final and complete design and layout will be provided by the bidder and submitted as part of the shop drawing process

1.3 REFERENCES

A. Abbreviations and Acronyms:
   1. AHJ: Authority Having Jurisdiction.
   2. BDA: Bi-directional amplifier.
   3. DAQ: Delivered Audio Quality.
   4. EMRES: Emergency Responder Radio Enhancement System.
   5. FCC: Federal Communications Commission.
   6. RF: Radio Frequency.

1.4 COORDINATION

A. Coordinate system scope and layout requirements, attachment methods, and envelope penetrations with architectural and MEP roof plans, elevations, and sections.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations with Division 07 Section "Roof Accessories."

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Five continuous years, minimum, design and manufacture of the systems specified.

2. Manufacturing facilities certified to ISO 9001 International Quality Standard with third-party certification verifying quality assurance in design/development, production, installation, and service.
3. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, maintenance, emergency repairs to equipment, and response times less than eight hours.
4.
5. Employ trained staff that are available 24/7 to provide scheduling support and assist with reporting needs.

B. Installer Qualifications:
1. Manufacturer's authorized representative who is trained and certified by the manufacturer for installation and testing of the specified product.
2. Minimum of five years successful installation experience with Projects of similar size and complexity.
3. Upon request, be able to provide a minimum of three reference accounts at which similar work, both in scope and complexity, have been completed by The Contractor within the last three years.
4. Project Personnel Requirements: Installer must have the following certified full-time employees on staff and assigned to the project:
a. Designer of system and lead installation personnel shall hold a valid FCC issued general radio operators license and certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.

1.6 WARRANTIES

A. Manufacturer Warranty: Manufacturer agrees to repair or replace specified product, and all of its components that fail in materials or workmanship within 12 months from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. All equipment shall have required FCC approvals.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Delegated Design Criteria:

1. Coordinate with the AHJ to ascertain operating frequencies in use. Include local fire, police, EMS, Sheriff and any state, city or county first responder frequencies as required by the AHJ.
2. Provide equipment compatible with the existing state, county and local Fire/Police communications system utilized by the Public Safety and Emergency Responder agencies.
3. Fully coordinate with all agencies involved and any state, federal or county agencies required and fully comply with requirements of such agencies.
4. Provide an FCC certified and compliant system.
5. Signal strength for the installed system shall be considered to have acceptable coverage when signal strength measurements in 90% of all areas on each floor and 99% in all critical areas as determined by the AHJ of the building meet a minimum signal strength into (downlink) the building of -95dBm and a minimum signal strength out (uplink) of the building of -100dBm when received by the agency's radio system when transmitted from within the building.
6. Provide an antenna distribution system installed to provide in-building amplification for all in use bandwidths tuned to the frequencies utilized. Provide building mounted "donor" antennas for all frequencies. The antennas will feed into a BDA (bi-directional amplifier), one for each band, which will distribute the boosted signal throughout the facility with a distributed antenna system utilizing point source fixed antennas, or other proposed solution by designer.
7. The system will be designed and installed per the requirements of NFPA, Building Code, Fire Code, and FCC.
8. Optional methods of achieving conformance to the code and distributing the signal throughout the building may be submitted.

2.3 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Alpha Refuge
   2. Rath
   3. Talk-a-phone

B. Source Limitations: Obtain components through one source who assumes responsibility of system component compatibility.

2.4 SYSTEM COMPONENTS

A. Bi-Directional Amplifier:
   1. BDAs shall incorporate appropriate RF filters, firmware/software upgradeable band migration, output level control, degrade performance capabilities, and incremental adjustable gain. BDA gain shall be determined by this contractor and sufficient to increase signal to meet or exceed Code levels throughout the building.
   2. BDAs shall be class A channelized amplifiers. Full spectrum or Class B amplifiers shall not be used.

B. Donor Antenna:
   1. The "donor" antenna signal level shall provide as much head end gain off system as possible but shall be a minimum of 9dB – 15dB above the source under all operating conditions.
   2. Antenna Masts: Wind rated per AASHTO Wind Charts with an additional 10 mph rating and a 1.3 gust factor. Contractor to provide all required supports, mounting hardware, and anchoring required for components per manufacturer's requirements. Coordinate materials with Roofing Manufacturer/Contractor if roof mounted and maintain roof warranty.

C. Power Supply:
   1. Power supplies for amplifiers and head end equipment shall be served from two independent reliable sources if available. Emergency 120V Generator power (if available) shall be obtained from a local emergency panel.
   2. Amplifiers shall be located as determined by designer or as shown on drawings. It is preferable to be as centrally located as possible and if room permits, in the Main Technology Closet or Electrical Room.
   3.
   4. Each BDA shall be served by a dedicated 20A branch circuit and breaker with a handle lock on device. The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 12 hours at 100% operation capacity.
   5. Battery system shall be self/automatic charging system and contained in an enclosure. All signal booster and battery components shall be contained in a NEMA 4 or 4 X type enclosures per NFPA requirements. All enclosures shall be red in color.

D. All signal boosters shall have FCC certification prior to installation. All signal boosters shall be compatible with both analog and digital communications simultaneously at the time of installation. The AHJ shall provide the maximum acceptable propagation delay standard. Contractor shall coordinate with the AHJ.

E. System Monitoring
   1. Provide monitoring of system integrity in accordance with NFPA requirements. Provide monitor modules for each BDA and battery cabinet enclosure, quantity as required.
   2. Extend addressable fire alarm loop or if zoned system, provide zone modules and zone wiring to these monitor modules and mount the modules near the BDA enclosures.
   3. System and Signal Booster Supervisory Signals shall include the following:
   4. Donor Antenna Malfunction
   5. Signal Components Failure
   6. Active RF Emitting Device Failure
   7. Power Supply Supervisory Signals shall include the following for each signal booster:
   8. Loss of Normal AC Power
   9. Failure of Battery Charger
   10. Low-Battery Capacity, Alarming at 70 percent of battery capacity
   11. Integrity of communications link between fire alarm system and ERCES.

F. Annunciator:
   1. Provide a dedicated annunciator located next to the BDA enclosures to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
   2. Normal AC Power
   3. Signal booster trouble

4. Loss of normal AC power

G. Cabling:
1. Coaxial cable bandwidth shall be as required for frequencies used. Verify that any stopbands built into the cable do not block the frequencies used.
2. Unless specified or approved by the Engineer, radiating coaxial cable shall not be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with manufacturer's installation requirements. Confirm installation tolerances and other conditions affecting performance.

B. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wiring Methods: Install all cabling in metal conduit, minimum 3/4-inch, in accordance with Section 260533, "Raceways and Boxes for Electrical Systems" and manufacturer's recommendations. Conceal raceway, except in unfinished spaces.
1. Riser runs shall be routed in 2 hour rated shafts.
2. Horizontal runs shall meet NFPA requirements for Survivability level 1 or 2 as required by code based on building construction and systems.

B. Antennas and cabling shall be kept a minimum of 24" from any high voltage cabling/raceways/bus duct or other EMI producing sources. Coordinate routing with field conditions and other trades.

C. Survey facility for any other RF producing components such as mobile radio or base stations and maintain proper separation of antennas so as to not cause interference. Perform adjustments to power output or antenna locations as required to mitigate interference. Coordinate with Owner.

D. Utilize cable manufacturers stripping and crimping tools.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

F. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.3 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 “Grounding and Bonding for Electrical Systems”.
   1. Ground cable shields and equipment per manufacturer’s requirements.
   2. Provide grounding blocks and surge protection for exterior coaxial cabling.
   3. Ground antenna mast in accordance with NEC and manufacturer’s requirements..

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 “Identification for Electrical Systems”.
   1. Identify all interior antennas to coincide with schematic diagram inside BDA.
   2. Identify all exterior RF Antenna cables outside and inside at their point of entry.
   3. Permanently affix schematics of the system within the main BDA enclosure.
   4. Affix FCC information as to the license holder, call letters, frequencies in use and other pertinent information on the exterior of the BDA.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

B. Provide written 7-day advance notice of any testing to allow The Engineer and Owner’s Representative the option to witness the tests.

C. Visual and Mechanical Inspections
   1. Inspect connectors for correct pin depth and torque, weatherproofing and damage from minimum bending radius, crushed or deformed cable.
   2. Document and label donor antenna(s) physical location(s), cable type and cable length.
   3. Ensure all cables are securely captivated with an approved clamp or strap and that the outer jacket has not been compromised from over tightening.
   4. Verify all interior antennas have an identifying number visible from the traffic path location.
   5. Check NEMA Box enclosure and filters for proper ventilation.
   6. Confirm/Verify that the antenna(s) BDA(s) and applicable AC/DC power source are installed to R56 standards and working clearances.

D. Electrical Tests
   1. Confirm proper antenna orientation via signal strength test. Coordinate with system municipality the closest and/or strongest tower/signal source to orientate to.
   2. Sweep donor antenna(s) using a calibrated FTDR for Return Loss and Distance to Fault.
   3. Measure and record donor antenna grounding hardware and ground resistance for adherence to manufacturer or R56 specifications utilizing a megger documenting reading(s) and exact location(s).
   4. Measure and record received signal strength of all applicable frequencies at input.
   5. Verify BDA amplified power output with spectrum analyzer in both directions from RF in/out.
   6. Test amplifiers for proper gain output and signal level.

7. Check spectral purity of amplified signal for harmonics, spurs, and distortion in both directions.
8. Perform an over the air sweep test for excessive harmonic content, spurs, and distortion.
9. Sweep entire cable plant of each frequency band utilizing a FTDR for Return Loss and Distance to Fault from BDA out to building.
10.
11. Cabling and connectors shall be tested with a FTDR Meter for continuity and signal levels for RF power. Testing shall be for input and output paths.
12. Check and log AC input voltages and document circuit number, breaker, and physical location for both the BDA and AC/DC supply.
13. Test battery output under load for 1 hour for proper output. Test charging circuitry for proper performance.

E. Acceptance Tests
   1. The radio frequencies used by the ER shall be tested to ensure two-way coverage on each floor of the building to ensure the following:
      a. Measurements in 95 percent of all areas on each floor of the building shall meet the following signal strengths:
         1) Minimum signal strength into the building shall be -95 dBm.
         2) Minimum signal strength out of the building shall be -95 dBm.
      b. Critical areas such as fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage.
   2. RF Signal Strength Testing
      a. The signal strength test shall be conducted using a calibrated (within last 12 months) spectrum analyzer utilizing antennas similar in use by the emergency responders.
      b. Where signal strength out of the building cannot be efficiently measured, a DAQ Test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.
      c. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
      d. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
      e. Measurements shall be made with the antenna held in a vertical position at three (3) to four (4) feet above the floor to simulate portable radios worn on the belt or turnout coat pocket.
      f. A maximum of one (1) (or 5 percent) of nonadjacent test areas shall be allowed to fail the test per floor.
      g. In the event that two or more (or > 5 percent) of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of more than two (or 5 percent) nonadjacent test areas shall result in failure of the test. If the building fails the 40 area test, the building shall be deemed in non-conformance to Code. The facility shall be equipped with an in-

building RF amplification antenna system to meet a 90 percent coverage requirement per floor and retested.

h. The gain values of all amplifiers shall be measured, and the test measurement results shall be kept on file with the building Owner so that the measurements can be verified during annual tests.

3. Voice Signal Quality Testing
   a. For quality purposes, DAQ readings shall be taken at the same time as the above RF signal strength measurements. The DAQ scale is as follows:
      1) DAQ 1: Unusable. Speech present but not understandable.
      2) DAQ 2: Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
      3) DAQ 3: Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
      4) DAQ 3.4: Speech understandable without repetition. Some noise or distortion present.
      5) DAQ 4: Speech easily understandable; little noise or distortion.
      6) DAQ 4.5: Speech easily understandable; rare noise or distortion.
      7) DAQ 5: Perfect; no distortion or noise discernible
   b. A DAQ level of 3 or better throughout the building shall be deemed acceptable and passing. Areas not achieving this level shall be deemed as failing.
4. Test Fire Alarm Supervisory and Trouble Signals in accordance with NFPA 72 and project fire alarm specifications. Verify proper annunciation.

F. Test and Inspection Reports: Prepare a written report to certify compliance with test parameters and record the following:
   1. Test procedures used.
   2. Date, time, and weather conditions during testing.
   3. Results that comply with requirements.
   4. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   5. Prepare information in a format required by the AHJ.

G. Products will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Completion, provide on-site assistance in adjusting antennas to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Provide 4 hours of system training and maintenance instruction to Owner’s personnel. Record training and submit DVD with O&M.

END OF SECTION

SECTION 310800 - EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General: Perform earthwork in accordance with the Contract Documents.

B. Work Included: Work of this Section includes all labor, materials, equipment, and services necessary to complete the excavation, foundations, subgrade preparation, filling and grading as shown on the Drawings and specified herein including, but not limited to the following:

1. Removal and replacement beneath the building pad, foundations, utilities, and hardscape features as detailed in the project geotechnical report.

2. All earth excavation to the bottom of foundations, walls, pits, slabs, manholes, etc. as required and indicated on the Contract Drawings, or to a lower elevation to achieve required bearing capacity, as directed by the Owner's Geotechnical Engineer.

3. Excavation, filling and rough grading of site area at adjacent structures and roadways as required and within the Contract Limit Line.

4. Excavation, filling, grading and compacting to required elevations for all floors, slabs on grade, and structural slabs.

5. Excavation, filling, grading and compacting to required elevations for appurtenances and site work.

6. Filling and compacting of soil below foundation slab-on-grades, behind below grade walls, and beneath structural slabs.

7. Legal disposing off the site, of surplus excavated materials unsuitable for filling or backfilling.

8. Pumping and dewatering as required for work of this section and for foundation work.

9. Subgrade preparation for foundations.

10. Protection and monitoring of adjacent structures, structures to remain, utilities, and pavements.

11. Other labor and materials as may be reasonably inferred to be required to make the work under this Section complete.

C. The contractor shall coordinate all earthwork activities with the specialty ground improvement contractors such that all slab, foundation, utilities, and hardscape features bear on natural/competent material, are improved with ground improvement elements, or are addressed through a removal and replacement program. See geotechnical report.

D. The contractor shall coordinate all work with the specialty ground improvement contractor in the vicinity of utilities to remain. See geotechnical report.

1.2 RELATED SECTIONS

A. Ground Improvement

B. Concrete

C. Rock Excavating

D. Construction Drawings and Documents

1.3 HIGH PERFORMANCE BUILDING REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCES

A. General: All work and materials under this section shall conform to the latest revision of the following standard specifications, where not otherwise required by the Contract Documents.

American Society for Testing and Materials (ASTM) – latest edition.

1. C 136 Test for Sieve Analysis of Fine and Coarse Aggregates.

2. D 422 Method for Particle Size Analysis of Soils.

3. D 1140 Test for Amount of Material in Soils Finer than No. 200 (75 mm) Sieve.

4. D 1556 Test for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

5. D 1557 Test for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (Modified Proctor).

6. D 2216 Laboratory Determination of Moisture content of Soil and Rock Mass.

7. D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System).

8. D 6938 Tests Methods for In-Place Density and Water Content of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).

9. D 4253 Test Method of Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

10. D 4254 Test Methods for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density.

11. D 4318 Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils.

12. D 1883 Test Method for California Bearing ratio (CBR) of Laboratory Compacted Soils.

B. American Association of State Highway and Transportation Officials (AASHTO) – Latest edition.

1. T 88 Mechanical Analysis of Soils.

C. All work shall comply with the requirements of the 2018 Connecticut State Building Code (IBC 2015), and the requirements and regulations of any other Federal, State, or Local ordinances having jurisdiction.

D. All work and materials under this section shall conform to the following references:

1. Geotechnical Engineering Study, prepared by Langan (revised 11 November 2020).

E. Limits of Ground Improvement Work

1. See geotechnical report.

2. See structural and landscape plans.

3. See ground improvement specification.

F. Connecticut Department of Energy & Environmental Protection's General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer).

G. Connecticut DOT Form 819.

1.5 SUBMITTALS

A. Within ten days after award of the contract, the Contractor shall submit a schedule detailing the sequence, and time of completion of all phases of work under this section.

B. At least two weeks in advance of imported fill use, the Contractor shall submit the following laboratory test data and a 25-pound soil sample to the Owner's Geotechnical Engineer for review and approval:

1. Contractor to submit test reports on borrow material as follows:

a. Moisture and Density (modified proctor) Relationship: ASTM D1557.

b. Mechanical Analysis: AASHTO T-88.

c. Moisture content in accordance with ASTM D 2216.

d. Relative Density: ASTM D4254.

e. California Bearing Ratio (CBR): ASTM D1883, if utilized as subgrade material beneath paved areas.

f. Plasticity Index: ASTM 4318.

g. Test for Sieve Analysis of Fine and Coarse Aggregates: C 136.

2. Include data for all samples indicating the exact location and methods of transportation and placement of all materials.

3. Submit documentation for each of the imported material certifying them as "Clean Fill" in accordance with Part 2, Section 2.1, Article A of this specification and in accordance with Specification 02 6113.

C. The contractor shall submit the name of each material supplier and specific type and source of each material. Any change in source or soil type throughout the job requires approval of the Builder and the Owner's Consultants.

D. Samples: Submit a 12 inch by 12 inch sample of geosynthetic filter fabric.

E. Temporary Excavation Support Shop Drawings:

1. Submit detailed shop drawings and calculations, to be reviewed by the Owner's Geotechnical Engineer, of earthwork procedures and sequences including temporary excavation support systems, if required.

2. The temporary excavation support system drawings shall bear the signature and seal of a Professional Engineer registered in the State of Connecticut.

F. Dewatering: The contractor shall prepare dewatering shop drawings. The dewatering plan shall be designed by the contractor's engineer.

G. Pre-Construction Conditions Survey: The Contractor will perform a pre-construction conditions survey of all immediate offsite adjacent structures and surrounding critical site features, the results of which will be made available to the Owner and Design Team upon completion of the survey (include digital copies of photographs). The survey shall consist of photographic and video documentation and shall include a plan detailing the limits of the work and any observed damage.

H. Monitoring: Submit a plan showing location of proposed vertical and horizontal control points. Submit survey readings of the control points within 24 hours of the survey. Plan and survey readings shall be signed and sealed by a Land Surveyor registered in the State of Connecticut.

I. Certification for Examination of Site and Records: Before proceeding with the Work, submit certification in an acceptable form, signed by the Contractor, stating that careful examination has been made of the site, existing structures, records of utility lines, test boring records, test pit records, and subsurface exploration reports by the Owner's Geotechnical Engineer, the Drawings, and all other Contract Documents.

J. Submit approvals and permits to the General Contractor a minimum of 15 days prior to commencement of construction.

1.6 ENVIRONMENTAL CONSIDERATIONS

A. Install erosion control measures in the sequence shown of the plans or as directed by the Architect or regulatory agencies to protect adjacent properties and water resources from erosion and sediment damage.

B. Any off-site soil disposal requirement shall be performed in accordance with all applicable Local, State, and Federal regulations governing soil movement and disposal.

C. Dust and Erosion Control:

1. The Contractor shall take all necessary measures and provide equipment and/or materials to minimize dust from rising and blowing across the site and also to control surface water throughout the operation so that it does not run onto paved ways without being filtered. In addition, the Contractor shall control all dust created by construction operation and movement of construction vehicles, both on site and on paved ways. Comply with the 2002 Connecticut Sediment and Erosion Control Guidelines.

1.7 PROJECT CONDITIONS

A. The Contractor, by careful examination, shall inform himself as to the nature and location of the work; the conformation of the ground, the nature of the subsurface conditions; the location of the groundwater table; the character, quality and quantity of the materials to be encountered; the character of the equipment and facilities needed preliminary to and during the execution of the work; the conditions of adjacent structures and utilities and all other matters which can in any way effect the work.

B. The Contractor shall be held to have visited the site and to have familiarized himself with the existing conditions of adjoining utilities and structures.

C. The Contractor shall make his own deductions of the subsurface conditions which may affect the methods or cost of construction of the work hereunder, and he agrees that he will make no claims for damages or compensations, except as are provided under the agreement, should he find conditions during the progress of the work different from those as calculated and/or anticipated by him. Additional borings and other exploratory operations may be performed by Contractor, at the Contractor's option and following the Owner's approval. No change in the Contract Sum will be authorized for such additional exploration undertaken by the Contractor.

D. The Contractor shall investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to, ingress and egress of the site of the work. The Contractor shall conform to all University, City and State, and Federal regulations concerning the transportation of materials to and from and at the job site and shall secure in advance such permits as may be required.

1.8 PRE-CONSTRUCTION CONDITION SURVEY

A. The Contractor shall perform a pre-construction conditions survey of the structures and critical site features immediately adjacent to the work area, prior to the start of work and shall include the results of this survey with their shop drawings submittal to the Owner and Design Team before commencement of said work.

1.9 PROTECTION

A. Protection of Adjacent Structures, Utilities and Pavements

1. Prior to commencement of any work, consult the records for existing utilities, and note all conditions and limitations, which might affect the work required under this section.

2. The Contractor shall become acquainted with the existence and location of all surface and subsurface structures and utilities within the project area. Contractor shall not damage any of those that are to remain and shall leave them accessible.

3. The work shall be executed so that no damage or injury will occur to existing public and adjoining or adjacent structures, streets, paving, sewers, gas, water, electric or any other pipes. Should any damage or injury caused by the contractor, or anyone in Contractor's employ, or by the work under this Contract occur, the Contractor shall, at his own expense, make good such damage and assume all responsibility for such injury.

4. Provide barricades and warning lights, barriers, etc., to prevent accidents, to avoid all necessary hazards and protect the public, the work, and property at all times, including Saturdays, Sundays, and holidays.

5. The above shall also include the protection of all existing utilities to remain in use within and adjacent to the area affected by the work of this project.

6. Monuments, bench marks and other reference features on streets bounding this project, shall be protected. Should these be disturbed in any manner, the Contractor shall have them replaced at own expense.

7. Excavation work shall be restricted to hours indicated in the Contract Documents.

8. The Contractor's surveyor shall install control points on the adjacent structures and pavement for vertical and horizontal monitoring (to the nearest 0.005 ft.). Control points shall be monitored weekly during excavation and foundation construction work.

B. Protection of Excavation Bottoms

1. Facilities and materials needed to prevent earth at bottom of excavation from becoming frozen or unsuitable to receive the foundations shall be furnished.

2. The excavation shall not be carried to final grades during freezing weather without providing complete protection against freezing of the subgrades as specified hereinafter. Complete protection against freezing shall also be provided if freezing weather sets in after completion of the excavation to final subgrade. This protection shall include adequate heating and coverage of the area to maintain temperatures above freezing until foundations have been concreted and backfilled.

3. Where excavations have been brought to the bottom elevations called for on the drawings, and the bottom of these excavations become unsuitable in the opinion of the Owner's Geotechnical Engineer because of inadequate protection by the Contractor, these excavations shall be carried to lower depths sufficient to provide stable bearing as determined by the Owner's Geotechnical Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Imported Material: Imported fill should consist of a relatively well-graded mixture of sand and gravel. Suitable imported fill should be free of organics, clay, excessive silt, other deleterious or compressible materials, cinders, frozen material, trash, masonry, rubble, and other deleterious materials. In addition, any approved imported fill should be free of all hazardous substances. Grain-size distribution and modified Proctor compaction tests (ASTM D1557) should be made on representative samples of the imported fill proposed.

B. Imported clean fill shall be "Clean Fill" as defined in the Solid Waste Regulations found at Section 22a-209-1 of the Regulations of Connecticut State Agencies: "Clean fill" means (1) natural soil (2) rock, brick, ceramics, concrete, and asphalt paving fragments which are virtually inert and pose neither a pollution threat to ground or surface waters nor a fire hazard and (3) polluted soil as defined in subdivision (45) of subsection (a) of section 22a-133k-1 of the Regulations of Connecticut State Agencies which soil has been treated to reduce the concentration of pollutants to levels which do not exceed the applicable pollutant mobility criteria and direct exposure criteria established in sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies and which soil is reused in accordance with R.C.S.A. subdivision (3) of subsection (h) of section 22a-133k-2 of such regulations. Documentation, including, but not limited to laboratory analytical reports and source location, shall be provided for review and approval by owner or owner's Licensed Environmental Professional prior to the importation of clean fill materials.

C. 3/4-Inch Crushed Stone: Crushed stone shall be a quarry product or washed gravel stone obtained from offsite sources for use as detailed on the drawings. Crushed stone shall consist of durable crushed rock or gravel stone essentially free of silt, clay, loam or other deleterious materials and shall conform to the following graduation requirements for the nominal size indicated.

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 1 Inch	100
Pass 3/4 Inch	90 – 100
Pass 1/2 Inch	20 – 55
Pass 3/8 Inch	0 – 15
Pass No. 4	0 – 5

D. Surface Aggregate Course: Naturally or artificially graded non-plastic mixture of durable, sound coarse and fine aggregate and obtained from offsite sources. Mixture to be free of debris, waste, frozen materials, and organics, and shall be well graded within the following limits (processed stone, no gravel) and conforming to the requirements of CT DOT 817 M.02.06 Grading C:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 1.5 Inch	100
Pass 3/4 Inch	45-80
Pass 1/4 Inch	25-60
Pass No. 10	15-45
Pass No. 40	5-25

Pass No. 100	0-10
Pass No. 200	0-5

E. Base: Naturally or artificially graded non-plastic mixture of durable, sound coarse and fine aggregate and obtained from offsite sources. Mixture to be free of debris, waste, frozen materials, and organics, and shall be well graded within the following limits (processed stone, no gravel):

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 2-1/2 Inch	100
Pass 2 Inch	95 - 100
Pass 3/4 Inch	50 - 75
Pass 1/4 Inch	25 - 45
Pass No. 40	5 - 20
Pass No. 100	2 - 12

F. Subbase: Subbase material for use as pavement subbase course and other uses as detailed shall be obtained from offsite sources. Base shall consist of a non-plastic mixture of durable, sound coarse and fine aggregate with no more than 15 percent by weight of recycled bituminous concrete and shall be well graded within the following limits:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 3-1/2 Inch	100
Pass 1-1/2 Inch	55 - 100

Pass 1/4 Inch	25 - 60
Pass No. 10	15 - 45
Pass No. 40	5 - 25
Pass No. 100	0 - 10
Pass No. 200	0 - 5

G. Bedding Material:

1. Type "A" Bedding: Well-graded gravels and gravel sand mixtures free of debris, waste, frozen materials, and organics within the following limits:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 1-1/2 Inch	100
Pass No. 4	10 - 50
Pass No. 200	0 - 5

2. Type "B" Bedding: Sand or sandy soil free of debris, waste, frozen materials, and organics within the following limits:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 3/8 Inch	100
Pass No. 4	100 - 95
Pass No. 200	0 - 10

H. Granular Fill (Also Termed Structural Fill): Granular fill shall be obtained from offsite borrow sources for use as fill and backfill below and interior to building areas except where other materials are specified or detailed, and as details on the drawings. Granular fill shall consist of non-plastic naturally or artificially graded mixture of sound coarse and fine aggregates free of debris, waste, frozen materials and organics and conforming to the following gradation:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 3-1/2 Inch	100
Pass 1-1/2 Inch	55 – 100
Pass 1/4 Inch	25 – 60
Pass No. 10	15 – 45
Pass No. 40	5 – 25
Pass No. 100	0 – 10
Pass No. 200	0 – 5

I. General Fill: Clean, sound mixture of satisfactory soils free of debris, waste, frozen materials and organics with 3-inch maximum size aggregate and not more than 12 percent passing the No. 200 sieve.

J. Flowable / Excavatable Fill: Mixture of cement, GranCem, sand, water and admixtures to produce a flowable / excavatable fill with a compressive strength at 28 days of 100 psi to 150 psi.Crushed Stone/Crushed Gravel/Drainage Aggregate: Free draining natural clean, crushed durable stone free of deleterious materials and conforming to the gradation requirements commercially known as ¾-inch clean crushed durable stone (AASHTO No. 57 or approved alternative). Recycled concrete aggregate shall not be acceptable.

K. Processed Aggregate: Coarse and fine aggregates mixed to conform to the gradation requirements of M.05.01 material as defined on Connecticut DOT Form 817.

L. The use of recycled concrete aggregate (RCA) is not permitted as a drainage backfill material against structures.

M. Filter Fabric: Mirafi 140N manufactured by TC Mirafi or approved equivalent woven geotextile filter fabric where specified.

N. The use of mole rock is not permitted.

PART 3 - EXECUTION

3.1 CODES, PERMITS AND REGULATIONS

A. Comply with all applicable laws, rules, and ordinances and regulations of the Federal Government, Connecticut, and other jurisdictions.

B. Obtain and pay for all permits and licenses required to execute and complete the work.

C. In case of conflict between regulations and specifications, the Contractor shall comply with the most stringent applicable codes, regulations or specifications.

3.2 PUMPING AND DEWATERING

A. Provide adequate pumps, or other equipment, appurtenances, power, drains, materials and labor necessary to excavation continuously dry during excavation, foundation construction, and backfilling and at such other times as the progress of the work may demand or as necessary to insure safety to the structure shall be provided.

B. All pumping both inside and outside the areas of the building shall be performed, continued and maintained as required for the completion of all work, including the work of the mechanical trades, throughout the period of the contract.

C. Contractor shall manage runoff to limit impact on construction.

D. The dewatering system or systems shall be installed and operated in such a manner as to avoid the movement of fines or loss of ground from below the bearing level and shall not influence the stability of surrounding areas. The facilities needed to eliminate loss of ground shall be included.

E. The Contractor shall not use any portion of the building foundation units or any part thereof as a sump for drainage resulting from pumping in any other area. The Contractor shall not conduct water to privately owned properties.

F. Any pumped groundwater which will require off-site disposal shall comply with all Local, State, and Federal Environmental Regulations.

3.3 EXCAVATION

A. Removal and Replacement

1. The existing fill and peat material within the limits of the proposed building are not suitable for foundation or slab support in their current state. In areas where the depths of unsuitable material, as documented in the geotechnical report referenced herein, are relatively shallow, the contractor may elect to perform a removal and replacement program in lieu of ground improvement (outlined in the ground improvement specification).

2. In areas of the removal and replacement program, the Contractor shall removal all unsuitable material to the top of natural stratified sand and gravel, weathered rock, or bedrock material within the footprint in this area and beyond (i.e. exterior edge) a horizontal distance equal to the depth of the over-excavation below the proposed footing elevation. The contractor shall minimize disturbance of the natural material using appropriate techniques (i.e., flat plate welded across bucket of backhoe). Contractor shall backfill accordingly to proposed grades with structural fill as defined herein.

3. Contractor shall coordinate all removal/replacement work with the specialty contractor installing ground improvement elements and with the architectural, structural, and site drawings.

4. The base or bottom of the excavation shall be as-built and overlain upon the foundation (within the building) or site plan (throughout the site). The contractor's licensed professional surveyor shall provide this information to the Geotechnical and Structural Engineer.

5. In lieu of structural fill, the contractor may use drainage fill (stone) to assist with backfilling operations in proximity to the dewatered level of the groundwater. Drainage fill shall be placed in maximum 12-inch thick lifts and compacted with appropriate equipment to achieve densification. A properly designed geosynthetic filter fabric (Mirafi 140N or equivalent) shall be placed on the top and sides of the drainage fill to serve as a means of preventing migration of overlying soil fill into the drainage fill layer.

6. The contractor shall proofroll the bottom of the excavation prior to placement of structural fill or drainage stone or excavate in a manner so as to obtain a firm and unyielding condition of the surface of the sand and gravel with excavation techniques which minimize disturbance. The excavation subgrade shall be observed and approved by the Owner's Geotechnical Engineer prior to the placement of any structural fill or drainage fill material. The excavation shall be maintained in a dewatered condition such that observation of the surface of the excavation and subsequent backfilling can be accomplished in a relatively dry condition. Should soft or yielding conditions be observed, the contractor shall remove and replace this material with approved suitable compacted material. If alternative drainage fill material is to be utilized by the contractor based on particular circumstances, the proposed material shall be submitted to the Owner's Geotechnical Engineer for review and approval.

B. General

1. Excavation work shall include removal and disposal of all materials encountered regardless of the nature of the materials and shall be understood to include but not limited to rock, boulders, earth, hardpan, fill, structures, utilities, pavements, curbs, piping and debris, and others. Re-use of existing fill material shall only be permitted if the material meets the requirements for structural fill.

2. All excavation shall extend to the dimensions and elevations required for the installation of the work described herein and as indicated on the Drawings. Excavation shall be made to a depth that will allow installation of full depth of concrete slabs, and sub-base as shown on the Drawings and within a 1 inch tolerance. Excavation lines shall provide sufficient clearance for the proper execution of all concrete work, including allowances for form work, shoring and inspection.

3. Materials that in the opinion of the Owner's Geotechnical Engineer are not suitable for fill and any surplus earth shall be removed from the site and legally disposed off-site.

4. Existing utility lines to be retained that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at own expense.

C. Excavation for Foundations

1. Foundation subgrades shall be inspected and approved by the Owner’s Geotechnical Engineer before proceeding with the construction of foundations. Bottoms of footings shall be founded on the natural sand and gravel material, structural fill or fill improved via rammed aggregate piers or controlled modulus columns having net allowable uniform bearing pressures as specified in the Structural Drawings and as approved by the Owner’s Geotechnical Engineer.

2. Subgrade of foundations shall be level and free of loose soil, debris, standing water and frost prior to acceptance for placing concrete. A Geotechnical Engineer shall inspect and approve the foundation subgrade to verify that the subgrade material is adequate to provide the recommended allowable bearing pressure.

3. Unauthorized Excavation: When suitable bearing material is encountered at subgrade elevations shown on Drawings and excavation is made to greater depth, the foundations and foundation walls shall be extended to the lower elevation with concrete of the same strength used for the foundations, at no additional cost to the Owner.

D. Subgrade Preparation

1. Natural undisturbed material shall be graded and compacted to attain a uniform surface. These areas shall be determined by the Owner’s Geotechnical Engineer.

2. Prior to constructing foundations, slabs, utilities, utility structures, fields, and paved/hardscape areas, the subgrade shall be proofrolled in the presence of the Owner’s Geotechnical Engineer for the following conditions:

a. Subgrades shall be proofrolled with a minimum of six passes of a 10-ton roller. For all other subgrades, proofrolling shall be accomplished with a minimum of six passes of a 5-ton walk-behind vibratory roller.

b. Foundation elements shall not be placed until the subgrade is approved by the Owner's Geotechnical Engineer. All structural fill footing subgrades shall be tested to confirm the top lift of the footing subgrade is compacted to the project specified requirement for structural fill material.

c. Soft Areas during Compaction: If any areas show pumping, noticeable weaving, or which are otherwise unsatisfactory, undercut material to competent material within the limits and extent suggested by the Owner's Geotechnical Engineer. These areas shall be replaced with either concrete of the same strength used for the foundation or structural fill, compacted to 95% of maximum dry density by ASTM D1557. The appropriate water content at the time of compaction should be plus or minus 2 percentage points of optimum moisture content as determined by the laboratory compaction test aforementioned, unless otherwise directed by the Engineer of Record. If structural fill is utilized, the excavation shall be oversized to include the zone of influence (1H:1V) beneath and beyond the footing and footing level.

d. Subgrades should be excavated level and if any cobbles or boulders are encountered at the footing subgrade level such that a relatively level subgrade is not achieved, the cobbles or boulders should be removed and replaced with compacted structural fill or compacted crushed stone.

e. Consideration should be given to protecting the natural sand and gravel subgrades after excavation utilizing either clean, crushed, durable, compacted ¾ inch stone, or a mud mat.

E. Excavation for General Grading:

1. Excavations made below the elevations shown or specified, unless authorized by Change Order, shall be filled and compacted as hereinafter specified, at no additional cost.

F. Trench Excavation:

1. Unless otherwise shown or specified, make trenches for piping and utilities not less than 16 inches or more than 24 inches wider than the outside width of the piping or utilities. Accurately grade bottoms of trenches with bell holes scooped out to provide uniform bearing and support of pipe and utilities on undisturbed soil throughout its entire length, except where other means of supporting pipe are indicated.

2. Trenches for underground conduit and piping, where necessary, shall be excavated to the required depth and bell holes shall be provided where necessary to insure uniform bearing. Trench excavation lines shall provide sufficient clearance for the proper execution of underground mechanical work.

3. Trenches shall be by open cut from the surface. No tunneling will be allowed except by consent of the Owner's Geotechnical Engineer. Irregularities at bottom of trench, or where excavation is below required depth, shall be refilled to required grade with compacted granular fill.

4. Pipe trenches shall be excavated and minimum cover shall be provided to required depths as per the Connecticut State Building Code. Excavated materials adjacent to trench as directed shall be neatly banked.

5. Where trenches are in wet or soft ground that in the opinion of the Owner's Geotechnical Engineer is unsuitable for supporting the piping, concrete cradles or approved equivalent shall be installed.

6. Where necessary, the sides of trenches and excavations shall be supported by adequate sheeting and bracing and conform with applicable OSHA regulations to insure proper construction and safety of the workers. The Contractor will be held responsible for the sufficiency of sheeting and bracing and for all damages to property or injury to persons resulting from improper quality, strength, placing, maintaining and removing of same.

7. Prior to utility installation, soil subgrades in the utility trenches should be proofrolled as specified herein. Pipe bedding should be placed and compacted in accordance with the pipe manufacturer's requirements or as indicated in the Drawings, whichever is more stringent.

8. Immediately after piping has been installed, tested, inspected, and accepted, piping shall be filled around with special care to solidly fill voids without causing injury to piping. Up to two feet above the pipe's crown, the utility excavation shall be backfilled using structural fill placed in 4-inch thick loose lifts. For the remainder of trench backfill, the excavation shall be backfilled using structural fill placed in 12-inch thick loose lifts. Each layer shall be compacted before placing the next layer. Backfill shall be in such a manner so as to prevent future settlement.

3.4 FILLING AND COMPACTING

A. General

1. Do not commence filling and backfilling operations until construction below finish grade has been approved, underground utilities and mechanical items inspected and tested, forms removed, waterproofing or damproofing and other improvements installed, trash and debris removed, and temporary and permanent bracing installed.

2. Do not commence backfilling, filling and grading until existing subgrade has been compacted to 95% of the material's maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D1557).

3. Fill all excavations, backfill against all walls, and do all filling and grading necessary to bring the surfaces to the level required.

4. No fill material shall be placed on areas where free water is standing, or frozen subsoil area, or on surface which have not been approved for fill placement by the Owner's Geotechnical Engineer.

5. Do not backfill against concrete elements until the concrete has obtained its specified compressive strength.

6. Perform backfilling around foundation walls when the first floor provides sufficient bracing to withstand the backfill pressure. All other fill, backfill, and rolling to approximately finished grades shall then be completed.

7. Take particular care when rolling over areas where trenches or other excavations have been made and backfilled.

8. Grade bottoms of pavements and area way bottoms toward sediment pits or catch basins to maintain uniform thickness of the slabs.

B. Grading

1. Prior to placing fill or backfill in any area, grading is to be performed as required to provide for drainage. Ditching or filling around the area will be performed to intercept or divert all surface water. Within the area the ground which fill is to be placed will be graded so as to provide for unobstructed drainage from every point to a sump or other disposal point.

2. On completion of grading as specified above, closely examine to determine whether excessive wetness, springs, or other seepage of water can be observed at any point. If such conditions exist, positive drainage in suitable form, such as french drains or tilling, must be provided before placement of fill is undertaken.

C. Placement and Compaction of Controlled Fill and Backfill

1. Placement

a. Begin fill and backfilling in the lowest section of the area. Spread material evenly by mechanical equipment or by manual means above the approved compacted subgrade in lifts not exceeding 10 to 12 inches for material compacted by heavy machinery and 4 inches for material compacted by hand tamping. Build layers as horizontally as practical to prevent thickness of lift from exceeding that specified but provide with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point.

b. Moisture Control: The moisture-density curve for the fill use shall be supplied to the Contractor as a guide in controlling moisture to achieve the required degree of compaction. If, in the opinion of the Owner's Geotechnical Engineer, fill material becomes too wet for the required compaction, the fill shall be dried by a method approved by the Owner's Geotechnical Engineer prior to commencing or continuing compaction operations. Likewise, if, in the opinion of the Owner's Geotechnical Engineer, the fill material becomes too dry for the required compaction, the fill shall be moistened by a method approved by the Owner's Geotechnical Engineer prior to commencing or continuing compaction operations. The water content at the time of compaction should be within 2% points of the optimum water content.

2. Compaction: Compact each lift to 95% of the maximum dry laboratory density by ASTM D1557. The degree of compaction shall be checked by the Owner's Geotechnical Engineer and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the Owner's Geotechnical Engineer. Compact the fill and backfill to elevations and limits shown on Drawings and is subject to final inspection and approval by the Owner's Geotechnical Engineer.

3. Drainage During Fill Operation: At all times, maintain and operate proper and adequate surface and subsurface drainage to the satisfaction of the Owner's Geotechnical Engineer in order to keep the construction site dry and in such condition that placement and compaction of fill may proceed unhindered by saturation of the area.

4. Frost: Do not place fill materials when either the fill materials or the previous lift (or subgrade) on which it is placed is frozen. In the event that any fill which has already been placed on the surface shall become frozen, it shall be scarified and re-compacted, or removed, to the approval of the Owner's Geotechnical Engineer before the next lift is placed. Remove or re-compact any soft spots resulting from frost to the satisfaction of the Engineer before new fill is placed.

3.5 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.6 QUALITY CONTROL AND INSPECTION

A. The Owner will employ, at his own expense, a Geotechnical Engineer to review all laboratory test results and submitted reports specified in this Section.

B. The Owner's Geotechnical Engineer will interpret the tests, state in each report whether or not the test specimens and results comply with all requirements of the Contract Documents and note any deviations.

C. The Owner's Geotechnical Engineer will identify when and where samples are to be obtained. Contractor shall collect samples and forward them to the Owner's Testing Laboratory for testing. Testing Laboratory will submit the following laboratory test reports to the Owner's Geotechnical Engineer:

1. Laboratory results conducted on each type of borrow and fill material:

   a. Gradation Analysis ASTM D422.

   b. Atterberg limits ASTM D 4318.

   c. Modified Moisture-density curve determination ASTM D1557.

2. Owner's Geotechnical Engineer will determine the conformance of materials to be used for fills.

D. Field Inspection:

1. Foundation Subgrades: Foundation subgrades shall be inspected by Owner's Geotechnical Engineer to verify the design bearing capacities. The bottom of excavation prior to placement of structural fill shall be observed and approved by the Owner's Geotechnical Engineer prior to placement of structural fill. No foundation shall be constructed unless the Owner's Geotechnical Engineer approves the subgrade.

2. Proofrolling: Proofrolling where required shall be inspected by Owner's Geotechnical Engineer.

3. Paved Area and Building Slab Subgrades: Owner's Geotechnical Engineer shall inspect subgrades for paved areas and building slabs. No pavement or slab shall be constructed unless the subgrade approved by the Owner's Geotechnical Engineer.

4. Backfilling and Compaction: Backfilling and compaction below paved areas, building slabs, behind the foundation walls, and any other backfilling and compaction work shall be inspected by the Owner's Geotechnical Engineer. No fill shall be placed unless the previous lift is approved by the Owner's Geotechnical Engineer. Owner's Geotechnical Engineer will take field density tests of the subgrade for every 2,500 sq- ft. but not less than 3 tests in each compacted fill layer. All footing subgrades within structural fill shall have field density tests. Perform field density tests in accordance with ASTM D6938.

E. Contractor shall cooperate with the Owner's Geotechnical Engineer in the performance of the required tests.

3.7 DISPOSAL OF EXCAVATED MATERIALS

A. Legally dispose the excavated material to an off-site disposal facility, in accordance with all Local, State, and Federal Environmental regulations.

3.8 ERRORS IN DEPTH

B. In the event that any part of the excavation is carried, through error, beyond the depth and the dimensions indicated on the drawings of called for in the specifications, then the Contractor, at his own expense, shall furnish and install gravel or stone with which to fill to the required level, in all locations except beneath footings and piers. At these locations, Contractor shall be required to fill to level of bottom footing with concrete mixed in the proportion of the foundations bearing on them. Where established bottoms as shown on drawings have not been maintained or have been disturbed by operations under this contract, they shall be cleaned out and filled with concrete mixed in the proportion of the footings bearing upon them, without additional cost to the Owner.

PART 4 - ALLOWANCES & UNIT RATES

4.1 ALLOWANCES & UNIT RATES

A. See Division 1 for required allowances and unit rates.

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SECTION 311100 – CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SECTIONS AND DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The applicable provisions of the Connecticut Edition of the International Building Code, latest edition or as enforced by the local agency.

C. Architectural and Structural Plans and Specifications where the architectural and structural requirements are more stringent than the requirements outlined herein.

D. Section 02 01 00 – Protection of Existing Utilities

E. Section 31 25 00 – Soil Erosion and Sediment Control

F. Section 31 08 00 – Earthwork

G. Section 02 61 13 - Handling, Transport, Disposal of Excavated Soil

1.2 SCOPE OF WORK

A. Clearing Site of debris, grass, trees, and other plant life in preparation for Site or building earthwork.

B. Protection of existing structures, trees, or vegetation indicated in contract documents to remain.

C. Removal of existing sidewalks, drives, curbs, etc.

D. Removal of asphalt pavement and athletic courts where indicated on contract documents and as specified herein.

E. Stripping topsoil, if necessary, from areas that are to be incorporated into limits of project.

F. Disposal of cleared, grubbed, and stripped materials in accordance with all applicable codes and ordinances.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

The Connecticut Department of Energy & Environmental Protection's (CTDEEP) Guidelines for Soil Erosion and Sediment Control, latest edition.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems to protect adjacent properties and water resources from erosion and sedimentation.

B. Owner will obtain the Stormwater and Dewatering Wastewaters from Construction Activities permit for stormwater discharges associated with construction activities from the CTDEEP. Contractor shall conform to the requirements therein.

C. Contractor shall be totally responsible for conducting soil erosion and sediment control and the storm water management practices in accordance with all applicable permits and for enforcement action taken or imposed by federal or state agencies, including cost of fines, construction delays, and remedial actions resulting from contractor's failure to comply with all provisions of the applicable permits.

1.6 PROJECT CONDITIONS

A. Contractor to provide a thorough inspection of the site prior to bidding and accept the site as is.

B. Variations to conditions or discrepancy in actual or described as proposed conditions as they apply to site preparation operations are to be brought to the attention of the Owner prior to commencement of sitework.

PART 2 - PRODUCTS

2.1 MATERIALS

Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

Verify existing plant life that is to remain and any clearing limits are clearly tagged, identified, and fenced in such manner as to insure their safety throughout construction operations.

3.2 PROTECTION

A. Locate and identify existing utilities that are to remain and protect from damage.

B. Protect trees, plant growth, and features not designated for removal.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by the governing authority. Dust control shall be provided with sprinkling systems or equipment provided by contractor.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by same at contractor’s cost.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation's "Manual on Uniform Traffic Control Devices”, Connecticut Department of Transportation and local requirements.

3.3 CLEARING, GRUBBING AND STRIPPING

A. The Contractor shall clear areas required for execution of work.

B. Unless otherwise indicated on Construction Drawings, the contractor shall remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations are to be filled to subgrade elevation to avoid collecting water to form ponds. Satisfactory fill material shall be placed in accordance with Section 31 00 00.

C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.

D. The Contractor shall strip all asphalt within the building footprint area and 10 ft beyond, and from any other areas to receive new fill. Removed asphalt can be milled by the Contractor and asphalt millings can be reused as subbase material beneath new pavements. Asphalt to be used as recycled material shall be milled to form a well-graded material having a maximum particle size of 2 inches. The Contractor shall provide dust control measures during any milling process. Excess asphalt materials shall be properly disposed of in accordance with all applicable codes and ordinances.

3.4 TOPSOIL EXCAVATION

A. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, weeds, roots, and other objectionable material.

B. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

C. Strip topsoil from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

D. Stockpile topsoil in storage piles in areas acceptable to the Owner. Construct storage piles to freely drain surface water. Cover storage piles in compliance with the erosion and sedimentation control specifications to prevent windblown dust and waterborne erosion. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Excess topsoil shall be removed from site by Contractor unless specifically noted otherwise on Construction Drawings.

E. Stockpiled topsoil shall be reused as general fill in landscaped areas as permitted by Owner’s geotechnical engineer and as specified in specifications.

END OF SECTION

SECTION 312316 – EXCAVATION, BACKFILL AND SUBGRADE PREPARATION FOR PAVEMENT

PART 1 - GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 320000 – General Requirements

C. Section 312500 – Soil Erosion and Sediment Control

D. Section 310000 – Earthwork

E. Section 321216 – Asphaltic Concrete Paving

F. Section 321313 – Portland Cement Concrete Paving

G. Section 321613 – Curbs and Sidewalks

H. Contract Drawings and Documents

I. Geotechnical Engineering Investigation by Langan Engineering

1.2 SCOPE OF WORK

A. Excavation and backfilling to line, grade and configuration as shown in the Contract Documents and as described in these specifications for proposed asphaltic concrete, porous asphaltic concrete and Portland cement concrete pavement

B. Removal of unsuitable material beneath proposed paved areas.

C. Compacting fill materials in acceptable manner as specified herein.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest

extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) - latest edition

1. D 422 Method for Particle Size Analysis of Soils
2. D 1557 Test for Moisture-Density Relations of Soils Using 10-lb (4.5 Kg) Hammer and 18-inch (457 mm) Drop (Modified Proctor)
3. D 2216 Laboratory Determination of Moisture content of Soil
4. D 2487 Classification of Soils for Engineering Purposes
5. D 2922 Tests for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)
6. D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
7. D 4318 Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) - latest edition
T 88 Mechanical Analysis of Soils

C. All applicable OSHA Regulations

D. Geotechnical Engineering Study, prepared by Langan CT, Inc. dated 03 January 2020

1.5 QUALITY ASSURANCE

A. An Engineer, familiar with the requirements of the Subsurface Investigation and Contract Documents, selected and paid by the Owner (herein referenced to as “Owner’s Engineer”), may be retained to perform construction testing on filling operations and subgrade preparation as specified in section 31 00 00 and described herein. This inspection will not relieve the Contractor from his responsibility to complete the work in accordance with the plans and specifications.

1.6 SUBMITTALS

A. Submit gradation and certification of aggregate material that is to be used for review at least one week prior to use on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 310000 of these Specifications and approved by the Owner's Engineer.

B. Fill material from off-site as specified in Section 310000 of these specifications and approved by the Owner's Engineer.

2.2 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on-site, transporting vehicles shall at no time endanger improvements by rutting, overloading, or pumping.

B. Excavation is to be performed using capable, well maintained equipment and methods acceptable to the Owner and the Contract Document requirements and schedule.

C. Compaction shall be performed using a 5-ton static drum weight, vibratory, smooth drum roller or as specified in the Geotechnical Report.

D. Smaller compaction equipment, together with thinner lifts may be required at areas of limited access or maneuverability. In such a case, the compaction equipment shall be a double drum walk-behind roller and shall be subject to the Owner's Engineer approval.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify lines, elevations, and grades necessary to construct pavements, curb, sidewalk, and roadways as shown on Contract Documents.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify site utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Overexcavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. These areas shall be stabilized by using aggregate material placed and compacted as specified.

3.2 EXCAVATION

A. Excavate roadways and pavement areas to line and grade as shown on the Contract Documents.

B. Areas of existing curb islands, sidewalks and existing pavement failure shall be excavated to competent soil to the satisfaction of the Owner's Engineer. Excavation of soft soils will be required in both fill and overlay areas to the satisfaction of the Owner's Engineer.

C. Perform excavation using capable, well maintained equipment and methods acceptable to Owner and local governing agencies.

D. Where existing grades are above proposed subgrade elevation, excavate materials in the pavement areas to the subgrade elevations necessary based on the finished pavement lines and grades as shown in the Contract Documents being careful not to overexcavate beyond the elevations needed. Replacement of fill in areas overexcavated by the Contractor without approval of the Owner's Engineer shall be replaced as compacted fill in accordance with these Specifications at no additional cost to the Owner.

E. Excavated on-site soils that meet the requirements of Section 31 00 00 of these Specifications and approved by the Owner's Engineer may be used as fill on-site.

F. Excavated on-site soils that are unsuitable for fill may be used in landscaped areas if approved by the Owner's Engineer. Otherwise this material shall be legally disposed of off-site at no additional cost to the Owner.

G. Unsuitable material, such as wood and any other deleterious materials determined to be unsuitable by the Owner's Engineer for use as on-site fill shall be legally disposed of off-site at no additional cost to the Owner.

3.3 SUBGRADE PREPARATION

A. Existing grades below areas of proposed pavement shall be leveled prior to fill placement or paving. The Contractor shall remove existing trees, roots, stumps, organic wetland soils, and top soil in these areas prior to placement of any fill and legally dispose of this material off-site at no additional cost to Owner.

B. The Contractor shall drain any standing or puddled water in low lying areas.

C. All existing grades below areas of proposed pavement shall be proofrolled and compacted with a minimum of 6 overlapping passes using the vibratory drum roller specified in part 2.02 of this Section prior to placement of pavement subbase. Existing areas which exhibit "pumping" or "rutting" under the action of the roller shall be removed and replaced with suitable fill material as specified in Section 310000 of these Specifications, or as directed by the Owner's Engineer.

D. Excavated on-site soils that are unsuitable for pavement subgrade below paved areas may be used in landscaped areas if approved by the Owner's Engineer. Otherwise this material shall be legally disposed of off-site at no additional cost to the Owner.

E. Unsuitable material, such as wood and any other deleterious materials determined to be unsuitable by the Owner's Engineer for use as on-site fill shall be legally disposed of off-site at no additional cost to the Owner.

3.4 SUBGRADE FILL PLACEMENT AND COMPACTION

A. Fill material shall not be placed in areas of standing water, in areas of frozen or thawing ground, or in areas that have not been approved by the Owner's Engineer.

B. Fill materials shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to a satisfactory moisture content as determined by the Owner's Engineer.

C. Maintain optimum moisture content of fill materials as specified herein to attain required compaction density.

D. Materials shall be tested in accordance with Section 310000.

E. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

F. Fill lift surfaces shall be made smooth and free from ruts or indentations at the end of any work day when significant precipitation is forecast to prevent saturation of surficial fill material. Fill surfaces shall be graded to drain and sealed with a smooth drum roller at the completion of each work day.

G. Subgrade fill in paved areas shall be placed in uniform loose lifts and compacted in accordance with the Specifications.

H. Wet, saturated material shall be removed and replaced or scarified and air dried as necessary to achieve the field densities specified in this Section. Drying may be assisted by discing, harrowing, or pulverizing until moisture content is reduced.

I. Prior to paving, the subgrade shall be proofrolled with a minimum of 6 overlapping passes using a 5-ton static drum weight vibratory roller.

J. Remove areas of finished subgrade found to have insufficient compaction density of depth necessary and replace with suitable compacted fill as approved by the Owner or Owner's Engineer. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.5 MAINTENANCE OF APPROVED SUBGRADE SURFACES

A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade and binder course from excessive wheel loading during construction including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material that has been approved by the Owner's Engineer. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 310000.

3.7 QUALITY CONTROL

A. Compaction tests shall be performed by the Owner's Engineer as specified in Section 310000 together with the following for areas of proposed pavement:
In cut areas, not less than one compaction test for every 15,000 square feet.
In fill areas, one test for every 15,000 square feet for each lift.

B. Prior to paving, the finished subgrades shall be verified by the Contractor to ensure proper elevation and conditions for construction above subgrade.

C. Tolerances of 0.10 feet will be permitted. Any deviation from the design grades shall not result in changes in drainage areas or ponding. The Contractor shall provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION

SECTION 312319 - DEWATERING

PART 1 – GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Comply with water disposal requirements of authorities having jurisdiction.

C. General Permit for Stormwater from Construction Activities

D. Section 31 08 00 – Earthwork

E. Section 31 23 33 – Trench Excavation and Backfill for Utilities

F. Geotechnical Engineering Study prepared by Langan

1.2 SCOPE OF WORK

A. Construction dewatering.

B. Erosion and Sediment Control

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 PERFORMANCE CRITERIA

Design, provide, test, operate, monitor, and maintain a dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrade.

PART 2 - PRODUCTS

2.1 PRODUCTS

All pumps, hoses, electricity, erosion control measures needed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding surrounding area.

C. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.

D. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

E. Accomplish dewatering without damaging existing buildings adjacent to excavation.

3.2 DEWATERING

A. Install dewatering system using wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavation below ground-water level, place system into operation to lower water to specified levels and then operate it continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner to avoid inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION

SECTION 312333 – TRENCH EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 – Earthwork

C. Section 312319 – Dewatering

D. Section 331116 – Site Water

E. Section 333000 – Site Sanitary Sewers

F. Section 334100 – Storm Sewer Systems

G. Section 337100 – Utilities

H. Construction Documents and Drawings

I. Local Utility Company Requirements

J. Geotechnical Engineering Study, prepared by Langan

1.2 SCOPE OF WORK

A. Excavating trenches for the installation of utilities.

B. Backfilling trench with bedding material as specified and finish filling trenches with suitable material to proposed subgrade.

C. Compacting subgrade, bedding, and backfill materials in an acceptable manner.

D. Compliance with all environmental and health and safety regulations.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a

construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Latest Edition

1. D 422 Method for Particle Size Analysis
2. D 698 Test of Moisture Density Relations of Soils - Standard Proctor Method
3. D 1557 Test for Moisture-Density Relations of Soils Using 10-lb. (4.5 Kg)
4. Hammer and 18-inch (457 mm) Drop (Modified Proctor)
5. D 2216 Laboratory Determination of Moisture Content of Soil
6. D 2487 Classification of Soils for Engineering Purposes
7. D 2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
8. D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
9. D 4318 Test for Plastic Limit, Liquid Limit, & Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T 88 Mechanical Analysis of Soils

1.5 QUALITY ASSURANCE

A. A Geotechnical Engineer, selected and paid by owner, may be retained to perform construction inspection and testing on backfilling operations. This inspection will not relieve the Contractor from his responsibility to complete the work in accordance with the plans and specifications.

1.6 SUBMITTALS

A. The Contractor shall contact all utility companies and identify any requirements. Contractor shall provide written confirmation of the status of all utility construction to the Owner at the time of the preconstruction conference or no later than 30 days following the project possession date.

B. Submit gradation and origin for each type of offsite fill and/or bedding material that is to be used in backfilling.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of all subsurface utilities, structures and obstructions encountered.

B. Accurately record any as-built variation from the construction plans and specifications. The Contractor shall provide as-built drawings within 30 days of project completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material: AASHTO No. 67 processed sand and gravel free from debris, clay lumps, organic, or other deleterious material, and complying with following gradation requirements:

1. U. S. Sieve: Size Percent Passing (by weight)

a. 1 Inch: 100
b. 3/4 Inch: 90-100
c. 3/8 Inch: 20-55
d. No. 4: 0-10
e. No. 8: 0-5

B. Backfill material as approved by the owner and/or the Geotechnical Engineer and utility provider.

PART 3 - EXECUTION

3.1 PREPARATION

A. Set all lines, elevations, and grades for utility and drainage system work and maintain for the duration of work. Provide careful maintenance of benchmarks, property corners, monuments, or other reference points.

B. Protect and maintain in operating condition, existing utilities encountered during utility installation. Repair any damage to surface or subsurface improvements shown on Drawings.

C. Verify location, size, elevation, and other pertinent data required to make connections between existing utilities and drainage systems, and proposed construction indicated on Drawings. Coordinate all building utility connection locations and elevations with architectural plans. Contractor shall comply with all local codes and regulations.

D. Install dewatering systems that will be required to construct the proposed utilities to the design elevations and using the methods described herein. Water pumped out of excavations shall be disposed of on-site, and will not be discharged directly to the city storm drainage system.

E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas are to be stabilized by using acceptable backfill materials and/or additional bedding material placed and compacted as specified to the satisfaction of the Geotechnical Engineer.

3.2 EXCAVATION

A. Contact local utility companies before excavation begins. Dig trenches at proper width and depth for laying pipe, conduit, or cable and in accordance with utility company requirements. Cut trench banks for safety and remove stones as necessary to avoid point-bearing.

B. All trench excavation side walls shall be sloped, shored, sheeted, braced or otherwise supported by means of sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Trench width requirements below the top of the pipe shall not be less than 12 inches nor more than 24 inches wider than the outside surface of any pipe or conduit that is to be installed. All other trench width requirements for pipe, conduit, or cable shall be the minimum practical width that will allow for proper compaction of trench backfill and satisfy safety and utility company regulations.

D. Accurately grade trench bottom to an elevation 6 inches below the pipe, as per bedding details in construction drawings. Provide uniform bearing and support for each section of pipe on bedding material at every point along the entire length, except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.

E. During excavation, stockpile excavated material suitable for backfilling in an orderly manner far enough from the trench to avoid overloading, slides, or cave-ins.

F. Remove excavated materials from the site which are not suitable for backfill.

G. Any abandoned structures, utilities or debris discovered during excavation shall be removed and disposed of.

H. Utility alignments have been designed to avoid expected obstructions wherever possible. If unanticipated significant obstructions are encountered during utility installation work immediately notify the Owner and Engineer.

I. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

J. Utility installation shall meet the following minimum pipe installation depths, or applicable codes and ordinances, measured from finished grade or the paved surface.

1. Water Mains: 54-inch minimum to top of pipe barrel, or as required by the local utility company, whichever is deeper.
2. Sanitary Sewer: Elevations, and grades as indicated on Drawings.
3. Storm Sewer: Elevations, and grades as shown on Drawings.
4. Electrical Conduits: 30-inch minimum to top of secondary service conduits, 36" minimum to the top of primary service conduits, or as required by NEC 300-5, NEC 710-36 codes, or the local utility company requirements, whichever is deeper.

5. Telephone Conduits: 18-inch minimum to top of conduit, or as required by the local utility company, whichever is deeper.
6. Gas Mains and Service: 30-inch minimum to top of pipe, or as required by the local utility company, whichever is deeper.

3.3 LATERALS

A. All utilities intended to connect to services within any building will be extended to within 5 feet of the exterior face of building in the direction and elevation to connect at those geometrical locations indicated or inferred on the drawings. All utility ends will be plugged and marked by a 2" x 4" piece of wood extending from the utility invert to 4 feet above final grade.

3.4 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit to designated line and grade 6 inches below the bottom of the pipe, to width as specified previously. Compact trench bottoms a minimum of 95% of the maximum dry density as determined by ASTM D1557, Modified Proctor Test.

B. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide a suitable base for continuous and uniform bedding.

C. Place bedding material and compact in 6 inch loose lifts to obtain at least 95% of the maximum dry density. Accurately shape bedding material to conform to lower portion of pipe barrel. After pipe installation, place and compact bedding material as specified above in maximum 6 inch loose layers to the springline of the pipe.

3.5 BACKFILLING

A. After pipe or conduit has been installed, bedded and tested as necessary, backfill trench to finish grade in 8 inch thick loose lifts of approved fill soils, compacting and testing each lift as specified above.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and recompacted.

3.6 COMPACTION

A. Exercise proper caution when compacting immediately over top of pipes or conduits.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

END OF SECTION

SECTION 312500 – SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 - Earthwork

C. Contract Drawings and Documents

D. CT DEEP General Permit for Stormwater Discharge from Construction Activities

1.2 SCOPE OF WORK

A. Temporary and permanent soil erosion control systems.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. The Connecticut Department of Energy & Environmental Protection's (CTDEEP) Guidelines for Soil Erosion and Sediment Control, latest edition

1.5 QUALITY ASSURANCE

A. The Contractor shall carefully adhere to the construction sequence that is shown on the Contract Drawings.

B. The Contractor shall follow Soil Erosion and Sediment Control Notes that are shown on the Contract Drawings.

C. The Contractor shall make frequent inspection of temporary soil erosion controls and maintain them in working order until permanent soil erosion controls are established.

1.06 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall protect adjacent properties and water resources from soil erosion and sediment damage throughout construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick-growing grasses such as wheat, rye or oats in accordance with Contract Drawings.

B. Fencing for siltation control as specified on the Contract Drawings.

C. Fibrous blankets by North American Green SC150BN, biodegradable, or approved Equal.

D. Temporary mulches such as loose hay, straw, netting, wood, cellulose or agricultural silage.

E. Filter fabric as specified on the Contract Drawings, or approved equal.

F. Haybales free from invasive species

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site conditions and sediment control plans.

B. Review the soil erosion and sediment control plans as they apply to current conditions. Any proposed deviation from the plans must be submitted to the Owner’s Engineer in writing 72 hours prior to commencing that work.

3.2 SOIL EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place soil erosion control systems in accordance with the Contract Documents prior to any earthwork construction.

B. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations by following the construction phasing on the Soil Erosion and Sediment Control Plan.

C. The Contractor will be required to incorporate all permanent soil erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical. Equip catch basins with filter fabric inlet protection immediately upon construction.

D. The temporary soil erosion control systems installed by the Contractor shall be maintained as directed by the Owner's Engineer to control siltation at all times during the life of the contract. The Contractor must respond to any maintenance or additional work ordered by the Owner's Engineer within a 48 hour period.

E. Slopes that erode easily shall be temporarily seeded as the work progresses with quick growing grass grains of wheat, rye or oats unless otherwise specified in the Landscape Specifications. In areas where seeding is ineffective, as determined by the Owner's Engineer or other governing authorities, the Contractor shall provide fibrous netting as shown on Contract Drawings at no additional cost to the Owner.

F. All soil erosion control measures shall be maintained until all permanent improvements to the site are complete unless otherwise directed by the Owner's Engineer.

END OF SECTION

SECTION 320000 – GENERAL SITE REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

A. The work generally includes, but is not limited to, the following:

1. Soil Erosion and Sediment Control Measures
2. Earthwork
3. Placement of Compacted Fill
4. Removal of Cut
5. Rough Grading of Grass Areas
6. Construction of Storm Drainage System
7. Construction of Sanitary Sewer System
8. Construction of Site Water System
9. Construction of On-Site Utilities
10. Construction of Curbs
11. Construction of Site Walks
12. Paving of Parking Areas and Roadways
13. Paving of Playground Areas
14. Traffic Striping and Signage
15. Fine Grading of Grass Areas
16. Landscaping
17. Site Lighting

B. Associated work items as described in the Contract Drawings and Documents and all construction methods and procedures necessary for the performance of the work.

C. The Site Contractor shall provide adequate personnel, facilities, material, and equipment to complete the work shown on the Contract Drawings and Documents and as specified herein and in accordance with the requirements of the town within the agreed upon schedule. When these specifications are at variance, the more restrictive requirements shall apply. The Contractor shall employ a qualified supervisor to provide adequate and efficient coordination of the Work and to adhere to all requirements set forth in this specification and general construction practices within the State of Connecticut and those required by the town. The Supervisor shall be present on the site on a continuous full-time basis and have authority to act on behalf of the Contractor.

D. The Contractor shall obtain and pay for the construction of all related site work. The Contractor shall pay for all other fees and services, give notice, file necessary drawings, and obtain permits and certificates of approval required in connection with the related work of their contracts, comply with laws, ordinances, rules and regulations of departments having jurisdiction over this work.

E. Additional Owner and Engineer time for repeat inspections of punch list items after the initial inspections will be charged to the Contractor in the form of a deductive change order.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 CONTRACTOR TO ACCEPT SITE CONDITIONS AND CONTRACT DOCUMENTS

A. The Contractor shall accept the site as is. The Contractor shall make and shall be deemed to have made a thorough site inspection in order to field check existing site conditions, correlate conditions with the drawings and resolve any possible construction conflicts with the Owner and Owner's Engineer prior to commencement of work. This includes a topographic survey of any areas the Contractor requires additional topographic information, and subsurface utility investigations. Any conditions that differ from the existing conditions shown on the drawings that are not brought to the attention of the Owner and Owner's Engineer prior to the start of work shall not be considered grounds for a change order.

B. The work to be performed is as shown on the Contract Drawings. Attempts have been made to note all specific items on the drawings. The contractor is responsible for means and methods of construction; as such, these plans may not completely represent all specific site details of installation required for sitework construction. Contractor is responsible to provide all improvements required to achieve construction depicted on these plans. Incidental items not included in the Contract Documents shall be constructed in accordance with standard engineering or architectural requirements. It shall be the Contractor's responsibility to repair or replace any existing facilities (utilities, streets, sidewalks, etc.) damaged by him during the work. Such repairs or replacement shall be done at the Contractor's own expense to the satisfaction of the Owner.

C. The Contractor shall provide written requests for information to the Owner and Owner's Engineer prior to the construction of any specific sitework item if any sitework item depicted on the plans warrants additional engineering information required for construction and is not related to means and methods of construction. The Contractor shall be responsible for sitework items installed differently than intended as depicted on the plans in the absence of submitting and receiving reviews and/or direction on written requests for information from the Owner or Owner's Engineer.

D. It is specifically noted that information related to elevations and proposed utilities (such as roadway grades, invert elevations, rim elevations, grate elevations, building finished floor elevations, etc.) may be found in more than one location on the contract documents. Contractor shall specifically review all plans, profiles and any information/data tables for consistency prior to construction. Any inconsistencies or discrepancies that are found shall immediately be brought to the attention of the Owner's Engineer in writing requesting clarification prior to construction.

E. Contractor is specifically noted that there are additional notes, specifications and requirements contained on sheets throughout the plan set and available references to specifications from applicable governing authorities and industry standards. It is the contractor's responsibility to obtain, review and adhere to all applicable requirements.

F. Contractor's acceptance of the project contract specifically binds the contractor to the requirements noted above and contained in this entire document.

G. Contractor is specifically noted that the project is subject to the conditions and requirements of the following permits:

1. Permit: Wetlands Permit
   Agency: Town of Trumbull Inland Wetlands and Watercourses Commission
   Permit No.: TBD
2. Permit: General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities
   Agency: CTDEEP – Water Discharge
   Permit No.: TBD
3. Permit: Certificate
   Agency: OSTA
   Permit No.: TBD

1.5 INDEMNIFICATION

A. The Contractor shall indemnify and save harmless the Owner, and its respective agents, officers, employees and Owner's Engineer (herein collectively called the "indemnities") from and against any and all liability, loss, damages, interest, judgments and liens growing out of, and any and all costs and expenses (including, but not limited to, counsel fees and disbursements) arising out of, or incurred in connection with, any and all claims, demands, suits, actions, or proceedings which may be made or brought against any of the indemnities for or in relation to any violation of this Contract, the laws, statutes, ordinances, rules, regulations, executive orders and agreements herein provided or any injuries, including death at any time resulting therefrom, sustained by any person or persons, or on account of any damage to property, arising out of or in consequence of the performance of or the failure to perform the contract, whether or not such injuries to persons or damage to property are due

or claimed to be due to any negligence of the Contractor or its employees, agents, subcontractors or materialmen, the indemnities or any other person.

1.6 WARRANTIES

A. The Contractor shall correct defective work at the Contractor's expense which appears within one year's time from acceptance of work. Failure of Contractor to correct such defects within a reasonable time after being notified to do so shall permit the Owner to cause such defects to be corrected and charge the Contractor the cost of corrections.

B. The Contractor shall submit to the Owner and Owner’s Engineer all material warranties supplied by manufacturers.

1.7 GENERAL QUALITY ASSURANCE

A. References and Standards: The Contractor shall comply with all rules, regulations, laws and ordinances of all Authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided without additional cost. All Standards shall be the latest edition and revisions.

B. The Contractor shall deliver material to the site, in the approved Manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to approved samples. Certifications for materials shall be included with the shipment.

C. The Contractor shall store material under cover (if appropriate) in a clean, dry, above-ground location, and remove materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.

1.8 SECURITY

A. Protect work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate and maintain security program as described herein throughout construction period until Owner acceptance precludes the need for Contractor security.

C. Restrict entrance of persons and vehicles into project site. Allow entrance only to authorized persons with proper identification. Maintain log of workers and visitors, make available to Owner on request.

D. Maintain a list of authorized persons; submit copy to Owner on request.

1.9 SAFETY PROVISIONS:

A. Site safety is entirely the responsibility of the Contractor. The Contractor is hereby made aware that the Owner's Engineer does not have the authority to stop the work on the grounds of unsafe work practices.

B. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations as required by all authorities having jurisdiction bearing on the conduct of the Work as specified.

C. If any of the Contractor's work is performed contrary to such laws, ordinances, rules and regulations, and/or without the required notices, he shall bear all cost arising therefrom.

D. The Contractor shall also give prior written notice to all concerned utility companies, agencies, authorities, owners, etc., at least forty-eight (48) hours in advance of commencing any work on this Contract.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.10 SUBMITTALS:

A. General:
1. The Contractor shall submit to the Owner's Engineer and to Town Officials and/or the Town Engineer, where required, sufficient documentation from the manufacturers that all material and products used by the Contractor meet the required specifications. Such documentation shall be submitted and reviewed prior to the delivery of the material.
2. This documentation shall include shop drawings, vendor drawings, manufacturer's specifications and catalog cuts. The shop drawings shall include plans, elevations, sections and details of the work showing in detail the methods of installation and all data and assumptions considered in the design.
3. The Owner's Engineer will review appropriate documentation for general compliance to the specifications prior to delivery. The Owner's Engineer's review will be made on a timely basis.
4. The review of the Owner's Engineer or failure to review shall not be construed as permitting any departure from Contract requirements, or as relieving the Contractor of responsibility for any errors, including details, dimensions or materials. If submittals show variations from Contract requirements, the Owner's Engineer may review such variations, subject to a proper adjustment in the Contract. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing work in accordance with the Contract Documents even though such submittals identifying other variations have been reviewed. It is specifically noted that variations from items depicted on the plan require the review and approval of the Town Engineer.
5. All submittals required by specifications shall be submitted, unless otherwise stated herein, as follows:

    a. Specifications – One electronic or three paper copies of material specifications shall be submitted to the Owner's Engineer unless agreed that less copies will be sufficient.
    b. Shop Drawings – One electronic or three paper copies shall be submitted to the Owner's Engineer.

6. The work shall not begin until all required submittals for each segment of work have been reviewed.

1.11 PROJECT COORDINATION

A. Cooperate with the Owner when necessary in allocation of mobilization areas of the site for field offices and sheds, for access, traffic and parking facilities.

B. Comply with Owner procedures for intraproject communications; submittals, reports and records, schedules, coordination drawings, and recommendations and resolution of ambiguities and conflicts.

C. Comply with instructions of the Town and the Owner for use of temporary utilities and construction facilities.

D. Submit preliminary progress schedule and coordinate with project construction schedule. After review, revise and resubmit schedule to comply with revised project schedule. During progress of work revise and resubmit as directed.

E. Provide information required by Owner and Owner’s Engineer for preparation of coordination drawings.

F. Notify Owner and Owner’s Engineer when work is considered ready for substantial completion. Accompany Owner’s Engineer on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion and punchlist.

1.12 PROGRESS SCHEDULE

G. The Contractor shall submit a detailed schedule for approval by the Owner before beginning work and shall adhere to the approved schedule. The schedule, which shall list all major and minor construction tasks, shall be based on the requirements set forth by the Owner and Construction Manager and shall be in accordance with the construction phasing plans. All work shall be done in a continuous manner unless otherwise directed by the Owner and Construction Manager and shall be completed at a satisfactory rate of progress. If in the opinion of the Owner, or his/her representative, work is not being done at a satisfactory rate of progress, the Owner may order the Contractor to increase his work force to insure completion of the project on schedule.

1.13 PERMIT APPLICATIONS AND COMPLIANCE

A. The Contractor shall carefully plan and coordinate his work so as to comply with all criteria, conditions and the intent of all project permits.

1.14 ENVIRONMENTAL PROTECTION

A. It is the Contractor's responsibility to assure himself that all applicable Federal, State and local laws, concerning pollution and environmental protection are being complied with by his personnel and subcontractors.

B. When Contractor is in, or it is anticipated that any part of the work may become in non-compliance with applicable Federal, State, and local laws or regulations, the Owner may issue an order stopping all or part of the work until satisfactory corrective actions have been taken, or may order supplemental actions to be taken to stay in, or come into, compliance. No part of the time lost due to any such stop order shall be made subject of a claim for extensions of time, or for extra compensation or damages by the Contractor.

C. In particular, the Contractor shall not allow the discharge of concrete, mortar, grout, gasoline, diesel, or the washing from vessels containing these materials, or other construction materials, into public areas, onto adjacent properties or the sewage or stormwater conveyance systems.

D. Contractor shall provide and maintain all facilities necessary for pollution control under this Contract as long as construction operations continue.

1.15 CONTRACTOR'S REPRESENTATIVES

A. The Contractor shall provide and maintain a capable and experienced field person to oversee all contract operations. The Contractor shall submit references for his proposed representative to, and obtain approval from, the Owner and/or Owner’s Engineer prior to the start of construction. The representative shall be on-site during all operating hours of the project.

B. As appropriate, the Contractor or his subcontractors shall provide qualified supervisory personnel for specialist aspects of the work, such as concrete, landscaping, and site furnishings.

1.16 JOB OFFICE

A. General:

1. The Contractor shall provide and maintain a suitable site trailer for the use of his supervising personnel at a location agreed upon by the Owner and/or Owner’s Engineer.
2. The offices shall be equipped with appropriate facilities, including, telephone, internet, water, heat, air conditioning, and electricity. The cost for maintaining the office facilities and the trailer shall be paid for by the Contractor for the duration of the project. The contractor shall arrange for weekly office trailer cleaning.
3. The Contractor shall provide and maintain in a neat and sanitary condition such temporary sanitary conveniences and accommodations for the use of his employees and Owner’s Representative as may be necessary to comply with the requirements and regulations of the Department of Health and other governing agencies having legal jurisdiction.
4. The Contractor shall provide all security necessary and be entirely responsible for protection of equipment and materials supplied and used in conjunction with his work.
5. The office shall be maintained throughout the course of construction and shall be removed upon final acceptance of the Contract work.

1.17 SITE ACCESS

A. General
   1. The Contractor shall construct any construction access ways shown on the Drawings or as required prior to the execution of his work. The contractor shall be required to maintain all necessary access and parking areas, haul roads, ramps and any other temporary facilities required by the Owner to insure safe and satisfactory operation of the facility and completion of the work in accordance with the schedule. Cleanliness of off-site streets (both private and public) shall be maintained by the Contractor throughout construction. All public roadways shall be kept free of debris and sediment that result from the subject work. The contractor will provide daily sweeping if required by the Town.
   2. The Contractor shall coordinate construction fencing with the Owner.

1.18 EXISTING CONDITIONS, UTILITIES AND STRUCTURES

A. Prior to the beginning of any grading work, the Contractor shall make sufficient checks on the topographic conditions and subsurface utilities to satisfy himself that the existing information as shown on the topographic survey and contract documents are adequate for construction. Should any discrepancies be found, they shall be reported to the Owner's Engineer immediately. Claims for extras due to discrepancies in the existing conditions will not be reviewed if the Owner's Engineer and Owner are not notified immediately (within 24 hours of beginning of site work).

B. Verify Locations: Locations of existing underground utilities and structures as shown on the Contract Documents are approximate and may not necessarily be complete. These locations must be verified by the Contractor prior to construction. It is specifically noted that the contractor may require the use of a utility location service in the event the Contractor deems it necessary to perform this verification.

C. Prior to construction of the sanitary, water, gas, electric, telephone, cable and storm sewer systems, the Contractor shall conduct test pits at all proposed utility crossings with existing underground utilities and/or storm pipes. Elevations of existing utilities shall be accurately recorded and submitted to the Owner's Engineer for verification of the proposed design. Any necessary adjustments to the proposed design will be made by the Owner's Engineer in a timely manner.

D. The Contractor is specifically made aware that the exact depth and location of the off-site water and gas mains are unknown. The Contractor shall perform test pits prior to installation of the new laterals where shown on the plans to verify the depth and location of existing connection points.

E. Avoid Damage: The Contractor shall exercise care to avoid damage to all existing structures, poles, utilities, pipes, etc. which are scheduled to remain. In locations where the excavation is carried beneath or adjacent to such facilities, the Contractor shall adequately support such structures, utilities or pipes as necessary to remain in operation and maintain their original position. The Contractor shall be responsible for any damage caused to any utilities by this work, and shall repair any damage without charge to the Owner.

F. The Contractor shall provide written requests for information to the Owner and Owner's Engineer prior to the construction of any specific item if any specific item depicted on the plans warrants additional information required for construction and is not related to means and method of construction. The Contractor shall be responsible for specific sitework items installed differently than intended as depicted on the plans in the absence of submitting and addressing written requests for information.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials appropriate to the work, and meeting with the Owner’s Engineer's approval.

PART 3 - EXECUTION

3.1 GENERAL

A. Execute general measures as appropriate, and meeting with the Owner’s Engineer's approval.

END OF SECTION

SECTION 321216 – ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 312316 - Excavation, Backfill, and Subgrade Preparation for Pavement

C. Section 321613 - Curbs and Sidewalks

D. Section 321723 - Pavement Markings

E. Connecticut Department of Transportation Standard Specifications, latest edition.

F. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. Preparation and placement of asphaltic concrete binder course.

B. Preparation and placement of asphaltic concrete surface course.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. The Asphalt Institute (AI) latest edition

1. MS 2 Mix Design Methods for Asphaltic Concrete and Other Hot Mix Types
2. MS 3 Asphalt Plant Manual
3. MS 19 Basic Asphalt Emulsion Manual

B. US Army Corp of Engineers

1. UN-13 Hot Mix Asphalt Paving Handbook, (CE MP-ET)

C. American Society of Testing and Materials (ASTM) latest edition

1. D 946 Penetration - Graded Asphalt Cement for use in Pavement Construction
2. D 1188 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
3. D 1559 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

D. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. M 117 Mineral Filler "Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing"
2. M 140 Tack Coat "Emulsified Asphalt"
3. M 208 Tack Coat "Cationic Emulsified Asphalt"
4. M 226 Viscosity Graded Asphalt Cement
5. T 245 Marshall Mix Design

E. Connecticut Department of Transportation Standard Specifications, latest edition.

F. Municipal Standards

1.5 QUALITY ASSURANCE

A. At the discretion of the Owner, an Engineer, selected and paid by Owner (herein referenced to as “Owner’s Engineer”, may be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, compaction, and surface smoothness. Asphaltic surface and base courses shall be randomly cored at minimum rate of 1 core per 20,000 sq. ft of paving. However, no less than 3 cores in light duty areas and 3 cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphaltic concrete. Asphaltic concrete pavement samples shall be tested for conformance with mix design.

B. Establish and maintain required lines and elevations.

C. In-place compacted thickness shall not be less than thickness specified on Contract Documents. Areas of deficient paving thickness shall receive tack coat and minimum 1-in. overlay; or shall be removed and replaced to proper thickness, at discretion of Owner; until specified thickness of course is met or exceeded at no additional expense to Owner.

D. Testing shall be performed on finished surface of each asphalt concrete course for smoothness, using 10-ft straightedge applied parallel with, and at right angles to centerline of paved area. Results of tests shall be made available to Owner upon request. Surfaces will not be acceptable if the following 10-ft straightedge tolerances for smoothness are exceeded:

1. Base Course Surface: 1/4-inch
2. Wearing Course Surface: 3/16-inch

E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

F. Field density test for in-place materials shall be performed by examination of field cores in accordance with one of following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D 1188.
2. Bulk specific gravity using saturated surface-dry specimens: ASTM D 2726.

G. Rate of testing shall be 1 core per 20,000 sq. ft of pavement, with minimum of 3 cores. Cores shall be cut from areas representative of project. Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with Specifications at no additional expense to Owner.

1.6 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, submit actual design mix to the Owner's Engineer for review and/or approval. Design mix shall be CTDOT approved. Submittal shall include the type/name of the mix, sources of coarse aggregate, fine aggregate, mineral filler and PG binder, gradation analysis for aggregate used within final mixes and final aggregate mix blend, grade of asphalt cement used, voids in mineral aggregate (VMA), voids filled with asphalt (VFA), air void percent and effective asphalt content (percent). Mix design over three (3) years old will not be accepted by the Owner's Engineer.

B. Material Certificates: Submit materials certificate to the Owner's Engineer which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

C. Testing Results: Results of concrete, steel and paving tests performed by Contractor's testing laboratory shall be submitted to Owner's Engineer in a timely manner.

D. The results of tests for the day of installation shall be submitted to the Field Engineer with the first truck delivery each day of asphalt placement.

1.7 PROJECT CONDITIONS

A. Weather Limitations:

1. Apply tack coats when ambient temperature is above 40 degrees Fahrenheit, and when temperature has been above 35 degrees Fahrenheit for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.

2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees Fahrenheit.

B. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall conform to the applicable sections of the CTDOT Standard Specifications except as modified herein.

B. Aggregate Base Course: Crushed aggregate base course shall conform to the CTDOT Standard Specifications, Material M.05.01 processed aggregate base with no more than 8% passing the No. 200 sieve.

C. Asphalt Binder: AASHTO M 332, Performance Grade 64E-22.

D. Aggregate for Bituminous Concrete Surface Course: HMA S0.375, shall meet the requirements of Table M.04.02-3 for Traffic Level 2 per Section M.04 of the CTDOT Standard Specifications.

E. Aggregate for Bituminous Concrete Binder Course: HMA S0.5, shall meet the requirements of Table M.04.02-3 for Traffic Level 2 per Section M.04 of the CTDOT Standard Specifications.

F. Tack Coat: Emulsified asphalt; AASHTO M 140 or AASHTO M 208, SS-1h, CSS-1, or CSS-1h, diluted with 1 part water to 1 part emulsified asphalt.

G. Bituminous Concrete Surface Course: HMA S0.5, shall meet the requirements of Tables M.04.02-2, M.04.02-4 and M.04.02-5 for Traffic Level 2 per Section M.04 of the CTDOT Standard Specifications.

H. Bituminous Concrete Binder Course: HMA S0.5, shall meet the requirements of Tables M.04.02-2, M.04.02-4 and M.04.02-5 for Traffic Level 2 per Section M.04 of the CTDOT Standard Specifications.

I. Joint Sealant: ASTM D6690, Type 2, hot-applied, single-component, polymer-modified bituminous sealant.

J. Air voids: 4 +/- ½%

K. The use of reclaimed asphalt pavement (RAP) in new bituminous pavement will not be permitted.

L. Asphalt plants shall conform to the requirements of AASHTO M156 including plant inspections.

2.2 EQUIPMENT

A. Maintain equipment in satisfactory operating condition and correct breakdowns in manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof roll prepared base material surface to check for unstable areas. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface immediately before applying prime coat.

3.2 APPLICATIONS

C. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphaltic concrete or into asphaltic concrete pavement.
2. Apply tack coat to asphaltic concrete base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphaltic concrete bases and on surface of bases where asphaltic concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with Connecticut Department of Transportation Standard Specifications.
4. Apply at minimum rate of 0.05 gal per sq. yd of surface.
5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphaltic concrete mixture on completed compacted subgrade surface, spread, and strike off. Do not place bituminous concrete pavement upon a wet surface. Ambient air temperature shall be at least 40 degrees F and rising. Delivery and mat temperature of the bituminous concrete mixes during paving operations shall be between 275 and 325 degrees F.

B. Whenever possible, pavement shall be spread by finishing machine; however, inaccessible or irregular areas may be placed by hand methods. Hot mixture shall be spread uniformly to required depth with hot shovels and rakes. After spreading, hot mixture shall be carefully smoothed to remove segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be type designed for use on asphalt mixtures. Loads shall not be dumped faster that they can be properly spread. Workers shall not stand on loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with surface course placed parallel to flow of traffic. Place in typical strips not less than 10-ft wide.

D. Joints: Make joints between old and new pavements, or between successive days and work in manner that will provide continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of asphaltic concrete course. Clean contact surfaces of joints and apply tack coat.

3.4 ROLLING AND COMPACTION

A. Mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of rollers without undue displacement. Number, weight, types of rollers, and sequences of rolling operations shall be such that required density and surface are consistently attained while mixture is in workable condition.

B. The bituminous concrete pavement shall have a minimum thickness as specified on the Contract Documents and should be compacted to a minimum of 96% of the maximum unit weight as determined by the Marshall Mix Design Procedures in accordance with ASTM D-1559.

C. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

D. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling with hot material.

E. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

F. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

G. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphaltic concrete. Compact by rolling to maximum surface density and smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

I. Scheduling: After complete placement of the base course the contractor may be required to remobilize for the placement of the top course. This schedule requirement will be based on the building progress, and fully at the discretion of the Owner’s Engineer.

END OF SECTION

SECTION 321313 – PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 - Earthwork

C. Section 312316 - Excavation, Backfill, and Subgrade Preparation for Pavement

D. Connecticut Department of Transportation Standard Specifications, latest edition.

E. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. Preparation and placement of Portland cement concrete sidewalk, pad areas, and other concrete areas identified on Contract Documents

1.3 REFERENCE STANDARDS

A. American Concrete Institute (ACI) latest edition
   1. 301 Specifications for Structural Concrete for Buildings
   2. 304R Guide for Measuring Mixing, Transporting and Placing Concrete
   3. 308 Standard Practice for Curing Concrete

B. American Society for Testing and Materials (ASTM) latest edition
   1. A 185 Steel Welded Wire Fabric, Plain for Concrete Reinforcement
   2. C497 Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
   3. A615 Deformed and Plain Billet-Steel for Concrete Reinforcement
   4. C33 Concrete Aggregates
   5. C 94 Ready-Mixed Concrete
   6. C 150 Portland Cement
   7. C 260 Air-Entraining Admixtures for Concrete
   8. D 309 Liquid Membrane-Forming Compounds for Curing Concrete
   9. C494 Chemical Admixtures for Concrete
   10. C1751 Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   11. FS TT C 800 - Curing Compound, Concrete, for New and Existing Surfaces.

C. Connecticut Department of Transportation Standard Specification, latest edition.

1.4 QUALITY ASSURANCE

A. The Contractor shall pay for the services of a test laboratory, approved by the Engineer, for concrete inspection. The test laboratory shall have at least one Professional Engineer on staff and shall submit proof that any concrete inspectors used on the project shall have successfully completed the ACI course in Concrete Inspection within the past year.

B. Establish and maintain required lines and elevations.

C. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner's Engineer.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

E. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of material.

1.5 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.6 SUBMITTALS

A. Submit materials certificate to the Owner's Engineer, which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

B. The Contractor shall retain an independent testing agency to perform the required tests. The Contractor shall provide any necessary assistance to the testing agency and provide the testing agency with the intended construction schedule at least one week prior to the start of construction.

C. Submit concrete mix design to the Owner's Engineer for review at least 14 days prior to use.

D. Testing results of concrete, steel and paving tests performed by Contractor's testing laboratory shall be submitted to Owner's Engineer in a timely manner.

1.7 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.

D. Concrete materials: Comply with applicable requirements for concrete materials, admixtures, bonding materials, curing materials and others as required. Concrete shall have a minimum 28-day compressive strength of 4000 psi.

E. Joint Sealers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A.

F. Welded wire fabric as indicated on Contract Documents.

2.2 MIX DESIGN AND TESTING

A. Concrete mix design and testing shall comply with requirements of ACI.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water reducing admixture, air entraining admixture, and water to produce following properties:
   1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on Contract Documents.
   2. Slump Range: 4-inches +/- 1-inch at time of placement
   3. Air Entrainment: 5 to 7 percent

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared base material surface to check for unstable areas. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to require grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10-ft
      b. Vertical face on longitudinal axis, not more than
      c. 1/4-inch in 10 ft
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
   5. Install 6-inch x 6-inch welded wire fabric as indicated on Contract Documents. Support wire on metal wire chairs to ensure that wire stays mid-depth of sidewalk section during concrete pour.

B. Reinforcement: Locate, place and support reinforcement in accordance with Contract Documents and ACI.

3.3 CONCRETE PLACEMENT

A. Place concrete in accordance with requirements of Connecticut Department of Transportation Standard Specifications and ACI requirements.

B. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.

C. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement at Contractor’s option. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish and jointing as specified for formed concrete. If results are not acceptable, replace with formed concrete as specified.

D. Concrete placement in poor weather conditions shall be subject to limitation of ACI.

E. Joint Construction: Construct expansion, weakened-plane control or contraction, and construction joints straight with face perpendicular to concrete surface. Construct traverse joints perpendicular to centerline, unless otherwise detailed.
   1. Weakened-Plane Control or Contraction Joints: Provide joints per the drawings. Construct control joints for depth equal to at least 1/4 concrete thickness, as follows:
   2. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
   3. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
   4. Construction Joints: Place concrete joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints using standard metal keyway-section forms.
   5. Expansion Joints: Locate expansion joints per the drawings. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.

F. Joint Fillers: Extend joint fillers full width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

3.4 CONCRETING FINISHING

A. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10-ft straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

C. Paving: provide course, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic.

D. Curbs and sidewalks: Broom finish by drawing fine haired broom across surface perpendicular to line of traffic. Repeat operation as necessary to produce a fine line texture.

E. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner’s Engineer.

F. Protect and cure finished concrete paving using acceptable moist curing methods, more particularly described in "water curing" section of ACI 308.

3.5 BACKFILL

A. After the concrete has set sufficiently, the spaces in front and back of the curb or sidewalk shall be refilled to the required elevation with suitable material in accordance with Section 310000, which shall be compacted until firm and solid and neatly graded.

3.6 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

SECTION 321613 – CONCRETE CURB AND SIDEWALKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 - Earthwork.

C. Section 312316 - Excavation, Backfill and Subgrade Preparation for Pavement.

D. Section 321313 - Portland Cement Concrete Paving

E. Connecticut Department of Transportation Standard Specifications Latest Edition.

F. Contract Drawing and Documents

1.2 SCOPE OF WORK

A. Preparation and Placement of Concrete Sidewalk

B. Preparation and Placement of Concrete Curb

1.3 REFERENCE STANDARDS

A. American Concrete Institute (ACI) latest edition
   1. 301 Specifications for Structural Concrete for Buildings
   2. 304R Guide for Measuring Mixing, Transporting and Placing Concrete
   3. 308 Standard Practice for Curing Concrete

B. American Society for Testing and Materials (ASTM) latest edition
   1. A 185 Steel Welded Wire Fabric, Plain for Concrete Reinforcement
   2. C497 Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
   3. A615 Deformed and Plain Billet-Steel for Concrete Reinforcement
   4. C33 Concrete Aggregates
   5. C 94 Ready-Mixed Concrete
   6. C 150 Portland Cement
   7. C 260 Air-Entraining Admixtures for Concrete
   8. D 309 Liquid Membrane-Forming Compounds for Curing Concrete
   9. C494 Chemical Admixtures for Concrete
   10. C1751 Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   11. FS TT C 800 - Curing Compound, Concrete, for New and Existing Surfaces.

C. Connecticut Department of Transportation Standard Specifications, latest edition.

D. Town of Enfield Standard Requirements

1.4 QUALITY ASSURANCE

A. The Contractor shall warrant that concrete curb and base is 4,500 psi unless otherwise noted on the Construction Documents.

B. Establish and maintain required lines and elevations.

C. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

E. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 30 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of material.

1.5 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.6 SUBMITTALS

A. Submit concrete mix design to the Owner's Engineer for review at least 14 days prior to use.

1.7 PROJECT CONDITIONS

A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. The forms shall be of a depth equal to the depth of curbing or sidewalk, and so designed as to permit secure fastening together at the tops. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

B. Concrete Materials: Comply with requirements of Connecticut Department of Transportation Standard Specifications and applicable Section 321613 for concrete materials, admixtures, bonding materials, curing materials and others as required. Concrete shall have a minimum 28-day compressive strength of 4,500 psi.

C. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with AASHTO M 213.

D. Welded wire fabric as indicated on Contract Documents.

2.2 MIX DESIGN AND TESTING

A. Concrete mix design and testing shall comply with requirements of ACI.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:
   1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on the Contract Drawings.
   2. Slump Range: 3-inches +/- 1-inch at time of placement
   3. Air Entrainment: 5 to 7 percent

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after any unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

B. Surface Preparation: Remove loose material from compacted base material surface to produce a firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
   4. Top of forms not more than 1/8-inch in 10-ft.
   5. Vertical face on longitude axis, not more than 1/4-inch in 10-ft.
   6. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
   7. Install 6-inch x 6-inch welded wire fabric as indicated on Contract Documents. Support wire on metal wire chairs to ensure that wire stays mid-depth of sidewalk section during concrete pour.

B. Concrete Placement
   1. Comply with applicable requirements of ACI and Architectural Specifications.
   2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at the required finish elevation and alignment.
   3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of dowels, and joint devices.
   4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 2 hours, place construction joint. Automatic machine may be used for curb and gutter placement at Contractor's option. Machine placement must produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, replace with formed concrete as specified.
   5. Concrete placement shall be conducted in accordance with related ACI recommended procedures.

C. Joint Construction
   1. Transverse Expansion Joints: Transverse expansion joint in sidewalk shall have the filler cut to the exact cross section of the sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement. Joint spacing as specified on the plans.
   2. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1-inch or more than 2-inches below finished surface where joint sealer is indicated. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
   3. Joint Sealants: All joints shall be sealed with approved exterior pavement joint sealants and shall be installed per manufacturer's recommendations.

D. Concrete Finishing
   1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10-ft straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
   2. Work edges of sidewalks, back top edge of integral curb, and formed joints with an edging took, and round to 2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing as follows:
   3. Inclined Slab Surfaces: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
   4. Curbs, gutters, and sidewalks: Broom Finish by drawing fine-hair broom across surface perpendicular to line of traffic. Repeat operation as necessary to produce a fine line texture.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

F. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the “water-curing” section of ACI 308-81.

3.3 BACKFILL

A. After the concrete has set sufficiently, the spaces in front and back of the curb and gutter or sidewalk shall be refilled to the required elevation with suitable material in accordance with Section 31 00 00, which shall be compacted until firm and solid and neatly graded.

3.4 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

TRUMBULL HILLCREST MIDDLE SCHOOL

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. Preparation and application of painted pavement markings.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. Connecticut Department of Transportation Standard Specifications, latest edition.

B. Manual on Uniform Traffic Control Devices, latest edition.

1.5 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall be non bleeding, quick drying, alkyd petroleum base paint suitable for traffic bearing surface and shall be mixed in accordance with manufacturer's instructions before application.

B. Provide ready-mixed one component waterborne traffic line paint. Materials shall be Sherwin-Williams “Setfast” paint or approved equal.
   1. Colors:
   2. Yellow: TM2161
   3. White: TM2160
   4. Blue: TM2133
   5. Black: TM2135

C. Preformed pavement markings shall be Stamark Intersection Grade Tape Series A420 as manufactured by 3M Traffic Control Materials Division, or approved equal.
   1.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on Contract Documents to be removed or would interfere with adhesion of new paint, motorized abrasive device shall be used to remove markings. Equipment employed shall not damage existing paving or create surface hazardous to vehicle or pedestrian traffic. Within public rights-of-way, method of marking removal shall be approved by appropriate governing authority.

3.2 APPLICATION

A. Apply two (2) coats of paint, without addition of thinner, with maximum of 100 sq. ft per gal. Apply the first coat less than 5 days after the placing of bituminous pavement. Apply the second coat just prior to school opening. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.

B. Install preformed pavement markings according to manufacturers recommended procedures for the specified material.

C. Following items shall be painted with colors noted below:
   1. Pedestrian Crosswalks: White
   2. Light Pole Bases, and Bollards: Yellow, or as specified in Contract Drawings.
   3. On-Site Sign Bases: Black, or as specified in Contract Drawings.
   4. Fire Lanes: as shown on Contract Documents.

5. Lane Striping where separating traffic moving in opposite directions: Yellow
6. Lane Striping where separating traffic moving in the same direction: White
7. Handicap Symbols: Blue or per local code and as shown on Contract Documents.
8. Parking Stall Striping: White, or as shown on Contract Documents.

D. The Minimum Required total Dry Film Thickness (DFT): The DFT shall be the minimum required dry film thickness as measured in mils. or as required by sections 2.1 of this specification as well as part of the referenced standard in section 1.2 of the same.

E. System Coverage Requirements:
1. 1st Coat - 3.0 mils DFT
2. 2nd Coat - 6.0 mils DFT

F. Exterior Paint Systems: Provide the following paint systems as indicated:
1. Parking stall, division and limit lines shall be 4" in width, true and straight. Color: White – DFT 6.0 mils.
2. Stop legends shall be as detailed on Drawing. Color: White - DFT 6.0 mils.
3. Wheelchair legends shall be as detailed on Drawing. Color: Blue. Parking stall striping shall be Blue at Handicapped stalls only - DFT 6.0 mils.
4. Diagonal striping Handicapped. Color: Blue - DFT 6.0 mils.
5. Diagonal striping Loading Zone. Color: White - DFT 6.0 mils.
6. Directional signage shall be as detailed on Drawing. Color: White - DFT 6.0 mils.
7. Centerline striping shall be 4" in width as detailed on Drawings. Color: White - DFT 6.0 mils.

END OF SECTION

SECTION 323100 – CHAINLINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 321313 – Portland Cement Concrete

C. Construction Documents

D. Manufacturer’s technical data and installation requirements

1.2 SCOPE OF WORK

A. Provide chain link fence, framework, fabric, and accessories.

B. Excavation for post bases: concrete foundation for posts and center drop for gates.

C. Manual gates and related hardware.

D. Manufacturer’s technical data and installation requirements

1.3 REFERENCE STANDARDS

A. ASTM A116 Zinc-coated (Galvanized) Steel Woven Wire fence Fabric.

B. ASTM A120 Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and seamless, for Ordinary Uses.

C. ASTM A121 Zinc-Coated (Galvanized) Steel Barbed Wire.

D. ANSI/ASTM A123 Zinc (Hot Dip Galvanized) Coatings on iron and steel products.

E. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A392 Zinc Coated Steel Chain-Link Fence Fabric.

G. ANSI A428 Weight of Coating on Aluminum-Coated Iron or Steel Articles.

H. ASTM A446 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

I. ASTM A491 Aluminum-Coated Steel Chain Link Fence fabric.

J. ASTM A569 Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.

K. ASTM A585 Aluminum Coated Steel Barbed Wire.

L. ASTM C94 Ready-mixed Concrete.

M. ASTM F567 Installation of Chain-Link Fence.

N. ASTM F573 Residential Zinc-Coated Steel Chain Link fence fabric.

O. ASTM F668 Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.

P. ASTM F669 Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.

Q. ASTM F1083 Pipe, Steel, Hot-Dipped Zinc-Coated.

R. Chain Link Fence Manufacturers Institute (CLFMI)-Product Manual.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with Manufacturer's instructions.

B. Perform work in accordance with ASTM F567.

1.5 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.6 SUBMITTALS

A. Submittals for review - the following submittals are intended for review and acceptability.
   1. Section 320000 General Requirements for submittals.
   2. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
   3. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
   4. Samples: Submit one sample of fence fabric, 12 inch X 12 inches in size Illustrating construction and finish.

B. Submittals for Information
   1. Manufacturer’s Installation Instructions: Indicate installation requirements, post foundation anchor bolt, templates, and any other data required.

C. Submittals for Closeout
   1. Data: Provide Warranties and Bonds.
   2. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fabric and boards:
   1. No. 9 ga. finished size galvanized steel wires, 2 inch mesh, with top salvage knuckled and bottom selvage twisted and barbed.
   2. Furnish one-piece fabric widths for fencing.
   3. Attached Wire Mesh shall be coated with Black PVC or approved equal.

B. End, Corner, and Pull Posts: Galvanized steel, minimum sizes and weights as follows:
   1. Up to 6'-0" fabric Height: 2.375" OD pipe, 3.65 lbs./1 in.ft., or 3.5"x 3.5" roll-formed sections, 4.85 lbs./1 in.ft.
   2. Over 6'-0" Fabric Height: 2.875" OD pipe, 5.79 lbs./1 in.ft., or 3.5"x 3.5" roll-formed sections, 4.85 lbs./1 in.ft.

C. Line Posts: Galvanized steel, minimum sizes and weights as follows:
   1. Up to 6'-0"Fabric Height: 1.90"OD steel pipe, 2.70 lbs./1 in.ft. Or 1.875'x 1.625" C-sections, 2.28 lbs./1 in.ft.
   2. 6'-0" to 8'-0"Fabric Height: 2.375"OD steel pipe, 3.65 lbs./1 in.ft. or 2.25" x 1.875" H-sections, 2.64 lbs./1 in.ft.
   3. Over 8'-0"Fabric Height: 2.875"OD steel pipe, 5.79 lbs./1 in.ft. or 2.25"x 1.875" H-sections, 3.26 lbs./1 in.ft.

D. Gate Posts: Galvanized steel, posts for supporting single gate leaf, or one leaf of double gate insulation, for nominal gate with as follows:
   1. Up to 6'-0": 3.5"x 3.5"roll-formed section, 4.85 lbs./1 in.ft. or 2.875 OD pipe, 5.79 lbs./1 in.ft.
   2. Over 6'-0" to 13'-0": 4.000"OD pipe, 9.11 lbs./1 in.ft.

E. Top Rails: Rails: 1.66"OD pipe, 2.27 lbs./ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs./ft.; galvanized steel, manufacturer's longest lengths.

F. Couplings: Expansion type, approximately 6" long, for each joint.

G. Attaching Devices: Provide means for attaching top rail securely to each gate corner, pull and end post.

H. Sleeves: Galvanized steel pipe not less than 6" long and with inside diameter not less than ½"greater than outside diameter of pipe. Provide steep plate closure welded to bottom of sleeve of width and length not less than 1"greater than outside diameter of sleeve.

I. Tension Wire: 7 gage galvanized steel, coated coil spring wire, located at bottom of fabric.

J. Wire Ties: 11 ga. galvanized steel

K. Post Brace Assembly: Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

L. Post tops: Galvanized steel, weather-tight closure cap for each tubular post. Furnish caps with openings to permit passage of top rail.

M. Stretcher Bars: Galvanized steel, one piece lengths equal to full height of fabric, with minimum cross-section of 3/16"x 3/4". Provide one stretch bar for each gate and end post, and two for each corner and pull post.

N. Stretch Bar Bands: Manufacturer's standard.

O. Gate Cross-bracing: 3/8"diameter galvanized steel adjustable length truss rods.

P. Portland Cement: ASTM C 150.

Q. Aggregates: ASTM C 33.

R. Water: Potable.

S. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, noncorrosive, non-staining, nongaseous, exterior grout complying with CE CRD-C621.

T. Swinging Gate Hardware:
1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide a pair of 1-1/2"hinges for each leaf over 6"-0"nominal height.
2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

U. Double Gate Hardware: Provide gate stops for double gates, consisting of mushroom type of flush plate with anchors set in concrete, to engage center drop rod or plunger bar. Include locking device and padlock eye as integral part of latch, using one padlock for locking both gate leaves.

PART 3 - EXECUTION

3.1 GATE FABRICATION

A. Fabricate swing gate perimeter frames of 1.90"OD pipe, galvanized steel. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space frame members a maximum of 8'-0"apart.

B. Assemble gate frames by welding or special fittings and rivets for rigid connections. Install same fabric as for fence with stretcher bars at vertical edges. Install diagonal cross-bracing on gates as required to ensure rigid frame without sag or twist. Bars may be used at top and bottom edges. Attach stretchers to gate frame at 15 inches on center maximum.

C. Attach hardware to provide security against removal or breakage.

3.2 FINISH

A. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz zinc/sq.ft. of surface.

B. Framing: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc/sq.ft. of surface.

C. Hardware and Accessories: Galvanized, ASTM A 153 with zinc weights in accordance with Table 1.

3.3 CONCRETE MIXING

A. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2,500 psi; 1" maximum size aggregate, maximum 3"slump, and 2-4% entrained air.

3.4 INSTALLATION

A. Comply with recommended procedures and instructions of fencing manufacturer. Provide secure, aligned installation with line posts spaced at 10 feet- 0 inches on center maximum.

B. Grade Set Posts: Drill of hand excavate using post hole digger in firm or compacted soil.

C. Excavate hole for each post to minimum diameter recommended by fence manufacturer but not less than four times largest cross-section of post. Excavate hole depths approximately 3" lower than post bottom with bottom of posts set not less than 36" below finish grade surface.

D. Center and align posts in holes 3" above bottom of excavation.

E. Place concrete around posts; vibrate or tamp for consolidation. Check each post for vertical and top alignment. Hold in position during placement and finishing operations. Extend concrete footing 2" above grade. Crown footing to shed water.

F. Top Rails: Run rail continuously, bending to form radius for curve runs. Provide expansion couplings as recommended by manufacturer.

G. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

H. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

I. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24 inches on center.

J. Fabric: Leave approximately 2" between finish grade and bottom salvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

K. Stretcher Bars: Secure at end, corner, pull, and gate posts by threading through or clamping to fabric at 4 inches on center, and secure to posts with metal bands spaced at 15 inches on center.

L. Tie Wires:
   1. Use U-shaped wire, conforming with diameter of pipe to which attached, clasping pipe and fabric firmly when ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
   2. Tie fabric to line posts with wire ties spaced 12 inches on center. Tie fabric to rails and braces with wire ties spaced 24 inches on center. Tie fabric to tension wires with hog rings spaced 24 inches on center.
   3. Manufacturer’s standard procedure will be accepted if of equal strength and durability.

M. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score treads to prevent removal of nuts.

N. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubrication.

END OF SECTION

SECTION 329000 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. B. Section 31 2310 – Earthwork

C. C. Section 32 9100 – Planting Soils

D. D. Section 32 9200 – Turf and Grasses

E. E. Section 32 9353 – Landscape Maintenance

1.2 SUMMARY

A. This Section includes the following:
1. Tree, shrub, groundcover, perennial and bulb installation.
2. Fertilizing, mulching, trimming, guying, wrapping and edging.
3. Maintenance of installed plant material.
4. Warranty.
5. Tree staking

1.3 REFERENCES

A. American Joint Committee on Horticultural Nomenclature Publication: Standardized Plant Names.

B. ANSI Z60.1 - American Standard for Nursery Stock.

C. FS 0-F-241 - Fertilizers, Mixed, Commercial.

1.4 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent.

Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. B. Submit complete list of plant material nursery sources within four weeks of notice to proceed and prior to digging of plants. List is to include names of individuals to contact, phone numbers, addresses and latest possible date for completion of tagging.

C. C. Contractor to cover cost of Landscape Architect's plant tagging.

D. D. Submit waterproof tags prior to tagging trip. Tags to contain following information:
1. Contractor's name.
2. Plant genus, species and cultivar/variety.
3. Plant common name.
4. Name of nursery.
5. Size of plant.
6. Quantity of plant (i.e. 2 of 10)

E. Submit proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons of delay.

F. Submit schedule of arrival of "specimen plant material".

G. Submit instructions for continuing Owner maintenance. Include pruning and trimming methods and types, application frequency and recommended coverage of fertilizer; and water requirements for year-round care of installed plants. Document is to be in bound 8 ½" x 11" format. Submit prior to expiration of required maintenance period(s).

H. Submit for approval a proposed maintenance procedure and schedule of the storage of plant materials. Trees, shrubs, groundcover and perennials stored on and off site shall be maintained by watering, fertilizing, mulching, and spraying for infestation and disease to maintain these plants in a healthy condition. Plants stored off site shall be available for inspection by the Landscape Architect.

I. Samples of each of the following:
1. 5 lb (2 kg) of mulch for each type required for the Project, in labeled plastic bags.
2. Edging materials and accessories to verify color selected.

J. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Landscape Architects and Owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Prior to being approved, the successful bidder will be required to submit to the Landscape Architect a statement of qualifications listing the names of contact references for at least three jobs of similar scope that have been completed in the last five years. Attention is called to the fact that the installation will not be awarded to a firm that does not possess the required technical expertise and construction organization.

B. Allow Landscape Architect option of traveling to nursery to select trees from available stock. (See 1.4 C)

C. Allow for receipt of stamped nursery source list, to tag trees. (See 1.4 B)

D. Trees dug prior to tagging by Landscape Architect are subject to rejection.

E. Landscape Architect will confirm the trees satisfy the requirements of ANSI Z60.1 and all special conditions stated in project manual and drawings.

F. Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300-mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

G. Unacceptable trees will not be tagged and a different Grower will be selected by Contractor at no expense to Owner. A second tagging trip will then be scheduled.

H. Decision by Landscape Architect to forego tagging trip does not release Contractor from responsibility of obtaining plant material which meets standards and conditions stated in project manual and drawings.

I. Minimum three years experience installing plant material of this type required of Installer.

J. Minimum five years' experience specializing in growing and cultivating the specified material is required by of Grower.

1.7 REGULATORY REQUIRMENTS

A. Comply with regulatory requirements for fertilizer and herbicide composition.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Plant material is to be COVERED with tarpaulin during transport.

B. Deliver soil conditioners and fertilizer in unopened waterproof bags showing weight, chemical analysis, and name of manufacturer. Keep materials in dry storage away from contaminants.

C. Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by Landscape Architect. Do not bend or bind tie trees or shrubs in such a manner as to damage bark, break branches, or destroy natural shape. Do not drop balled and burlapped stock during delivery. Protect plants until planted to prevent damage to root balls or desiccation of leaves.

D. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than six hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

E. Provide water to staged material as required to keep root balls moist.

F. Do not remove container-grown stock from containers until planting time.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 30 degrees F or above 90 degrees F.

B. Do not install plants when wind velocity exceeds 30 mph.

C. Planting shall be done when the ground is not frozen, snow covered, or in an otherwise unsuitable condition for planting.

D. Conduct planting operations during recommended planting seasons. Preferable planting season is March 15 to May 30 and October 15 to December 1, inclusive.

E. At the Subcontractor's option and full responsibility, planting operations may be conducted under unseasonable conditions without additional compensation.

1.10 JOB CONDITIONS

A. Locate above grade and underground utilities and perform Work in manner which will avoid damage. Hand excavate, as required.

B. Maintain grade stakes set by others until removal is mutually agreed upon by concerned parties.

C. Notify Landscape Architect, before proceeding, when conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions.

D. Install plants after final grades are established and prior to establishment of lawns, unless otherwise approved by Landscape Architect. If planting occurs in undisturbed lawn areas or after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.PROJECT CONDITIONS

1.11 SEQUENCING AND SCHEDULING

A. Coordinate the Work of this Section with installation of underground utilities, sodding and remainder of Work associated with this Project.

B. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations.

1.12 MAINTENANCE

A. Contractor shall maintain plant material until completion of 18-month guarantee period and Final Acceptance of work, as described in Part 3 of this Section

1.13 GUARANTEE

A. Plants shall be guaranteed for a period of 18-months after the date of Acceptance by the Owner.
   1. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.

B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size and color.

C. Replace dead plants and all plants not in vigorous, thriving condition, as determined by the Architect during and at the end of the guarantee period, without cost to the Owner as soon as weather conditions permit and within the specified planting window.
   1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.
   2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
   3. The guarantee of all replacement plants shall extend for an additional 18-month period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.

D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials, and tree wrap and ties shall be removed from the site.

1.14 FINAL INSPECTION AND FINAL ACCEPTANCE

A. At the end of the 18-month guarantee period, the Architect will, upon written notice offend of guarantee period inspect the work for Final Acceptance. Requests shall be received at least ten calendar days before the anticipated date for Final Inspection.

B. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Architect at that time, the Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

PART 2 - PRODUCTS

2.1 TREES, SHRUBS, GROUND COVER AND BEDDING PLANTS

A. Plant material to be nursery grown stock conforming to ANSI Z60.1.

B. Publication for Standardized Plant Names will govern nomenclature issues.

C. Plans will supersede planting material schedule where a discrepancy in quantity occurs.

D. Provide plant material which is well branched and formed, sound, vigorous, healthy, and free from disease, sun-scald, windburn, abrasion, and harmful insects, eggs, larvae and such defects as knots sun scald, injuries, abrasions and disfigurement, and shall have healthy, normal, and unbroken root systems.

E. Provide symmetrically developed plant material, of uniform habit with straight boles and free from objectionable disfigurements. Tree leader shoots shall not be cut or broken.

F. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with number to assure symmetry in planting.

G. Provide vigorous ground covers and vines with number and length of runners and clump size specified and proper age for the grade of plants specified. Use only vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections.

H. Plants shall have been grown in the same or colder climatic zone of this project.

I. Provide plants according to measurements indicated. Measure sizes before pruning and with branches in normal position. Plants larger in size than specified may be used as approved.

J. Spray plants, budding into leaf or having soft growth, with an anti-desiccant at the nursery or collecting field before digging.

2.2 PLANTING AMENDMENT MATERIALS

A. Shrub and Tree Fertilizer: Tightly compressed, slow release planting tablets. Provide 50% of Nitrogen as water insoluble. The following or equal is acceptable:
   1. AGRIFORM Planting Tablets by:

      The Scott's Company

      1-800-492-8255

B. Ground Cover Fertilizer: FS-0-F-241, Type 1, Class 1 with fifty percent of the elements derived from organic sources. Use fertilizer with N.P.K. ratio of 1:2:1 for Ground Cover Beds and 2:1:1 for Bedding Plant Beds.

C. Topsoil: Topsoil for backfill shall be as specified in Section 329100 - Landscape Grading.

D. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

E. Organic Matter Content: 50 to 60 percent of dry weight.

F. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

G. Herbicide: Comply with all applicable State and Federal Laws.

H. Pesticide: Comply with all applicable State and Federal Laws.

2.3 MULCH MATERIALS

A. Mulching Material: Double shredded, composted hardwood bark mulch free of growth or germination inhibiting ingredients.

B. Mineral Mulch: Hard durable stone, washed free of loam, sand, clay and other foreign substances, of following type, size range and color:
   1. Type: Rounded, natural tan/beige color.
      a. Size Range: 1"-2"

2.4 MISCELLANEOUS MATERIALS

A. Filter Fabric: Filter fabric shall be Trevira 1115, or equal approved by Landscape Architect. Trevira is manufactured by Hoechst Fibers Industries, P.O. Box 5887, Spartanburg, SC 29304 (1-800-845-7597 or 1-800-579-5479).

B. Anti-Desiccant: Emulsion type, film-forming agent, designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix

in accordance with manufacturer's instructions.Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Erosion Control Blanket: The following products or approved equal are acceptable:
   1. S75 as manufactured by North American Green for 3:1 slopes.
   2. C125 as manufactured by North American Green for 2:1 slopes or steeper.

D. Aluminum Edging: Edging shall be 3/16" x 4" aluminum painted black . Edging shall be installed according to manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site is ready to accept Work of this section

B. Test drainage of plant beds and pits by filling with water twice in succession. Notify Landscape Architect of conditions permitting the retention of water in planting beds for more than twenty-four (24) hours.

C. Prior to the excavation of planting pits, or placing tree stakes, the Contractor shall ascertain the location of utility lines, electric cables and conduits, so that proper precautions may be taken not to disturb or damage subsurface improvements. Should obstructions be found, the Contractor shall promptly notify the Landscape Architect.

D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION OF PLANT PITS AND BEDS

A. Plant Pits: Dig to produce vertical sides and flat, undisturbed bottoms. Scarify glazed side surfaces of pits. Size plant pits as shown on drawings.

B. Shrub masses, hedges, groundcover and perennial beds shall be entirely excavated edge to edge and backfilled with specified backfill mixture; they shall not be treated as individual planting pits.

C. Remove all sticks, stones, roots and other objectionable materials during tilling operations larger than one inch in diameter.

D. Damage to paving, sidewalks or other materials shall be removed and replaced at the Contractor's expense and to the satisfaction of the Landscape Architect.

3.3 LAYOUT

A. Stake tree and shrub locations with 3/4" x 2" x 18" wood stakes driven into the soil at center points of plants. Paint tops of stakes representing tree locations a color different from the stakes locating shrubs. Contractor may stake continuous uninterrupted straight runs of shrubs at each end. Outline ground cover beds.

B. Mark all underground utilities.

C. Notify Owner's Representative, in writing, of portions of plant material which have been staked. Allow one week for Landscape Architect to review and adjust stake locations.

D. Plants which are planted prior to contractor receiving Landscape Architect's approval of staking and bed outlines are subject to being relocated at no cost to Owner.

3.4 PLANTING

A. Setting Plants: Handle balled and burlapped and container-grown plants by ball or container. Set plants and hold in plumb position until sufficient soil has been firmly placed around roots or ball. Set plants in relation to surrounding grade so that they are even with depth at which they were grown in nursery, collecting field, or container.

B. Place fertilizer prior to backfilling and in accordance with the manufacturer's recommendations. Ground cover plants may be planted after mulch is in place. Take care to avoid contaminating mulch with planting soil.

C. Backfill excavations for balled and burlapped stock with planting soil mixture to approximately half the depth of the ball and then tamp and water. Carefully remove, open or fold back burlap and tying materials. Completely remove plastic wrap before the placement of backfill. Finish backfilling and tamp. Form earth saucers around isolated plants of size ample enough to hold at least 2-1/2 gallons for shrubs or 5 gallons for trees. Do not use planting stock if ball is cracked or broken before or during planting operation.

D. Bulbs shall be planted in the locations and at the spacing indicated on the Drawings. Plant bulbs at the depths and orientation recommended by the Supplier. Do not remove the leaves until after they have lost their green color. Remove leaves by cutting.

3.5 FERTILIZATION, WATERING, EDGING, AND MULCHING

A. Trees, Shrubs and perennials: Fertilize according to manufacturer's recommendations.

B. Ground Cover Beds: Topdress beds with .12 lbs of actual phosphoric acid per cubic yard of Planting Bed Mix.

C. Watering: Provide uniform coverage which will not cause erosion or damage to the finished surface. Water sufficiently to penetrate the planting bed to a depth of 4 inches.

D. Uniformly edge beds or individual plants using a sharp tool to provide a clear cut division line between the planted area and the adjacent lawn. Refer to drawings for bed shape. Provide plant pits circular in shape for individual pits.

E. Mulch within 24 hours after planting. Spread to uniform thickness of 3 inches.

3.6 PRUNING AND REPAIR

A. Plants shall be neatly pruned and or clipped to preserve the natural character of the plants (with exception to clipped shrub hedges); in a manner appropriate to the particular requirements of each plant and to the satisfaction of the Landscape Architect. Unless otherwise directed by Landscape Architect, do not cut tree leaders; remove only injured or dead branches.

B. Remove broken or badly bruised branches with a clean cut. All pruning shall be done with sharp tools in accordance with instructions of the Owner. Accidental damage to trees occurring during the course of planting operations which is not so great as to necessitate removal of a branch or replacement of a plant shall promptly be treated as required in accordance with recognized horticultural practices.

3.7 CLEANING

A. Keep worksite in clean and orderly condition as Work progresses. Leave worksite "broom clean" at end of Work.

3.8 MAINTENANCE

A. See Section 329353 Landscape Maintenance

END OF SECTION

SECTION 329100 – PLANTING SOILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. Section 31 0800 – Earthwork

C. Section 32 9000 – Planting

D. Section 32 9200 – Lawns and Grasses

1.2 RELATED SECTIONS

A. Testing off-site borrow soil, existing topsoil and amendment materials for approved use in planting soil mixes. Verification testing of on-site sub-soils.

B. Furnishing material from approved off-site source(s) as a base component for planting soil mixes and furnishing other soil amendment materials.

C. Amending, preparing, and mixing planting soils for plant areas.

D. Placing, spreading, and fine grading pre-mixed planting soil material of the type(s) indicated for plant areas.

E. Protecting all plant mix installations with snow fencing, filter fabric, or other approved means, over the surface area plant bed installations, until substantial completion.

F. Protection of finished paving, light poles utility or other finished work by means of wooden protection boards, or other approved means, over the area of construction concurrent with any and all construction operations.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this

Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 SUBMITTALS

A. Refer to and comply with General Requirements, for procedures and additional submittal criteria.

B. Product Data: Submit technical descriptive data for each manufactured or packaged product of this Section. Include manufacturer's product testing and analysis and installation instructions for manufactured or processed items and materials.

C. Locations: Submit locations of material sources. Submit location of mixing sites.

D. Certificates:
1. Submit certified analysis for each soil treatment, amendment, and fertilizer material specified and as used. Include guaranteed analysis and weight for packaged materials.

E. Test Reports: Submit written reports of each sample tested. Each report shall include the following as a minimum and such other information required specific to material tested:
1. Date issued.
2. Project Title and names of Contractor and supplier.
3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field and laboratory inspector.
4. Date, place, and time of sampling or test, with record of temperature and weather conditions.
5. Location of material source.
6. Type of test.
7. Results of tests including identification of deviations from acceptable ranges. Identify any toxic substance(s) harmful to plant growth or life.

F. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications as specified in Article 1.04, herein.

G. Schedule and Protection Plan: Submit a detailed plan for scheduling and sequencing of all contract work and for protection of soil mixes and other completed work including coordination with contractors requiring access through the site. Indicate with schedules and plans the utilization of soil mix and subsoil protection measures (filter fabric and snow fencing) over the surface area of plant bed installations, until substantial completion. Indicate with schedules and plans the utilization of finished work protection measures (wooden protection boards or other approved methods) over the work area of construction operations concurrent with all construction operations until substantial completion.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installation and maintenance foreman on the job shall be competent English-speaking supervisor(s), experienced in landscape installation and maintenance. Perform work with personnel totally familiar with planting soil preparation and planting installations under the supervision of a foreman experienced with landscape work.
   2. Agricultural Chemist: Experienced person or persons employed by public or private soils testing laboratory, qualified and capable of performing tests, making soil recommendations, and issuing reports as specified. Testing Laboratory and Agricultural Chemist shall be as approved by the Owner's Identified Agent.

B. References:
   1. Association of Official Agricultural Chemists.
   2. American Society for Testing and Materials (ASTM) using test criteria as specified or required by other references.

C. Pre-installation Conferences: Person(s) responsible for soil preparation and mixes of this Section shall attend Pre-installation Conference(s) to coordinate with work of other sections.

D. Inspections and Testing
   1. Soil, compost, and other material testing required in this Section or additionally required by Owner's Representative shall be furnished and paid for by Contractor.
   2. Contractor is to test installed soil in-place after installation to confirm material is as submitted. One sample should be taken per every 250sf of installed area.
   3. Owner's Identified Agent reserves the right to take and analyze at any time such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform testing as requested.
   4. If at any time, test results indicate that any soil delivered to the site does not comply with these specifications, the contractor shall immediately remove the non-compliant soils from site at the contractor's expense.

1.6 REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state, and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make work comply with such requirements without additional cost to Owner.

B. Procure and pay for permits and licenses required for work of this section. Comply with the requirement of any Remedial Action Work Plan that may apply to the project.

1.7 SITE CONDITIONS

A. Acquaintance with Existing Site Conditions
   1. Through study of all Contract Documents and by careful examination of the site, become informed as to the nature and location of the Work, the nature of surface and subsurface soil conditions, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work.
   2. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to, ingress and egress of this work site. Conform to all governmental regulations in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.
   3. Should the Contractor, in the course of Work, find any discrepancies between Contract Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Owner, it will be Contractor's duty to inform the Owner's Identified Agent immediately in writing for clarification. Work done after such discovery, unless authorized by the Owner's Identified Agent, shall be done at the Contractor's risk.
   4. Contractor shall be familiar with any Remedial Action Work Plan for the project and be experienced in working on sites with historic fill.

B. Environmental Requirements:
   1. Perform both off-site mixing and on-site soil work only during suitable weather conditions. Do not disc, rototill, or work soil when frozen, excessively wet, or in otherwise unsatisfactory condition.
   2. Soil mixes shall not be handled, hauled, or placed during rain or wet weather or when wet near or above field capacity.

C. Sequencing and Scheduling: Adjust, relate together, and otherwise coordinate work of this Section with work of Project and all other Sections of Project Specifications.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Product Data: Packaged Materials: Deliver packaged materials to the location where soils are to be mixed, in unopened bags or containers, each bearing the name, guarantee, and trademark of the producer, material composition, manufacturers' certified analysis, and the weight of the materials Retain packages for the Construction Manager or Owner's Representative.

B. Soil or amendment materials stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All temporary storage means and methods shall be approved by Owner's Representative.

C. After mixing, soil materials shall be covered with a tarpaulin until time of actual use.

PART 2 - PRODUCTS

2.1 PLANT MIX MATERIALS

A. All soil material to be imported to the site shall be tested every 500 CY to ensure soils meet applicable remediation standards for clean soils. Proof of compliance shall be provided by contractor prior to delivery of soils to site.

B. General:
   1. All plant mix materials shall fulfill the requirements for new plant mixes as specified.
   2. Samples of blended plant mixes shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub-soils. Comply with specific material requirements specified.
      a. As necessary to conform to the requirements of these specifications, make any and all soil mix amendments, retest and resubmit reports indicating results until approved.
   3. Owner's Representative may request additional testing by Contractor for confirmation of mix quality at any time until completion.

C. Base Component Material
   1. Base Component Material shall be a sandy loam. Base Component Materials shall not be site salvaged unless approved by Owner's Identified Agent and CT DEEP.
   2. Before base component material is used for mixing with amendments, handle and pile Base Component Material in the following manner:
      a. Homogenize to make a uniform mix, free of subsoil lenses and other irregularities.
      b. Aerate the base material to make a friable planting medium.
      c. Separate out and remove all clay lumps, stones, stocks, roots, and other debris.

D. Organic Matter
   1. Leaf Mold: Shredded leaf litter, composted for a minimum of one year (12 months) and confirming to the following characteristics:
      a. The leaf mold must be free of debris such as plastic fragments, glass, and metal fragments.
      b. The leaf mold must be free of stones larger than 1/2", large branches, and large roots.
      c. Woodchips over 1" in length or diameter should be removed by screening.

2.2 SOIL AMENDMENT MATERIAL

A. Ground Limestone: Ground Limestone as a soil amendment material will only be used pending results of analysis.
   1. Provide a Ground Agricultural Limestone with a minimum of 88% of calcium and magnesium carbonates.
   2. Ground Limestone material shall have a total 100% passing the 10 mesh sieve, minimum of 90% passing the 20 mesh sieve, and a minimum of 60% passing the 100 mesh sieve.

2.3 HERBICIDES

A. Herbicides: May be required for use if there is seed germination after sub-grade placement and prior to 2planting mix installation or after subsequent plant mix installation. Under no circumstances are materials to be applied without specific instruction from the Owner's Identified Agent.
   1. Herbicides shall be approved before use for type and rate of application by the Owner's Identified Agent and by local and state agencies with jurisdiction.
   2. Post emergent herbicide shall be Roundup, as manufactured by Monsanto Agricultural Products Company, C3NJ, St. Louis, MO 63166, or an approved equal.

2.4 PLANTING SOIL MIXES

A. General: Adequate quantities of mixed planting soil materials shall be provided, to supplement topsoil stockpiled from site, to attain, after compaction and natural settlement, all design finish grades. Verify quantities for placement as specified in Planting and Turf and Grasses specifications and to suit conditions.

B. Uniformly mix ingredients as specified (Base Component Material, leaf mold, and other ingredients deemed to be necessary as a result of testing) by wind rowing/tilling on an approved hard surface area. Organic matter shall be maintained moist, not wet, during mixing.

C. Testing of Plant Mixes:
   1. Perform initial soil mix tests to confirm compliance with specifications. In conjunction with the requirements of the specifications, these test results, when approved, will establish the standard to which all other test results must conform.
   2. Follow-up Testing: Have one (1) composite sample tested prior to delivery and upon arrival to the site from each 500 c.y. of material or as required by Owner's Representative intended for use in each type of lawn and plant mix to include the following:
      a. Soil Texture / Physical Analysis: Use the hydrometer method and classify the soil.
      b. Nutrient Analysis:
         1) Have nutrient levels (nitrate, nitrogen, phosphate, potassium, magnesium, calcium, ammonium, iron, and manganese) tested, and request testing laboratory recommendations for additional fertilizer requirements at both lawn and all plant areas if nutrient levels are below average.
         2) Nutrient deficiencies in soils of plant areas shall be corrected at time of installation.
         3) Nutrient deficiencies in soils of lawn areas shall be corrected both at time of lawn installations and during maintenance period as specified.
      c. Test organic matter, pH, soluble salts, and percolation.

D. Soil Mix Types: Provide the following planting soil mix at the locations indicated. Percentages of components, unless otherwise noted, will be established upon completion of test results of the various mixes. The controlling factor will be the percent (%) organic matter as specified for each mix. Note that percent (%) by volume of components will be, in large part, determined by the leaf mold. Specifically the bulk density reading of the leaf mold will directly impact the organic matter readings which have been specified for each mix.
   1. Topsoil / Horticultural Soil Mix shall be used for planting areas on natural subsoils.

a. Test results must be submitted for per-cent (%) retained as well as for per-cent (%) passing for all sieve sizes. Failure to include any of the aforementioned criteria will be cause for rejection of the test report.
b. Soil Texture/ Physical Analysis (Sandy Loam)
    1) Sand – 50-70%
    2) Silt – 20-30%
    3) Clay – 10-20%
    4) Gravel content should not exceed 3% and soil should be free of glass, plastic and other foreign materials
c. Chemical Analysis:
    1) Organic matter: 6.0 to 10.0%
    2) Soil reaction (pH): 6.0 to 7.0
    3) Soluble salt content (conductivity): The soluble salts measurement (Electric Conductivity) should not exceed 0.5 mmhos/cm measured as a 1: 5 dilute.
d. Heavy metal content not to exceed the following amounts:

2.

Element	Acetate Extract	HCL Extract
Iron	0.5 ppm	3.1 ppm
Manganese	0.5 ppm	15.4 ppm
Molybdenum	0.4 ppm	0.8 ppm
Zinc	0.2 ppm	4.4 ppm
Aluminum	0.2 ppm	1.2 ppm
Boron	1.1 ppm	1.7 ppm
Copper	None	0.01 ppm
Lead	01 ppm	0.4 ppm
Selenium	None	0.4 ppm
Mercury	None	None
Chromium	None	None
Cadmium	None	0.02 ppm
Nickel	None	0.04 ppm
Cobalt	None	0.05 ppm

None = none detected = below detection limits of 0.01 ppm.

3.

4.

a. Percolation: 60% passing in 2 minutes, 40% retained. Soil should be saturated prior to conducting test.
b. Other Amendments as required by test results and as approved.
c. All imported topsoil must meet pollution standards for residential areas.

5. Bioretention Soil Mix
    a. Bioretention soil mix is to be used in all detention basins and rain gardens.
    b. Mix to consist of 60% coarse sand, 40% submitted Topsoil/Horticultural Soil Mix
    c. Topsoil/Horticultural Soil Mix: Refer to specifications listed in section above
    d. Coarse Sand
        1) Particle Size Analysis

Sieve	Percent passing
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85

No 30 (.60 mm) 25-60
No 50 (.30 mm) 10-30
No 100 (.15 mm) 2-10
No 200 (0.75 mm 2-5

2) Chemical Analysis

pH: lower than 7.0

Toxic substance analysis

1)

e.

f. Final Bioretention Mix

1) Particle Size Analysis

a) Sand – 80-85%
b) Silt – 8-15%
c) Clay – 2-8%

2) Chemical Analysis

a) pH – 5.5-6.5
b) Soluble salts: less than 2 mmho/cm

3) Contractor to submit toxic substance analysis and material drainage rate in addition to information listed above. Drainage rate of material to exceed 1 inch/hour

E. Stockpiling and Plant Mixes

1. General: Stockpiling and Plant Mixes utilized for planting soil on-site, off-site and at source should be restricted to no more than the needs of what can be used in a 24-hr. period. Stockpiles should be no more than 6 feet in height to prevent anaerobic conditions within the pile(s). Stockpiles shall be sheltered from weather to prevent excessive water absorption and blowing by winds as approved by Owner's Representative.

2.5 VERIFICATIONS

A. Prior to construction and soil placement operations at planting areas, ascertain the location of all electric cables, conduits, underdrainage systems and utility lines.

B. Take proper precautions so as not to disturb or damage sub-surface elements. Contractor failing to take these precautions shall be responsible for making requisite repairs to damaged utilities at Contractor's own expense.

C. Verify that required underground utilities are available, in proper location, and ready for use. Coordinate with other trades.

D. Verify that all work requiring access through or adjacent to areas where plant mixes are to be placed has been completed and no further access will be required. In the event that access will be required, this must be coordinated with the Owner's Representative.

2.6 PREPARATION OF SUBGRADE

A. Prior to depositing and spreading clean fill, sand and/or plant mix soils, the Contractor shall furnish and install grade stakes on a 10 foot grid in open areas and sufficiently spaced in other areas to insure correct line and grade of subgrade and finished grade.
   1. Verify as constructed or existing subgrade elevations and do whatever additional grading is necessary to bring the subgrade to a true, smooth, slope parallel to the finish grade at all areas to receive planting soil for lawns.
   2. Clean up subgrade and dispose of all debris and garbage prior to inspection.
   3. Scarify compacted subgrades to permit drainage through soil layers. Scarification to occur minimum 6" in planting beds, 12" in rain garden or infiltration basins.

B. Remove all vegetation on subgrade or wherever additional soil is to be added to meet grade.

C. Any soils polluted by gasoline, oil, plaster, construction debris, unacceptable soils, or other substances which would render subgrade unsuitable for a proper lawn or plant growth, shall be removed from the premises whether or not such pollution occurs or exists prior to or during the Contract period. In the event that such material is placed, this material shall be removed and replaced with approved material. All remedial operations associated with soil mixes and controlled fill shall be reviewed and approved by the Owner's Representative responsible for remediation, when applicable.

2.7 PLACING PLANTING SOIL

A. Remove all large clods, lumps, brush, roots, stumps, litter, and other foreign material and stones one-half inch (1/2") in diameter or larger. Dispose of removed material legally off-site.

B. Do not place a muddy or wet soil mix.

C. Place and spread planting soil mix of the type specified over approved subgrade to a depth sufficiently greater than the depth required for planting areas so that after natural settlement, misting and/or light rolling, as previously approved by Owner's Identified Agent, the completed work will conform to the lines, grades, and elevations shown or otherwise indicated.

D. Topsoil/ Planting Soil Mix shall be placed at the following minimum depths, or as otherwise directed by the plans in all areas over natural subsoils.
   1. Lawn Areas – 6" minimum
   2. Planting Beds – 18" minimum
   3. Tree Pits – 36" minimum

E. Grading Tolerances: Lawn and Planting areas shall be fine graded within ±1/10 (0.10) feet of grades indicated on drawings. Maintain all "flat" areas and slopes to allow free flow of surface drainage without ponding.
   1.

END OF SECTION

SECTION 329200 – LAWNS AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 32 9000 – Planting

C. Section 32 9100 – Planting Soils

1.2 SCOPE OF WORK

A. Provide lawns, meadow mixes, and sod (if selected by owner) in accordance with the contract documents.

B. Provide stakes and rope for protection of seed during establishment.

1.3 REFERENCES

A. Hortus III - 1976 Edition, Bailey Horatorium, Cornell University.

B. Technical Association of the Pulp and Paper Industry for Wood Cellulose.

C. Contract Drawings and Documents

1.4 EXAMINATION OF SITE AND DOCUMENTS

A. By submitting a bid the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

B. Plans, specifications, surveys, measurements, other documents and dimensions under which the work is to be performed are believed to be correct; but the Contractor shall have examined them for himself during the Bidding period, as no additional compensation will be made for errors for inaccuracies that may be found therein.

1.5 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.6 SUBMITTALS TO LANDSCAPE ARCHITECT

A. Watering or irrigation plan and schedule, including source of water and methods for encouraging drought tolerance, prior to installation.

B. Maintenance plan through final acceptance, prior to installation.

C. Biweekly reports monitoring performance and corrective actions, after installation.

D. Product Data: Manufacturer's current catalog cuts and specifications of the following:
   1. Fertilizer
   2. Mulch

E. Certificates:
   1. Certificates of inspection as required by law for transportation of each shipment of seed along with invoice.
   2. Seed mix certificate including fertilizer and rate of application.
   3. Sod mix certificate (if selected by owner).
   4. Product certificates for soil amendments and fertilizer, from manufacturer.

1.7 FIELD QUALITY CONTROL

A. Tests: Samples of materials may be taken and tested for conformity to Specifications at any time.

B. Rejected Materials: Remove rejected materials immediately from the site at contractor's expense. Pay cost of testing of materials not meeting Specifications.

1.8 DELIVERY, STORAGE AND HANDLING

A. Seed:
   1. Delivery: Furnish standard seed in unopened manufacturer's standard containers bearing quantity, analysis and name of manufacturer
   2. Storage: Store seed with protection from weather, rodents or other conditions, which would damage or impair the effectiveness of the product.

B. Sod (if selected by owner):
   1. Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Mulch:
   1. Labeling: Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content.
   2. Storage: Store seed with protection from weather, rodents or other conditions, which would damage or impair the effectiveness of the product.

1.9 PROJECT/SITE CONDITIONS

A. Existing Conditions: For protection of existing plants to remain, refer to Spec Section 32 90 00 – Planting

1.10 SEQUENCING AND SCHEDULING

A. Period of Application of Hydroseeding:
   1. Within fourteen (14) calendar days after the completion of finish grading in any area.

B. Scheduling:
   1. Hydroseeding: Perform on a section-by-section basis, upon approval of Landscape Architect, and immediately after finish grading and irrigation installation except for seasonal Limitations.
      a. Season: Plant in Fall or Spring.
         1) Allow sufficient time for full germination and 2 mowings before preliminary acceptance.
   2. Embankment and Slopes: Complete in a continuous manner.
   3. Acceptable Planting Window:
      a. Place grass seed or sod only at seasonal times within appropriate temperature range and wind conditions for plant development as approved by Landscape Architect:
      b. Acceptable Seeding Seasons/Times:
         1) Spring: April 1st - June 15th
         2) Fall: September 1st - October 15th

c. Seeding or sodding at any time other than within the above seasons shall be allowed only when the Contractor submits a written request for permission to do so and permission is granted in writing by the Owner. Newly seeded or sodded areas, if installed out of season, must be continuously watered according to best recommended and Landscape Architect approved practice. Contractor shall be responsible for providing an acceptable stand of grass as specified.

1.11 WARRANTY

A. The 90 day maintenance period begins with the Landscape Architects certification of substantial completion. The warranty period begins after the final acceptance of the maintenance period. The final acceptance occurs upon satisfactory completion of all work, included in the 90 day maintenance period, but exclusive of replacement of materials under the Warranty Period.

B. Time Period: Warrant that meadows shall be in a healthy and flourishing condition of active growth 18-months from date. Lawn to be in a healthy and flourishing condition of active growth 90-days from growth.

C. Appearance During Warranty: Lawns and sod shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.

D. Delays: Delays caused by the Contractor in completing planting operations, which extend the planting into more than one planting season, shall extend the Warranty Period correspondingly.

E. Coverage: Warrant growth and coverage of hydroseeded planting to the effect that a minimum of 95% shall be covered with specified planting after one growing season with no bare spots.

F. Exceptions: Contractor shall not be held responsible for failures due to neglect by owner, vandalism, etc., during Warranty Period. Report such conditions in writing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/GROWERS

A. Hydro Mulch and Soil Stabilizer: Obtain mulch and soil stabilizer from a certified source within proximity of the project site.

B. Turfgrass Sod: Certified complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

C. Fertilizer:
1. Regular Type: Nitrogen content derived from organic sources; bearing manufacturer's statement of analysis. Minimum requirements: 12% nitrogen, 4% phosphoric acid, 8% potash.
2. Slow-release Type: 50% of nitrogen is in slow-release form. Content derived from organic or inorganic sources; bearing manufacturer's statement of analysis. Minimum requirements: 12% nitrogen, 4% phosphoric acid, 8% potash.

3. Commercial Mixed Type: Nitrogen content derived from organic or inorganic sources, bearing manufacturer's statement of analysis. Minimum requirements: 10% nitrogen, 10% phosphoric acid, 10% potash.

D. Lime: Ground limestone containing not less than 85% carbonates; 50% passing 100 mesh sieve and 90% passing 20 mesh sieve.

E. Seed: Shall be of a mix as specified on the plans furnished in un-opened containers and providing percentage of seed varieties and inert matter. All non-turf seeds shall be purchased and applied at a Pure Live Seed (PLS) rate as indicated on the plans. This may require the contractor to purchase/apply seed at a high rate as measured by bulk weight.

F. Straw Bales: Clean bales of straw of hay, wheat, rye, oats or barley.

G. Hydromulch: Wood cellulose fiber containing no germination inhibiting or growth inhibiting agents. Characteristics shall be as follows:
1. Percent moisture content: 9.0% (+3.0%)
2. Percent organic matter: 99.2% (+0.8).
3. Percent ash content: 0.8% (+0.2%).
4. pH: 4.8 (+0.5).
5. Water Holding Capacity: 1150 grams water/100 grams fiber, minimum.

H. Mulch: Clean, seed free straw of hay, wheat, rye, oats or barley.

I. Staking Pegs: 3/4" diameter by 8" long softwood.

J. Water: Clean, potable.

2.2 ACCESSORIES

A. Mulch: Shall be Product: "Silva Fiber", "X-100 Spra-mulch", or "Conwed".
1. Composition: Green-colored, fibrous, 100% virgin wood fibre mulch containing no growth or germination-inhibiting factors.
2. Weight: Weight specifications of this material from suppliers, and for all applications, shall refer only to air dry weight of the fiber material. Absolute air dry weight is based on the normal standards for wood cellulose and is considered equivalent to 10% moisture.
3. Dispersion in Slurry: Mulch shall be manufactured in such manner that after addition to and agitation in slurry tanks with fertilizer, seed, water and other approved additives, fibers in the material will become uniformly suspended to form a homogeneous slurry.
4. Absorption Capacity: When hydraulically sprayed on the ground, the material will form a blotter-like groundcover impregnated uniformly with seed, which will allow absorption of moisture and allow rainfall to percolate to the underlying soil.

2.3 HYDROSEED EQUIPMENT (if required)

A. Type: Commercial type hydro-seeder for the application of slurry. Equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix slurry.

B. Distribution Lines: Large enough to prevent stoppage and to provide even distribution of the slurry over the ground.

C. Pump Capacity: 150 psi at the nozzle.

D. Slurry-Tank: Minimum capacity of 1,000 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded.

2.4 MIXES

A. Hydroseeding Mix per (1,000 Sq. Ft.)
   1. Lawn Areas:
      a. 30 lbs. - Mulch
      b. 7 lbs. - Lawn Seed
      c. 10 lbs. - Fertilizer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Stones, Weeds, Debris: Verify that all areas to receive hydroseeding are clear of stones larger than 1/2 in. diameter, weeds, debris and other extraneous materials.
   2. Grades: Verify that grades are within 1 in. plus or minus of the required finished grades. Verify that fertilization have been installed in another section. Report all variations in writing.

3.2 PREPARATION

A. Soil Moisture:
   1. Excessive Moisture: Do not commence work of this section when soil moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily.
   2. Inadequate Moisture: Apply water, as necessary, to bring soil moisture content to an acceptable level.

3.3 SEEDING

A. Unless indicated otherwise, all "lawn" areas shall be seeded or sodded.

B. Provide soil preparation, seeding, sodding, weeding, watering, and otherwise all labor and materials necessary to secure the establishment of acceptable turf and meadows.

C. After planting soil has been placed, grading is complete, surface soils have been allowed to settle a minimum fourteen (14) days, remedial work is complete, and soil amendments have been applied as specified in this Section, water the planting soil seed bed twelve to twenty-four (12-24) hours prior to seed or sod installation to a depth making the planting soil evenly moist but not overly moist or slippery.

D. Water all seeded areas immediately following seed installation so that the seed bed surface is thoroughly soaked. Cut and maintain established grass in accordance with the requirements specified herein. Perform maintenance on completed areas as installation continues in other areas.

E. Seeding shall not be performed in windy weather.

F. Seeding shall be done in two (2) directions at right angles to each other.

G. Lawn areas shall be seeded by sowing evenly with an approved mechanical seeder at the rate indicated on the Construction Drawings. Culti-packer or approved similar equipment may be used to cover the seed and to form the seed bed in one operation. In areas inaccessible to culti-packer, the seeded ground shall be lightly raked with flexible rakes and rolled with a water ballast roller. After rolling, seeded areas are to be tightly mulched with wheat straw.

H. If the project completion date prohibits in-season planting, the Contractor shall prepare himself for out-of- season seeding so that all lawns shall be completed and ready for acceptance at time of project completion, without additional cost to the Owner. Lawn maintenance shall be the same as for other planting.

I. Lawns shall be maintained by the Contractor for at least 60 days after seeding, or as long as is necessary to establish a uniform stand of the specified grasses, or until substantial completion of the project or until acceptance of lawns, whichever is later.

J. In the event that lawn operations are completed too late in the Fall for adequate germination and/or growth, maintenance shall continue into the following growing season or until a uniform stand of the specified grasses has been established.

K. Water seeded areas twice the first week to a minimum depth of six inches (6") with a fine spray and once per week thereafter as necessary to supplement natural rain to the equivalent of one-inch (1") or to a six inch (6") depth.

L. The surface layer of soil for seeded areas must be kept moist during the germination period. After first cutting, water as specified above.

M. Make weekly inspections to determine the moisture content of the soil and adjust the watering schedule established by the irrigation system installer to fit conditions.

N. After grass growth has started, all areas or parts of areas, which fail to show a uniform stand of grass for any reason whatsoever shall be reseeded in accordance with the plans, and as specified herein. Such areas and parts of areas shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass at no additional cost to the Owner.

O. Watering shall be done in such a manner and as frequently as is deemed necessary by the Landscape Architect to assure continued growth of healthy grass. All areas of the site shall be watered in such a way as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to the finished surface due to the watering equipment.

P. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor. The Contractor shall, however, furnish his own portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the seeded areas in an approved manner.

Q. Mowing of the seeded areas shall be initiated when the grass has attained a height of two and one-half to three inches (1-1/2" to 2"). Grass height shall be maintained between two and two and one-half inches (2" to 2-1/2") at subsequent cuttings depending on the time of year. Not more than one third (1/3) of the grass leaf shall be removed at any cutting and cutting shall not occur closer than ten (10) days apart.

R. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by the Landscape Architect.

S. Protect seeded area against trespassing while the grass is germinating. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout settlement or other causes shall be repaired by the Contractor at his expense.

T. Remove all fences, signs, barriers or other temporary protective devices after final acceptance.

3.4 HYDROSEEDING

A. Roughen surface to break-up large clods and surface crust, to scarify and remove irregularities that will hold water.

B. Mix specified seed, fertilizer and fiber mulch in water using clean, washed equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into a homogenous slurry suitable for hydraulic application.

C. Apply slurry uniformly to all areas to be seeded in a two-step process.

D. Apply first slurry uniformly at a minimum rate of 500 lbs/acre dry weight but no less than a rate required to obtain the recommended seed-sowing rate of the seed mix supplier.

E. Apply second slurry cover coat of fiber mulch at rate of 1000 lbs/acre.

3.5 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

C. Lay sod across angle of slopes exceeding 1:3.

D. Retain subparagraph below if required. Steel staple anchors are commonly used.

E. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

F. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.6 SEEDING MEADOW AREAS

A. Do not use wet seed or seed which is moldy or otherwise damaged, in transit or storage.

B. Sow seed using a spreader, seeding machine or hydroseeder. Do not seed when wind velocity exceeds 5 mi. per hr. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other. Under no circumstances shall wildflower seeds be mixed with to nurse crop seeds or warm season grass seed in the same spreader or mechanical seeder. Variations in seed size, shape a weight will contribute to uneven application and undesirable results.

C. If spreader is utilized for wildflower seeding, mix sufficient quantity of slightly moist sand with seed to ensure even application of seed. After seeding, rake seed lightly into top 1/8” of soil, roll lightly, and water with a fine spray.

D. If cultipacker or seed drill is used to apply seeds, equipment should be set to install seed at a maximum of ¼” depth followed by firming of the soil to maximize seed/soil contact.

E. Sow not less than the quantity of seed specified or scheduled. If utilizing spreader or seeding machine, protect seeded area against erosion by spreading straw type mulch after completion of seeding operation. If seeds are applied using a hydroseeder, 5-10% of the mulching fiber should be applied with the seeds, the balance should be applied separately a second step for optimal seedling germination. Spread uniformly to form a continuous blanket not less than 1½” thick, loose measurement over seeded areas.
   1. If wind is a problem, then anchor mulch by spraying with tactifier at the rate of 10 to 13 gallons per 1000 sq. ft. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas.
   2. If a hydroseeder is employed to apply seed, the proper procedures should be followed to minimize the amount of time that seed is circulated through pumps and paddles prior to application. Over circulation may damage the seed.

F. For areas to be seeded before 26 April
   1. Areas to be seeded/planted are to be shallow tilled to a depth of 6” to remove existing turf type grasses and weeds, to expose dormant weed seeds and to remove large stones over 1½” in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas, which will be planted after preparation. Hand cultivation only will be permitted within the canopy areas of existing trees.
   2. Soil amendments, as determined by soil tests, are to be spread and incorporated into topsoil to a minimum depth of 6”.
   3. Fine grade lawn and wildflower areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag meadow areas, remove ridges and fill depressions, as required to meet finish grades.
   4. Moisten prepared meadow planting areas to settle soil and amendments. Do not create a muddy soil condition.
   5. Approximately two weeks following initial tilling, areas to be seeded/planted are to be treated with a non-selective, glyphosate based herbicide to kill any newly germinated grasses and weeds.

G. For areas to be seeded after 26 April
   1. Following the first flush of spring growth on existing turf areas, areas to be seeded/planted are to be mowed to a height of 4” with all debris raked off and disposed of off-site. Areas to be seeded/planted are then to be sprayed with a non-selective glyphosate based herbicide to kill all grasses and forbs.
   2. Approximately four weeks after initial spraying, Contractor is to inspect sprayed areas with Architect to determine success of vegetation removal. Follow up spot treatments may be required and shall be applied at that time. Soil amendments, as determined by soil tests, are to be applied to areas to be seeded/planted.

H. Preparation of Unchanged Grades: Where lawns or meadows are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not less than 6”; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter. Hand cultivation only will be permitted within the canopy of areas of existing trees.
   1. Note: Some limited tree protection areas may require removal of mulch, debris, stumps, herbaceous material, etc. before lawn can he installed.
   2. Prior to preparation of unchanged areas, herbicidally treat or physically remove existing grass, vegetation and turf. Dispose of such material properly outside Owner’s property; do not turn over into soil being prepared for lawns.

3.7 MAINTENANCE OF MEADOW AREAS

A. General Maintenance Requirements:
   1. Maintenance work shall include but not be limited to watering; remedial work such as repair of eroded areas, reseeding, and keeping the area clean. All other work as deemed by the Contractor required in support of his guarantee, or as may be pointed out to the Contractor by the Landscape Architect during the guarantee period shall be provided.

B. In early spring before growth begins, mow to a height of 4 to 6 inches and leave the residue on the ground as a reservoir of viable seed.
   1. Refer to plans for additional maintenance notes.
   2. For grassy annual weed control, apply post-emergent herbicides such as “Acclaim” or approved equal, as per manufacturer’s recommendations and with written approval of Landscape Architect. Apply twice during first growing season.
   3. Selectively apply broadleaf weed control spot spray as required with a broadleaf selective herbicide as recommended by manufacturer twice during first growing season.
   4. Apply overseed to wildflower areas original wildflower seed mix at 50% original rate.

3.8 CLEANING

A. Hydroseed Overspray: Immediately after application, thoroughly wash off any plant materials, planting areas, or paved areas not intended to receive slurry mix.
   1. Erosion: Immediately restore eroded areas. Keep all adjacent paved surfaces cleaned of dirt, mud or stains and organic debris.

END OF SECTION

SECTION 329353 – LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. Section 32 9000 – Planting

C. Section 32 9200 – Lawns and Grasses

1.2 SUMMARY

A. Provide labor, materials, equipment, services and transportation to complete work.
   1. Plant and turf maintenance including pruning, watering, drainage, irrigation, fertilizing, weed and pest control, adjusting tree guys, and mulching two times per year during 18-month warranty period.
   2. Guaranty and replacement of unacceptable plants.
   3. Fall Leaf Cleanup in fall every two weeks prior to acceptance
   4. Providing Owner with Maintenance Manual.

1.3 REFERENCES

A. Comply with applicable requirements of:
   1. State of Connecticut Department of Transportation (ConnDOT) Standard Specifications for Roads, Bridges and Incidental Construction, Latest addition
   2. American Association of Nurserymen, American Standards for Nursery Stock, (ANSI Z60.1), latest edition, published by the American Association of Nurserymen, 1250 I Street, N.W., Suite 500 Washington, D.C. 20005.

1.4 DEFINITIONS

A. Maintenance: consists of keeping turf , woody, perennial and annual plants in healthy growing condition including watering, weeding, cultivating, remulching twice during 18-month warranty period, removal and replacement of dead plant material, resetting plants to proper grades or upright positions and maintaining saucer.

1.5 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.6 SUBMITTALS

A. Submittals: in accordance with Section 013300 – Submittal Procedures

B. Materials List: provide list of materials to be used in maintenance; materials shall be the same as approved in related sections:
   1. Fertilizers, soil amendments, testing see Section 329113 – Planting Soils.
   2. Plant materials, mulch, and related materials, see Section 329000 - Planting.

C. Pest and Disease Treatment
   1. Submit plan for pest and disease treatment; identify proposed materials and methods.
   2. Explain why a problem does or may exist.

D. Maintenance Manual
   1. Provide a maintenance manual to Owner describing operations for on-going upkeep of the installed plants. The manual shall address itself to specified types and uses of plants installed, and provide information for care of both newly installed plants and long-term maintenance.
   2. Provide specific information on the following items:
      a. Watering: Watering season; diagnosis of watering need; frequency of watering; amount; time of day; methods and equipment; equipment maintenance.
      b. Fertilization: Fertilizing seasons; analysis for fertilizer selection; application rates and methods; preparation and conditions; application times; application equipment; post-application operations and care; precautions for fertilizer use.
      c. Liming: Liming season; analysis for liming; application rate; method and equipment for application.
      d. Pruning: Pruning goals and purposes; methods and techniques (relate to species); equipment; season; cleanup and disposal; precautions.
      e. Mulching of beds: Depths of mulch; refreshment and replacement of mulch.

f. Miscellaneous plant maintenance: Weeding and weed control; pest and disease control; leaf and litter removal (required every two weeks during the fall if maintenance period is not complete before fall clean-up); bed edging; professional assistance for plant care; and plant replacement as necessary.

3. Include a month-by-month calendar of maintenance procedures, indicating operations listed above.
4. Include a developed Record Keeping document to be completed by the maintenance staff and submitted weekly to the Owner's Representative during active maintenance period.
5. Submit a copy of maintenance manual to Owner's Representative for approval. Submit prior to planting completion. Owner's Representative may request revisions to manual to meet intent of project design.
6. Submit three copies of manual to Owner at acceptance meeting for planting work. Acceptance shall not be granted until manual has been submitted and approved.

1.7 QUALITY ASSURANCE

A. Qualifications: contractor shall have minimum five years' experience in landscape maintenance.

B. Regulatory Requirements
1. Secure permits, licenses, and pay fees including traffic control.
2. Comply with laws, regulations, and quarantines for agricultural and horticultural products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: deliver materials in unopened containers bearing the manufacturer's name. Transport materials without damage. Protect finishes from abrasion, dirt, oils, grease, and chemicals. Pack materials to protect from weather.

B. Acceptance at Site: verify in writing that delivered materials conform to specifications and approved submittals.

C. Storage and Protection:
1. The owner will not provide areas of storage for the maintenance contractor.
2. Store materials in dry place, on pallets, off the ground; protect from sun.
3. Protect materials from theft, damage, weather, dirt, oils, grease, and construction.

1.9 PROJECT/SITE CONDITIONS

A. Environmental Requirements: do not work soils when dry, wet, or frozen.
1. Field Test
a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
b. If soil will not retain shape it is too dry and should not be worked.
c. If soil retains shape and will not crumble, it is too wet and should not be worked.

B. Planting Seasons: see Section 329000 – Planting

1.10 COMPLETION

A. Upon completion of planting, request Owner's Representative's review to determine if work is substantially complete. If work is complete, Owner's Representative will issue a Letter of Substantial Completion that establishes the effective date of the start of the 18-Month Maintenance Period for plantings and turf.
   1. If work is not substantially complete, Owner's Representative will make a list of outstanding work to be done on a timely schedule agreed upon by Contractor and Owner's Representative.
   2. Contractor shall notify Owner's Representative when outstanding work is accomplished and ready for review. When outstanding work is complete, in the judgment of Owner's Representative, a Letter of Substantial Completion will be issued.

1.11 PRELIMINARY ACCEPTANCE

A. After the Letter of Substantial Completeness the work will be reviewed for completeness and of Preliminary Acceptance

B. Plantings and turf shall be in thriving and vigorous condition at the time of review for Preliminary Acceptance. If plantings and turf are acceptable, Owner's Representative will issue a Letter of Preliminary Acceptance establishing the effective date of the 18-Month Guaranty Period.
   1. If plantings are not thriving, in the judgment of Owner's Representative, remedial actions by Contractor will be required to repair or replace plantings.
   2. Remedial work shall be done immediately and in accordance with related work of other sections.
   3. At the conclusion of remedial work, Owner's Representative will review work and extend the Guaranty Period to incorporate new plantings.

1.12 FINAL ACCEPTANCE

A. After the 18-month Maintenance and Guaranty Period, plantings and turf will be reviewed.

B. Plantings and turf shall be in thriving and vigorous condition at the time of review for Final Acceptance. If plantings and turf are acceptable, Owner's Representative will issue a Letter of Final Acceptance.
   1. If plantings and turf are not thriving, in the judgment of Owner's Representative, remedial actions by Contractor will be required to replace plantings.
   2. Remedial work shall be done immediately and in accordance with related work of other sections.
   3. At the conclusion of remedial work, Owner's Representative will review work and extend the Maintenance and Guaranty Period until plantings are deemed acceptable.

PART 2 - MATERIALS

2.1 MATERIALS

A. Materials utilized during the maintenance period shall be the same specified in the work of the related sections:
   1. Fertilizers, soil amendments, testing, see Section 329113 – Planting Soils.
   2. Seed, sod and related materials, see Section 329200 – Turf and Grasses
   3. Plants, mulch, and related materials, see Section 329300 - Planting.

2.2 BIOLOGICAL, HORTICULTURAL, HERBICIDAL AND OTHER PEST CONTROL

A. Material Specification: shall be by a licensed pest control operator, with authority to purchase, utilize, and specify agricultural chemicals and agricultural products.

B. Use the least hazardous, least intrusive materials and methods.

2.3 EQUIPMENT

A. Vehicles: in good working order so oil and grease does not stain pavements and poison plantings. Signs identifying the vehicles shall be clearly displayed.

B. Machinery: in good working order so oil and grease does not stain pavements and poison plantings.

2.4 WATER

A. Water: Furnished by Contractor, suitable for irrigation and free from ingredients harmful to plant life.

B. Hoses and other watering equipment to be furnished by Contractor.

2.5

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: in the event field conditions are not as shown on Drawings and outlined in the Specifications, notify Owner’s Representative in writing.

3.2 PREPARATION

A. Protection:
   1. Agricultural Chemicals: protect site improvements from contact with agricultural chemicals, soil amendments, and fertilizers.

3.3 PRUNING

A. Pruning: prune with approval of Owner's Representative.
   1. Remove dead branches, rubbing branches, and branches growing towards plant center.

3.4 DRAINAGE

A. Observe drainage in plant pits with hand soil augur.

B. Verify plant pits are draining; plant pits not draining shall be identified on the plan and brought to the attention of Owner's Representative.

3.5 PLANTS

A. Maintain plants in vigorous condition throughout the Maintenance and Guaranty Periods.

B. Replace plants that are missing, dead, not true to name or size as specified, or not in satisfactory growth, as determined by Owner's Representative. Replace plants found unacceptable within one month or in first month of next growing season, whichever comes first.

C. Plants must show a minimum of 75% healthy head with obvious growth since planting. Signs of disease, injury, or damage shall have been successfully treated or plant shall be rejected as determined by Owner's Representative.

D. Replacements plants shall be same kind and size as specified in plant list. Furnish and plant. Cost of replacement borne by Contractor except where it can be shown loss resulted from vandalism, fire, theft, or other causes beyond Contractor's control. Restore areas damaged or disturbed by replacement operations to their original condition.

3.6 WATERING

A. Water at a rate of one inch of water every five to seven days. Apply water such that it penetrates the soil to a depth of 6".

B. Trees require a minimum of ten gallons each and shrubs a minimum of five gallons each per week.

C. If spring or fall months experience below average rainfall, periodic watering could be extended as part of this contract and at no additional charge as requested by Owner's Representative.

D. If natural rainfall provides water to meet watering requirements, weekly watering could be reduced but only at the request of Owner's Representative.

3.7 BASINS

A. Keep foot tamped and shaped earth dikes around plantings.

3.8 MULCH

A. Maintain mulch at 2" depth in planting areas with the exception of at stems and trunks of plants where mulch to be placed to a 0" depth and increasing to a depth of 2" at edge of rootballs and beyond.

B. Mulching is required two times per year during maintenance period, remove existing mulch as needed to maintain maximum 2" cover.

C. Maintain finish grades around plantings, at pavement edges, and at irrigation fixtures.

3.9 TREATMENT OF PEST AND DISEASES

A. Spray for both insect pests and diseases during maintenance period with notification and permission of Owner's Representative. Apply herbicides, insecticides and fungicides as prescribed by their manufacturer and in accordance with State laws. Contractor shall possess from the State of Connecticut the proper registrations and permits for application of materials or have applications made by approved, qualified firm holding registrations and permits. Furnish copies of permits in connection with materials to Owner's Representative. Spraying to be considered only after full consideration has been given to alternative pest control strategies. The least toxic approach to pest control shall be used.

3.10 ADJUSTING

A. Re-set settled plants to proper grade and position.

B. Restore planting saucer and adjacent material.

3.11 CLEANING

A. Clean up, remove and dispose off-site excess planting mixture, soil and debris generated under work of this section.

B. Wash and sweep clean site improvements and building surfaces. Clean spills and oversprays immediately.

C. Repair damage caused by maintenance operations.

3.12 PROTECTION

A. Protect work of this section until Final Acceptance.

B. Protect planted areas and soils from compaction by construction traffic and from contamination by construction materials.

END OF SECTION

TRUMBULL HILLCREST MIDDLE SCHOOL

SECTION 329400 - ARBORICULTURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

B. Section 024113 – Site Demolition

C. Section 311100 – Clearing and Grubbing

D. Section 310000 - Earthwork

E. Section 312333 – Trench Excavation for Utilities

F. Section 334100 – Storm Sewer

G. Section 329200 – Lawns and Grasses

H. Section 329300 – Landscape Planting

1.2 SCOPE OF WORK

A. This Work Included: Provide labor and materials as indication on Drawings and specified to implement basic arboricultural activities for existing trees, as well as construction observation of activities within the Tree Preservation Areas. Scope to include but not limited to
   1. Pruning
   2. Shade Tree Inventories
   3. Diagnosis and Treatment Recommendations
   4. Pre Planting Site Analysis, Plant Recommendations
   5. Root Pruning
   6. Integrated Pest Management
   7. Monitor Excavation & Construction within Tree Preservation Area (Section 02200-Earthwork).
   8. Disposal and Cleanup

B. Coordinate Work with that of other trades affecting or affected by Work of this Section and cooperate to assure the steady progress of Work.

1.3 REFERENCE STANDARDS

A. National Arborist Association (N.A.A.) Standards

B. American Society of Consulting Arborists

C. American National Standard for Tree Care Operations
   1. ANSI Z133.1 – 1994
   2. ANSI A300 – 1995

D. American Nurseryman Association Standards

1.4 QUALITY ASSURANCE

A. Arboriculture: comply with all applicable standards of the National Arborist Association (NAA) for pruning, guying, fertilizing and installation of lightning protection systems. Arborist shall have current certification by the International Society of Arboriculture (ISA).
   1. All arboricultural work under this section shall be performed by personnel totally familiar with arboricultural work and under the supervision of an experienced foreman and ISA certified arborist.
   2. Pruning shall be performed by tree workers who, through a minimum of five years related training and on-the-job experience, are familiar with the techniques and hazards of this work.

B. Analysis and testing of materials required under these specifications shall be in accordance with the current methods of the Association of Official Agricultural Chemists (AOCA) and ASTM.

C. Equipment and Safety
   1. Equipment shall be modern and well maintained. Adhere to all applicable state and federal regulations. Contractor shall be responsible for damage to property resulting from equipment, including fluid leakage or damage resulting from equipment failure. Report incidents of this type immediately to Owner's representative.
   2. Safety shall be a primary concern while working on the Site. Contractor shall have an established safety program and adhere to NAA, OSHA and ANSI standards applicable to the tree care industry, including electrical and utility requirements as well as personal equipment and safe work procedures.

D. Pesticide Applications
   1. Certified Pesticide Applicator shall be responsible for supervision of all applications of fertilizer or pesticides on the site.
   2. Pesticides shall be applied in strict compliance with label instructions and all applicable federal, state and local requirements. Material Safety Data sheets shall be available for pesticides in the Contractor's possession while on the site.

E. Arrange a pre-construction meeting between the Landscape Architect, General Contractor and Arboriculture Subcontractor. Such meeting shall seek to review the proposed arboriculture procedures, schedule, consideration of substitutions, and general review of specifications. Note that pruning, fertilization, vertical mulching and mulching activities should be performed prior to the start of construction activities, to improve the vigor of the existing trees to be preserved and to help mitigate the effects of construction stress.

1.5 DEFINITIONS

A. Diameter shall be defined as diameter at breast height (dbh) which is the average tree diameter at 4.5 feet from the ground on the uphill side of the tree.

B. Caliper shall be defined as the diameter of the trunk at 6” above the soil for trees up to 4” in caliper and as the diameter of the trunk at 12” above the soil for trees up to 12” caliper.

C. Root zone shall be defined as 1 (one) foot of radius around trunk for every inch of trunk diameter (at 4.5 feet above the ground level on the uphill side of the tree).

D. Tree Preservation Area shall be defined as all areas outside the limits of construction which contain trees and all areas within the limits of construction which are designated as tree preservation areas on the plans and/or in the field by fencing and signs.

1.6 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project’s environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.7 SUBMITTALS

A. General: Make submittals in accordance with the provisions and procedures of these documents. Render submittals and receive approval prior to delivery or installation. Approval by the Landscape Architect of submitted product data, samples, test reports, and certificates, or material inspected at source of supply, does not constitute final acceptance.

B. Product Data: Submit producers/manufacturers specifications, quality control, product data, and test reports for the following: Include instructions for handling, storage, installation and protection.
1. All Pesticides, Insecticides, Herbicides, and other chemicals

C. Arboricultural Program: Submit detailed program of Arboriculture work and proposed schedule at the pre-construction meeting.

D. Arborist Qualifications
   1. Include evidence of experience, including project list.
   2. Verification of membership in the National Arborist Association (NAA).

1.8 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1.9 PERMITS AND CODES

A. All work shall comply with applicable codes, ordinances, rules, regulations, and laws of all local, municipal, and state authorities having jurisdiction. All work necessary to make site preparation comply with such requirements shall be provided without additional cost to Owner.

B. Procure and pay for all permits and licenses required for work under this Section.

1.10 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor materials, equipment and services necessary to make Work comply with such requirements without additional cost to Owner.

B. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to and ingress and egress at the site. Conform to all governmental regulations regarding the transportation of materials and secure, in advance, any necessary permits.

C. Procure and pay for permits and licenses required for Work.

1.11 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in clearly marked containers showing net weight, guaranteed analysis and name of manufacturer. Specified requirements for packaged materials apply to bulk shipments. Protect materials from deterioration during delivery and during storage at site.

1.12 PROJECT CONDITIONS

A. Existing Conditions
   1. Carefully examine the site before submitting a bid. Be informed as to the nature and location of the Work, general and local conditions including climate, adjacent properties and utilities, conformation of the ground, the nature of subsurface conditions, the character of equipment

and facilities needed prior to and during execution of the Work. Be aware of and comply with restrictions regarding subsurface utilities and subterranean structures, including excavation and loading parameters.

2. Should the Contractor, in the course of Work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Landscape Architect, it will be his duty to inform the Landscape Architect immediately in writing for clarification. Work done after such discovery unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

B. Environmental Conditions – Arboriculture

1. Pruning: Pruning shall occur, no later than April 1st, prior to the leafing out of the trees. Pruning shall only occur when weather conditions are favorable; pruning shall not occur when branches are wet with snow or rain or when covered by ice.
2. Fertilization: Spring fertilization shall occur in early spring, before bud break. When leaves have fully expanded, fertilizing can continue until early July Fall fertilization shall occur after October 1st or after the first hard freeze, whichever comes first, when all possibility of top growth in past and before the moisture in the soil freezes casing root activity. Avoid fertilizing between July and September 1.
3. Pest control: Avoid use of herbicides within planting bed. Avoid use of fertilizer/herbicide combinations within the dripline of trees in plant beds.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENT MATERIAL

A. Sand: Natural, medium to coarse grained in texture, free from decomposed organic matter like roots, sticks, leaves, paper and of any other undesirable trash-like glass, plastic or metal fragments, that could interfere with soil drainage and planting operations. Sand shall be salt-free.

B. Ground Limestone: Natural dolomitic limestone containing a minimum of 88% of calcium and magnesium carbonates. Total of 100% passing the 10 mesh sieve; minimum of 90% passing the 20 mesh sieve; minimum of 60% passing the 100 mesh sieve.

C. Water: Potable, clean, fresh and free from harmful materials. Water shall be furnished by the Owner. All hoses and other irrigation equipment required for the Work shall be furnished by the Contractor.

2.2 FERTILIZERS

A. General: As specified below, all fertilizer shall conform to applicable state fertilizer laws. It shall be uniform in composition, free-flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which is unsuitable for use will be rejected.

B. Fertilizer: To be determined based on testing.

2.3 MULCH

A. Mulch shall be double shredded hardwood bark.

2.4 PESTICIDES

A. Biological control for trees and shrubs: Bacillus thuringensis, predatory mites, parasitic nematodes, parasitic insects, predatory insects, or other approved biological agents.

B. Miticide for trees: chinomethionate or dicofol.

C. Miticide for trees: chinomethionate or dicofol.

D. Superior oil for trees: horticultural grade, highly refined potassium salts or fatty acids.

E. Insecticides for trees: acephate, cyfluthrin, fluvalinate, chlorpyrifos, bendiocarb, or dimethoate.

PART 3 - EXECUTION

3.1 GENERAL

A. Basic arboriculture shall include all activities as noted in drawings, and shall include other arboriculture activities as described herein. Note that pruning, fertilization, vertical mulching and mulching activities should be performed prior to the start of construction activities, to improve the vigor of the existing trees to be preserved and to help mitigate the effects of construction stress.

B. The Arborist shall monitor excavations and construction within the Tree Preservation Area, including: being on site during all excavations within the Tree Preservation Area to ensure that hand or approved mechanical excavations does not damage existing root systems, and to perform compensatory pruning. The construction that would occur within the Tree Preservation Area would include but not be limited to removal of existing pavements, pavements, and utility trenching.

3.2 PRUNING

A. Pruning – General: Pruning shall conform to ANSI A300 – 2017 standards as specified. Stripping of interior growth on trees is not acceptable. Interior growth may be selectively thinned when appropriate to type of prune. Thinning in general shall be accomplished from the tips of branches by removing diseased, crossing, and/or conflicting branch structure. Target pruning shall be the preferred method of branch removal. Equipment shall be sharp and well maintained. Proper equipment shall be used for all pruning procedures (i.e., handsaw, chainsaw, polesaw, or pole pruner). Employees pruning trees shall have adequate training as to the proper methods and procedures for tree pruning. Refer to ANSI A300 standards for other pruning requirements.
   1. On trees known or suspected of being diseased, tools are to be disinfected with methyl alcohol at 70% (denatured wood alcohol diluted appropriately with water) or Clorox solution after each cut and between trees where there is known to be a danger of transmitting the diseased on tools.

2. The presence of any structural weakness, disease conditions, decayed trunk or branches, split crotches or branches, should be reported in writing to the Architect and Owner, and corrective measures recommended.

B. All Trees shall receive a crown cleaning to remove all dead, weak, and conflicting branches 1 (one) inch and larger at the point of attachment. Trees with root zone affected by construction shall receive a slight reduction in the meristematic regions at the branch tips in the crown.

3.3 ROOT PRUNING

A. Root pruning shall be performed in conjunction with Tree Preservation Fencing. Root pruning shall be performed as indicated on Drawings or as required, including: trenching for utilities, excavations for foundations, or wherever grades will be changed within the root zone of the tree to be preserved. Root pruning shall be to the depth of excavation or 24 inches, whichever is less. A trencher or vibratory plow shall be used to prune roots. Roots over 2" in diameter shall have a clean cut made on the surface of the root which is still attached to the tree. This cut shall be made with a hand saw or chain saw as soon as larger root is severed. Where fill is to be placed, root pruning shall be to the depth of top soil.

B. The Arborist must verify exact layout with General Contractor, to ensure root pruning in appropriate location.

C. When root pruning in conjunction with excavation and installation of utilities, the Arborist shall endeavor to work around and preserve the existing tree roots. Make all effort to preserve roots greater than 2" in diameter.

3.4 FERTILIZATION

A. Position Trees shall receive a liquid fertilization. Fertilizer shall be applied at a rate of 1.5 pounds of nitrogen per 1,000 square feet of root zone treated. A root stimulant shall be added for trees with root loss or disturbance or otherwise affected by construction. Fertilizer shall be injected using a soil probe at a depth of six inches. Fertilizer shall be applied in three foot grid pattern evenly distributed throughout the root zone.

3.5 INTEGRATED PEST MANAGEMENT (IPM)

A. Arborist shall provide an IPM technician and equipment to make necessary treatments. Technician shall be trained and licensed to apply necessary controls, and the control methods shall be reviewed and approved by the Arborist.

B. Work shall be completed in accordance with the town of Enfield landscaping standards.

C. IPM technician shall monitor and treat any pests which may inhibit the health or survival of the trees to be preserved. Technician shall make ten monitoring / treatment visits per year. Arborist shall submit a Site Monitoring/Treatment Report following each visit, which describes the pests observed

and treatments which were applied, and shall report on other issues observed on Site which may affect survival or the trees.

D. Watering shall be included in IPM program. Water shall be applied to trees during Site Monitoring / Treatment Visits, whenever soil moisture is below 40% of field capacity.

3.6 TREE WOUND CARE

A. Tree wounds shall be treated according to standard practices, by a professional arborist. Wounds shall not be covered with dressings.

3.7 DISPOSAL AND CLEAN UP

A. All refuse and debris from these operations shall be legally disposed of off-site. Material shall be removed or neatly stored at the end of each day's work. Dumping on the site shall not be permitted. Burning of material on the site shall not be permitted.

B. Maintain the site in an orderly condition during the progress of Work. Con tenuously and promptly remove excess and waste materials; keep lawn areas, walks and roads clear. Store materials and equipment where directed. Immediately remove rejected materials from the property. Promptly remove equipment, surplus material, and debris and trash resulting from operations under this Contract upon completion and prior to initial acceptance of Work. Lave the site in a neat, orderly condition, "broom clean".

C. All materials generated by construction activities during this phase of work shall be completely removed at the end of this phase and the site shall be left in a safe and clean conditions.

END OF SECTION

SECTION 331116 – SITE WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 312333 –Trench Excavation and Backfill for Utilities

C. Town of Trumbull and Aquarion Water Company Standards and Regulations

1.2 SCOPE OF WORK

A. Work under this Section shall consist of providing all labor, plant facilities, materials, and equipment necessary and required to install all proposed water facilities in accordance with the Contract Documents. This Work shall include but not be limited to:
   1. Installation of water mains consisting of pipes, valves, thrust blocks, meter pits, hydrants, storage tanks, and all necessary and required accessory items and operations.

B. Coordination of the connection of building domestic and fire service lines to the on-site water mains with the Building Contractor.

C. Sterilization and testing of new water facilities.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's certificate for castings, pipe and accessories to certify that products meet or exceed specified requirements.

B. Shop drawings of hydrants, valves, and valve boxes.

C. Shop drawings of storage tanks including plan layout, access hatches, vent, refill, suction, overflow, and pipe connection locations between tanks. Provide anti-buoyancy calculations. Provide product data on seals, sealants, and couplers and access hatches.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ductile Iron Pipe: AWWA C151-91. Thickness Class 52 or better. Push-on joint complying with AWWA C110-90 or C153, rubber gaskets. Cement mortar lining complying with AWWA C104-90 for pipe and fittings minimum 1/16” thick. Note this type of pipe is most preferred and must be used for all lines 4” in diameter or greater.

B. Copper Tube: ASTM B88-61, soft annealed temper with bituminous coating, cast copper alloy flared joint fittings, ANSI B16.26, Type K for domestic service under four (where required by local authorities in lieu of ductile iron or as shown on the Drawings).

C. Control Valves:
1. General: Provide valves and flow control devices as indicated.
2. Minimum Working Pressure: 200 psi unless otherwise indicated, or required.
3. Valves shall open left.
4. Gate Valves: Standard shut off valves with maximum working pressure cast into body, outside screw and yoke type complying with AWWA C500.
5. Check Valves: Gravity operated, regular type, iron bodied, bronze fitted with metal to metal rubber faced checks, complying with AWWA C506.
6. Butterfly Valves: Rubber seated, equipped with gear or traveling nut actuator to minimize water hammer, complying with AWWA C504.

D. Valve Boxes: Minimum 5-1/4” diameter cast iron, slide type. Covers shall be non-locking and have the word WATER in the casting.

E. Accessories:
1. General: Provide anchorages for tees, plugs, caps, and bends. After installation, apply a full coat of asphalt or other acceptable corrosion retarding material to surfaces of rods and clamps.
2. Clamps, Straps and Washers: Steel, ANSI/ASTM A506.
3. Rods: Steel, ANSI/ASTM A575.
4. Rod Couplings: Malleable iron, ANSI/ASTM A197.
5. Bolts: Steel, ANSI/ASTM A307.
6. Cast Iron Washers: ANSI/ASTM A126, Class A.
7. Trust Blocks: 2,500 psi concrete. Use at all changes in directions and elsewhere as necessary.

8. Fittings: Fitting should be short body, cast iron or ductile iron, and should conform and be installed per applicable AWWA C110/A21.10-82 or C153/A21.53-84.
9. Water Service Identification: Blue metallic tape reading 'WATER LINE BURIED

F. Joints:
1. Restrained: 1700 series by EBAA Iron or field lock gaskets
2. Retaining Glands: 'Megalug' with a minimum working pressure of 250 psi, or approved equal

G. Hydrants:
1. Per drawings and local utility Specifications.
2. 3-way hydrant with a 5-1/4" valve and mechanical joint connections in accordance with AWWA C502, open left, as manufactured by Mueller or approved equal.

H. Concrete Valve Seats: Concrete for valve seats shall have a minimum compressive strength of 3,000 psi in 28 days.

I. Concrete Storage Tanks:
1. Tank: precast concrete conforming to ACI-350 standards, steel support saddles, taps for accessories, threaded connections, access manhole.
2. The structures shall be constructed to the lengths, widths and heights as shown on the contract drawings. The chambers shall be designed to adequately and safely support all live and dead loads to which the structure will be subjected, and to withstand all conditions which may be encountered.
3. Design calculations to be prepared by a State of Connecticut licensed professional engineer. Engineer shall verify that the structures have been designed to withstand the burial depth, submergence due to high groundwater (assumed at the ground surface), and the dead and live loads (H20 wheel load) anticipated for the station. The station structures shall have adequate wall, floor and roof thickness and steel reinforcement sufficient for the depth of burial shown on the drawings.
4. Design calculations for uplift forces shall contain a 1.15 minimum factor of safety. When required for counter-flotation, as determined by the buoyancy calculations, the structures shall be designed with an anti-flotation collar (factory casted or field installed) to satisfactorily withstand up-lift pressures exerted on the chambers.
5. The concrete used for the structural components shall attain a minimum, 28-day compressive strength of 5,000 PSI
6. Each pre-cast tank shall be provided with minimal joints to insure a watertight seal. Vertical joints are not allowed and, if required, horizontal joints are to be located above the wet storage volume of the tank. When modules are set in the field, utilize a vulcanized butyl rubber compound sealant conforming to AASHTO M- 198 (latest revision). Sealant shall be "Conseal CS-102" as manufactured by Concrete Sealant or equal. All surfaces of the pre-cast structure shall be smooth, even and free from roughness, irregularities and other defects, and shall be suitable for the application. All joints shall be both internally and externally sealed in the field with 12" wide woven elastomeric wrap.
7. Structures shall be completely watertight with 0% leakage. The manufacturer shall warranty the tanks for a period of five (5) years. In the event a tank should leak the contractor and manufacturer shall repair the chamber at no cost to the Owner. Structures utilizing vertical joints regardless of sealing techniques are NOT ALLOWED.
8. All storage tanks shall be equipped with a suitably protected screened overflow. Overflow pipes shall discharge to a site catch basin and be provided with a rubber flapper valve.

9. All storage tanks shall be equipped with a suitable protected and screened vent. Vents shall terminate in an inverted “J” manner. Overflows shall not be used as vents. Vents shall be located above the overflow level of the tank such that during an overflow condition there would be no water overflowing through the vent.
10. Vents and overflows shall be equipped with a minimum 24-mesh noncorrodible screen.
11. Tanks shall be equipped with a filler pipe to allow for water to be trucked in case of emergencies. The filler pipe shall be capped and locked.
12. All access hatches and manholes shall be locked. Hatches shall be aluminum construction, gasketed, lockable, with spring assist opening.
13. Tanks shall be cast with PVC couplers sized to accept pipe connections. Penetrations of piping through the tank shall be made with mechanical Link-Seals within cast-in-place HDPE or PVC sleeves. Link seals shall be rated for direct burial and for the system which they serve. Tanks shall be cast with pvc couplers sized to accept pipe connections.

J. Liquid Chlorine: In conformance with AWWA standards

K. Hypochlorite: In conformance with AWWA standards.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all water pipe in the locations as shown on the Drawings and/or as approved by the Owner's Representative. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented. Installation should conform with applicable AWWA Standards for the installation of water mains.

B. The tank manufacturer shall be present for tank installation. In addition, the tank manufacturer shall provide a site inspection and certification report indicating that the tank is installed, leveled, and sealed appropriately.

C. The fire marshal’s office shall be present at time of tank installation and will be responsible for directing above grade pipe connections in the field.

3.2 EXCAVATION AND BACKFILL

A. The provisions of Section 312333 entitled "Trench Excavation and Backfill for Utilities" shall govern all work under this Section.

B. The bottom of the trench shall provide a minimum of 4-1/2’ of cover over the crown of the pipe. Stones are not permitted at the bottom of the trench or in contact with the pipe in any location.

C. Sand bedding shall be installed to line and grade as shown on the Contract Drawings. Bedding shall provide continuous and uniform support along the entire length of the pipe.

D. Backfill shall be in accordance with Section 312333, entitled “ Trench Excavation and Backfill for Utilities”

E. Metallic tape reading ‘WATER LINE BURIED BELOW’ shall be placed in trench along entire length of water line.

F. The trench shall be kept free of water throughout pipe installation in accordance with Section 312319, entitled “Dewatering”

G. Contractor shall plug open ends of pipe overnight with an inflatable rubber plug, or approved equal.

3.3 STORAGE AND HANDLING PIPE

A. All pipes shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations, subject to the approval of the Owner's Representative.

3.4 DAMAGE TO PIPE

A. Pipe which is defective from any cause, including damage caused by handling, and determined by the Owner's Representative as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Representative.

B. Pipe that is damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced as directed by the Owner's Representative, at the Contractor's expense.

3.5 PIPE INSTALLATION

A. The installation of water pipe shall conform to the requirements of AWWA standards and shall be laid to required lines and grades.

B. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 312333 entitled "Trench Excavation and Backfill for Utilities”. All pipe shall have sufficient cover above the top of the pipe, and must be laid in separate trenches at least ten feet from the sewer pipe. Crossing of other facilities must have 12 inch minimum clearance (18 inches minimum clearance from sanitary).

C. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. No pipe is to be trimmed or chipped to fit.

D. No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.

E. Full Length of Pipe - Full lengths of pipe are to be used whenever possible to minimize the amount of cutting and splicing in the field.

F. Bedding and Backfilling - The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 312333 entitled "Trench Excavation and Backfill for Site Utilities", Section 3.2 above, and as shown on the Details on the Drawings.

G. Protection During Construction - The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.

H. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has passed.

3.6 PIPE JOINTS

A. All joints are to be made water-tight and shall be tested in accordance with the requirements of the Water Company.

B. Pipe shall be jointed in strict accordance with the pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench.

C. At all tees, bends, dead ends and hydrant, joint restraint shall be provided on the first two joints on either side of the fitting.

D. Install retaining glands at all mechanical joint locations per manufacturer’s installation method.

3.7 THRUST BLOCKS

A. Thrust blocks shall be constructed at all bends by placing a minimum of one-third cubic yard of concrete for each fitting at the undisturbed side of excavation. The thrust block construction shall be adequate to sustain the imposed load. Placement of thrust blocks shall conform to the details and schedule of the Drawings.

3.8 CONNECTION TO EXISTING FACILITIES

A. General - The Contractor shall make all required connections of the proposed water lines into existing water facilities, where and as shown on the Drawings and/or as approved by the Owner's Representative. Connections shall be performed by a Contractor approved by the local utility company. The Contractor shall perform any investigation measures including, but not limited to, exploratory test pits to confirm the point of tie-in and avoidance of other utilities. All investigation measures should be performed a minimum of two weeks prior to the start of water main installation work. Notify engineer of any conflicts. The Contractor shall be responsible for relocating utilities in conflict.

B. Compliance with Requirements of Owner of Facility - Connections into existing water facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the owner of the existing facility shall be included in the Contract Sum.

3.9 SERVICE LINES

A. General - The Contractor shall terminate the water laterals five feet from the building. Work shall include making the service line connections into the on-site water mains, furnishing and installing all service line pipe from the on-site water main systems to points located five feet outside of the proposed building lines and properly sealing the ends with watertight plugs. Service line extensions from these points into the building will be performed by the Building Contractor.

B. Coordination with Building Contractor - The Contractor shall be required to coordinate his work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building. If the Building Contractor has installed his portion of the water service line, work under this Contract shall also include final connection of the water service line five feet outside the building line to the building service line at no additional cost to the Owner. The Contractor shall review the latest architectural/ mechanical plans to verify the location of the service laterals.

C. Connection into On-Site Water System - Water service line connections to the pipe of the on-site water mains shall be made with proper fittings supplied by the pipe manufacturer and as shown on the Drawings in a manner satisfactory to the Owner's Representative.

D. Connection into Off-Site Water System - Water service line connections to the pipe of the off-site water mains shall be made with proper fittings supplied by the pipe manufacturer and as shown on the Drawings in a manner satisfactory to the local authorities.

3.10 STERILIZING

A. All new water lines shall be flushed, sterilized and inspected prior to being put into service and the final connection(s) made to the existing system. Contractor shall sterilize lines in accordance with AWWA C601 or the local utility requirements, whichever is more restrictive.

B. The contractor is responsible for properly disposing of any chlorinated water in accordance with all State and Federal regulations. Any required permits for this work is also the responsibility of the contractor.

3.11 TESTING

A. General: The Contractor shall coordinate and perform all required testing in connection with water line installation. Hydrostatic and leakage tests shall be performed in accordance with the latest edition of AWWA C600 or the local utility requirements, whichever is more restrictive.

B. Scheduling of pressure and leakage tests shall be coordinated with the local water company and performed in the presence of local water company personnel.

C. Contractor shall furnish all necessary items to complete the required tests. Items include, but are not limited to:

Temporary plugs or caps
Pumps
Water meter
Pressure guage

D. Pipes proposed to be encased in concrete shall be tested prior to placing of the concrete.

3.12 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, the entire water system may be subjected to a final inspection in the presence of the Site Engineer and/or Owner's Representative at the Owner's discretion. The Work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and workmanship have been met.

END OF SECTION

SECTION 333000 – SITE SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 310000 – Earthwork

C. Section 312333 –Trench Excavation and Backfill for Site Utilities

D. Town of Trumbull WPCA Standards and Regulations

1.2 SCOPE OF WORK

A. This Work under this section of the specifications shall consist of providing all labor, plant facilities, materials and equipment necessary to install all of the sanitary sewer facilities. This work shall include but not be limited to:
   1. Installation of sanitary sewers consisting of manholes, pipe, cleanouts, laterals, wye connections, pump stations, septic tanks, leaching fields, and all necessary and required accessory items and operations as shown on the Details and Drawings.
   2. Connection to existing sanitary sewer facilities.

B. All necessary coordination with governing sewerage authority including local sewerage authority and local health department and/or Connecticut Department of Energy and Environmental Protection.

C. Testing of sanitary sewer system.

D. Abandonment and removal of existing sanitary sewer pipes and manholes.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's certificate for castings, pipe and accessories to certify that products meet or exceed specified requirements.

B. Submit shop drawings of the precast structures to the Owner’s Engineer for review prior to fabrication. Shop drawings shall include dimensions, reinforcing, joint treatment, invert elevations and invert locations.

C. Submit shop drawings of structure tops including frames and covers.

D. Anti-buoyancy calculations for septic tank, if necessary

PART 2 - PRODUCTS

2.1 MATERIALS

A. The Contractor shall install materials based on this specification or per local specifications, whichever is more restrictive.

B. Polyvinyl Chloride (PVC) Pipe: ASTM D3034-93 for pipe and fittings, minimum wall thickness of SCH-40 or SDR-35 as indicated on drawings. Provide minimum three feet of pipe cover in pavement areas.

C. Precast Concrete Manholes: AASHTO M199-93/ASTM C478-90b, rated for H20 loading, with concrete strength of 4,000 psi.

D. Manhole Frames and Covers: Gray iron casting, AASHTO M105-93/ASTM A48, Class 30B. Pattern number as specified by the local authority or approved equal. All openings to comply to OSHA confined space access diameter. The word sewer is to be on the cover or as specified by the local sewage authority.

E. Manhole Steps: Aluminum alloy 6016T6 steps, manufactured by Alco or approved equal.

F. Cleanouts: Iron body type with extra heavy bronze plugs. Cover shall consist of Neenah Foundary Company Pattern No. R-1914 with locking cover, or approved equal.

G. Pipe joint: Rubber compression gaskets meeting ASTM D 3212.

H. Precast Concrete Grease Trap: Type and location as shown on the drawings

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all sanitary sewer structures and pipe in the locations as shown on the Drawings and/or as approved by the Owner's Representative. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

3.2 EXCAVATION AND BACKFILL

A. The provisions of Section 312333 entitled “Trench Excavation and Backfill for Utilities” shall govern all Work under this Section.

3.3 STORAGE AND HANDLING OF PIPE

A. All pipe shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations, subject to the approval of the Owner's Representative.

3.4 DAMAGE TO PIPE

A. Pipe which is defective from any cause, including damage caused by handling, and determined by the Owner's Representative as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Representative. Damaged pipe shall be immediately marked with white paint and separated from usable pipe on site.

B. Pipe that is damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced as directed by the Owner's Representative, at the Contractor's expense.

3.5 PIPE INSTALLATION

A. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 312333 entitled “Trench Excavation and Backfill for Utilities”. Pipe will be laid with bells upgrade.

B. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly assembled without over stressing the bells. No pipe is to be trimmed or chipped to fit.

C. No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.

D. Full Lengths of Pipe - Only full lengths of pipe are to be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

E. Pipe Entrances to Structures - All pipe entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation.

F. Bedding and Backfilling - The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements Section 312333 entitled “Trench Excavation and Backfill for Utilities” and as shown on the Details of the Drawings.

G. Protection During Construction - The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.

H. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by temporary water tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has passed.

I. Tolerance - Pipe shall be laid accurately to the line and grade as shown on the Drawings and/or as approved by the Owner's Representative. Allowable tolerances shall be 1/4 inch in grade and 1/2 inch in line in any section of pipe between manholes. No adverse grades shall be allowed. Deviations from these tolerances shall be grounds for rejection of the line of pipe by the Owner's Representative. Any line which has been rejected shall be rebuilt to the correct line and grade by the Contractor at his own expense.

J. Do not lay the sanitary sewer line closer than ten feet horizontally or 1.5 feet vertically to a water main or service line. Where sanitary sewer lines pass above water lines, encase the sewer in six inches of concrete for a distance of ten feet on each side of the crossing or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance if approved by the appropriate sewerage authority.

3.6 PIPE JOINTS

A. All joints are to be made watertight in accordance with the requirements specified herein.

B. Pipe shall be jointed in strict accordance with the pipe manufacturer's instructions. Jointing of all pipe shall be done entirely in the trench.

C. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet horizontally to the water line.

D. Where sanitary sewer lines pass less than 18 inches below the water line, provide concrete encasement. The length of encasement is to be increased to the nearest joint beyond the specified horizontal offset distance.

E. Make joints between ductile-iron pipe and other types of pipe with standard manufactured ductile-iron adapters and fittings or as directed by the local sewerage authority. Install ductile-iron piping and fittings in accordance with the recommendations of the pipe manufacturer.

3.7 MANHOLES AND OTHER PRECAST STRUCTURES

A. General Requirements - All manholes shall be built in accordance with the Details and in the locations shown on the Drawings and as specified herein.

B. Structures shall be constructed of precast concrete. Precast structures will require Shop Drawing approval by the Owner's Representative and/or the Site Engineer.

C. No concrete shall be poured when the temperature is below 40 degrees Fahrenheit, or when indications are for lower temperatures within 24 hours, unless protection of concrete is approved by the Owner's Representative.

D. Manholes are to be constructed as soon as the pipe-laying reaches the location of the manhole. Should the Contractor continue his pipe-laying without making provision for completion of the manhole, the Owner's Representative shall have the authority to stop the pipe-laying operations until the manhole is completed.

E. Any manhole which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at the Contractor's expense.

F. Foundations - All foundations shall rest on firm ground of uniform bearing.

G. Inverts - Smooth concrete invert channels shall be constructed in all manholes to insure a smooth flow of water through the structure.

H. The invert channels shall be carried up to the elevations shown on the Drawings and/or as approved by the Owner's Representative. Channels shall slope smoothly and evenly from the entrance pipe to the outlet pipe.

I. Frames, Covers and Gratings - Frames, covers and/or grating for manholes shall be of the type and size indicated on the Drawings or as required by the local authority. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade.

J. Ladder Rungs - Ladder rungs shall be installed in all manholes, spaced 12 inches on center vertically and staggered. Rungs shall be set securely in place during the construction of the masonry wall.

K. Precast Manhole - Precast manholes shall be installed only after Shop Drawings have been approved. Any manholes required by the appropriate utility shall be fabricated, bedded, located and backfilled in accordance with said utility requirements and recommendations.

L. The top grade of the precast concrete corbel section shall be set sufficiently below finished grade to permit a maximum of four and a minimum of two courses of eight inch brick to be used as risers to adjust the grade of casting. Manhole frames shall be set on a grout pad as specified herein above.

M. Bitumastic coating - The entire exterior surface of all manholes shall be coated with two coats of an approved bitumastic material to produce a dry film thickness of 0.07 inches (7 mils) per coat.

3.8 INTERFACE WITH EXISTING FACILITIES

A. Requirements: The Contractor shall make all required connections of the proposed sanitary sewer facilities into existing sanitary sewer facilities, where and as shown on the Contract Documents and/or as approved by the Owner's Engineer.

B. Compliance with Facility Owner Requirements: Connections made into existing sanitary sewer facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor will be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum.

3.9 MODIFICATIONS OF EXISTING STRUCTURES

A. General: The Contractor shall alter, reconstruct and/or convert existing structures where and as shown on the Contract Documents, and/or as approved by the Owner's Engineer. In general, alterations shall be performed with the same type of material used in the original construction unless otherwise indicated on the Contract Documents of approved by the Owner's Engineer.

B. Damage to Existing Installations: The Contractor shall exercise extreme care during such alteration, reconstruction and/or conversions so as not to damage any portions of the structure and/or pipe shown to remain. Any Such damage shall be repaired by the Contractor at his own expense and to the satisfaction of the Owner's Engineer and Owner of the damaged structure.

C. All existing sanitary sewer manhole covers, rims, and structures to remain shall be adjusted to proposed grade.

3.10 SERVICE LINES

A. General - The Contractor shall terminate sanitary laterals five feet from the building.

B. Coordination with Building Contractor - The Contractor will be required to coordinate his work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building. If the Building Contractor has installed his portion of the sanitary sewer service line, work under this contract shall also include final connection of the sanitary sewer service line five feet outside the building line to the building service line at no additional cost to the Owner. The Contractor shall consult the latest architectural/mechanical drawings to confirm lateral locations.

3.11 INSPECTION AND TESTING

A. General - The Contractor shall test the completed sewers, including manholes and laterals for leakage by low-pressure air test, infiltration and exfiltration tests as specified herein and any other testing required by the local sewer authority. The Contractor shall furnish all necessary equipment, materials

and labor for performing the tests as specified. The Contractor shall notify the Owner's Representative and the sewage authority at least 48 hours prior to the start of testing. Sections of pipe tested for infiltration and exfiltration prior to completion of the project shall be subject to additional leakage tests, if warranted in the opinion of the Owner's Representative, and/or the sewage authority prior to acceptance of the project.

B. Infiltration and Exfiltration Testing - The test length intervals for either type of leakage test shall be approved by the Owner's Representative and the sewage authority, but in no event shall they exceed 1000 feet. In the case of sewers laid on steep grades, the length of line to be tested by exfiltration at any one time may be limited by the maximum allowable internal pressure on the pipe and joints at the lower end of the line.

C. The test period, wherein the measurements are taken shall not be less than four hours in either type of test.

D. Leakage Requirements - The total leakage of any section tested shall not exceed the rate of 50 gallons per day per mile per inch of nominal pipe diameter. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of 48 inch diameter pipe, five feet long, and the equivalent leakage allowance shall be 2.25 gallons per manhole per 24 hours. Depending on field conditions, the following test for leakage shall be employed:
   1. Infiltration Test - The test may be used only when groundwater levels are at least four feet above the highest point of the crown of the sewer being tested and after the trench has been backfilled and compacted. The groundwater leakage into the pipe will be measured near the lower end of the section of sewer under test.
   2. Exfiltration Test - This test consists of filling the pipe with water to provide a head of at least five feet above the top of the pipe or five feet above groundwater, whichever is higher, at the highest point of the pipe line under test, and measuring the loss of water from the line by the amount which must be added to maintain the original level. In this test, the line must remain filled with water for at lest 24 hours prior to the taking of measurements. Exfiltration shall be measured by the drop of water level in a closed-end standpipe or in one of the sewer manholes available for convenient measuring.When a standpipe and plug arrangement is used in the upper manhole of a line under test, there must be some positive method of releasing entrapped air in the sewer prior to taking measurements.

E. Low Pressure Air Testing - The sewer mains and/or laterals shall be tested for leakage by the use of low-pressure air as specified hereinafter or by the local sewage authority and as approved by the Owner's Representative. The test length shall not exceed one interval of pipe between two manholes. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.

F. The proper procedure for air testing of sanitary sewers shall be as described in ASTM C-828, latest edition, entitled "Recommended Practice for Low-Pressure Air Test of Vitrified Clay Pipe Lines (4-12 inches)". Although the title specifies vitrified clay pipe, the same procedure maybe used for any other pipe material.

G. It is important that test plugs be properly installed to prevent blowouts. It is also important to maintain pressure relief devices to prevent system over pressurization.

H. Correction of Defective Work - If leakage exceeds the specified amount, the Contractor shall, at his own expense, make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.

I. Any defects found in the system are to be repaired at the expense of the Contractor so as to conform strictly to the Specifications and to the satisfaction of the Owner's Representative. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed, and sanitary sewer left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance by the Owner.

J. Compliance with Agency Requirements - In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sanitary sewers installed under this Contract, the more restrictive requirements shall govern.

3.12 CLEANING AND REPAIR

A. The Contractor will be required to clean the entire sanitary sewer system of all debris and obstructions. This shall include, but not be limited to removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sanitary sewers or streams; all debris shall be removed from the system.

B. After the system has been cleaned, the Contractor shall thoroughly inspect the system and all repairs shown to be necessary shall be promptly performed by the Contractor.

C. All work of cleaning and repair as specified herein shall be performed at the Contractor's expense and to the complete satisfaction of the Owner's Representative.

3.13 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, the entire sanitary sewer system shall be subjected to a final inspection in the presence of the Site Engineer and/or Owner's Representative and local sewerage authority. The Work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and workmanship have been met.

END OF SECTION

SECTION 334100 – STORM SEWER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 320000 - General Requirements

C. Section 020100 - Protection of Existing Utilities

D. Section 310000 - Earthwork

E. Section 312333 - Trench Excavation and Backfill for Utilities

F. Section 312500 - Soil Erosion and Sediment Control

G. Section 333100 Sanitary Sewerage System

H. Section 321313 - Portland Cement Concrete Paving

I. Local governing authority and code requirements.

J. All necessary construction permits.

K. Contract Documents

L. Town of Trumbull standard requirements

1.2 SCOPE OF WORK

A. Work under this section shall consist of providing all labor, plant facilities, materials, tools, equipment, shop drawings and supervision necessary and required to install all of the storm drainage facilities as specified in accordance with the Contract Documents. This work shall include but not be limited to:

1. Installation of the drainage system consisting of manholes, catch basins, pipes, yard drains, cleanouts, flared end sections, stormwater management units, water quality units and all necessary and required accessory items and operations.
2. Connections to existing drainage facilities.

1.3 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition.
1. A706 Type 1R
2. C14 Concrete Sewer, Storm Drain, and Culvert Pipe.
3. C55 Concrete Building Brick.
4. C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
6. C478 Precast Reinforced Concrete Manhole Sections.
7. C923 Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.
8. D1557 Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
9. D2922 Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
10. D3017 Test Methods for Moisture Content of Soil and Soil Aggregate Mixtures.

B. American Association of State Highway and Transportation Officials (AASHTO) - latest edition

C. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.5 QUALITY ASSURANCE

A. An Engineer, selected and paid by the Owner (herein referenced to as "Owner's Engineer"), may be retained to perform construction inspection on-site based on measurement, visual observation, and judgment.

B. Visual field confirmation may be performed by the Owner's Engineer as part of the construction testing requirements.

C. All costs related to reinspection due to failures shall be paid for by the Contractor at no additional expense to Owner. The Owner reserves the right to direct any inspection that is deemed necessary. Contractor shall provide free access to site for inspection activities.

1.6 SUBMITTALS

A. Product Data: Provide manufacturer's certificate for castings, pipe and accessories to certify that products meet or exceed specified requirements.

B. Submit shop drawings of the precast structures to the Owner's Engineer for review prior to fabrication. Shop drawings shall include dimensions, reinforcing, joint treatment, invert elevations and invert locations.

C. Submit shop drawings of structure tops including frames, covers, and/or grates.

D. Submit shop drawings of the below grade stormwater management system including material, layout, elevations, pipe connection locations, inspection ports, access locations, and backfill requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.8 COORDINATION

A. Coordinate the Work with termination of storm sewer connection outside building including connection to existing storm sewer system.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS AND ACCESSORIES

A. Reinforced Concrete Pipe (RCP): Straight and flared end sections complying with requirements of ASTM C 76, Class III unless another class type is indicated on the Contract Documents, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M 198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. Corrugated High Density Polyethylene Pipe (HDPE): Shall conform to AASHTO Designation M294 and M252. Pipe must be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12" and HANCOR, Inc. "Hi-Q" or approved equal.

C. Polyvinyl Chloride Pipe (PVC)
   1. On-site pipe and fittings shall comply with ASTM D 3034, rated SDR 35 unless otherwise specified on the Contract Documents or required by the local utility. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
   2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.2 CATCH BASINS, INLETS, MANHOLES AND COMPONENTS

A. General: All manholes, catch basins and drain inlets shall be built in accordance with, and in the locations shown on the Contract Documents. All structures will require shop drawings approved by the Owner's Engineer and Town Engineer.

B. No concrete or masonry shall be placed when the temperature is below forty (40) degrees Fahrenheit, or when indications are for lower temperatures within twenty-four (24) hours, unless protection of concrete and masonry is approved by the Owner's Engineer. Damage to the structure because of freezing shall be corrected by the Contractor at his own expense, to the satisfaction of the Owner's Engineer.

C. Manholes, catch basins and drain inlets shall be constructed as soon as the pipe laying reaches the location of the structures. Should the Contractor continue his pipe laying without making provisions for completion of the structures, the Owner's Engineer shall have the authority to stop the pipe laying operations until the structure is completed.

D. Any structure which is mislocated or oriented improperly shall be removed and re-built in its proper location, alignment and orientation at the Contractor's expense.

E. Precast Concrete Manholes: AASHTO M199-93/ASTM C478-90b. Manhole diameter shall be selected to accommodate the inflow and outflow pipes.

F. Pour-in-place or Precast Reinforced Concrete Catch Basins (Control Structures): AASHTO M199-93/ASTM C478-90b rated for H20 loading, with minimum concrete strength of 3,000 psi. Inlet size shall be selected to accommodate the inflow and outflow pipes.
   1. Manhole Barrel: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923 & C361
      a. Construct manholes of precast concrete sections as required by Contract Documents to size, shape, and depth indicated, but never less than 4-ft inside diameter.
   2. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than two (2) inches deep shall be repaired using Class "D" mortar.
   3. Brick Transition Reinforcement: Formed steel 8-gage wire with galvanized finish.
   4. Foundations: All foundations shall rest on firm soil of uniform bearing and stone subbase as shown on Contract Documents.
   5. Inverts: Brick or smooth concrete invert channels shall be constructed in all manholes and in all catch basins and drain inlets which do not have sumps, to insure a smooth flow of water through the structure.

6. The invert channel shall be constructed to the elevations shown on the Contract Documents and/or as approved by the Owner's Engineer. Channels shall slope smoothly and evenly from the entrance pipe to the outlet pipe.
7. Frames, Cover, and Gratings: Frames, Covers and/or gratings for manholes, catch basins, and drain inlets shall be of the type and size indicated on the Contract Documents. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade.
8. Ladder Rungs: Forged Aluminum to dimensions shown on Contract Documents to be Alco steps 6061T6 or approved equal.
9. Precast Structures: Precast structures shall be installed only after shop drawings have been approved by Owner’s Engineer and shall meet the requirements of ASTM C478.
10. Grout around pipes which protrude through the walls of the structure and on all joints shall contain "Antihydro", or other approved additive to insure water tightness. Cement grout shall contain two parts cement to one part sand and additive in accordance with manufacturer's recommendations. Mortar shall be applied to the bottom 1/3 of the opening before the pipe is inserted.
11. The top grade of the precast concrete corbel section shall be set sufficiently below finished grade to permit a maximum of seven (7) and a minimum of two (2) courses of 8-inch brick to be used as risers to adjust the grade of the casting. Manhole frames shall be set on a grout pad as specified herein above.
12. Provide precast manhole shaft construction with eccentric cone top section and lipped male/female rubber gasket joints or mortar joints.
13. Brick shall be new units conforming to AASHTO Designation M-91, latest revision, Grade MS.
14. Mortar shall conform to ASTM C270, Type M.
15. Pipe joints for rigid pipes shall be made with mortar, grout, gaskets, or as recommended by the pipe manufacturer.
16. Manholes and Pipe constructed within the Right-of-Way shall be manufactured and installed in accordance with all applicable Standard Specifications and the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Contract Documents.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 GENERAL

A. The Contractor shall install all drainage structures and pipe in the locations shown on the Contract Documents and/or as approved by the Owner's Engineer. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

B. Excavation and Backfill shall be in accordance with Section 312333 of these specifications.

C. Storage and Handling of Pipe - All pipe shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations.

D. Damage to Pipe - Pipe which is defective from any cause, including damage caused by handling, and determined by the Owner's Engineer as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Engineer.

E. Pipe that is damaged or disturbed through any cause prior to acceptance of the Work, shall be repaired, realigned or replaced as directed by the Owner's Engineer, at the Contractor's expense.

3.4 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 33 for work of this Section.

3.5 INSTALLATION - PIPE

A. Laying Pipe: Each length of pipe shall be laid with firm, full and even bearing throughout the entire length, in a trench prepared and maintained in accordance with Section 31 23 33 of these Specifications and Contract Documents. Pipe shall be laid upgrade unless otherwise approved by the Owner’s Engineer.

B. Concrete pipe over 24-inches in diameter shall be laid with the lift holes on top of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs to the satisfaction of the Owner's Representative. No lift holes will be permitted in pipes 24-inches in diameter and smaller.

C. Bell and spigot pipe shall be laid with the bell end upgrade. The pipe shall be joined so that there will be uniform space around the pipe. Trimming of the pipe shall not be allowed.

D. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. Prior to placing a length of pipe, the end of the previously laid length shall be carefully and thoroughly wiped smooth and clean to obtain an even and close fitting joint.

E. No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.

F. Place pipe on minimum 6-inch thick bed of compacted bedding or as detailed on the Contract Documents.

G. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321, manufacturer's instructions and/or state or local requirements. Seal joints to be watertight.

H. Lay pipe to slope gradients noted on Contract Documents with maximum variation from true slope of 1/8-inch in 10-ft.

I. Place and compact bedding aggregate at sides and to the springline of the pipe as per these Specifications.

J. Refer to Sections 310000 and 312333 of these Specifications for backfill requirements. Do not displace or damage pipe when compacting.

K. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

L. Pipe Entrances to Structures: All pipe entering structures (e.g.: manholes, catch basins, etc.) shall be cut flush with the inside of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation.

M. Only full sections of pipe shall be used where entering a structure which will be exposed to view, such as endwalls, headwalls, end sections, etc.

N. Bedding and Backfilling: The type of materials to be used in bedding and backfilling and the method and placement shall conform to the requirements of these Specifications.

O. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and or adjacent to any pipe shall be performed at the Contractor's risk.

P. Tolerance: Pipe shall be laid accurately to the line and grade shown on the Contract Documents and/or as approved by the Owner's Engineer. Allowable tolerances shall be 1/2-inch on grade and 1-inch on line in any section of pipe between structures. Deviations from these tolerances shall be a basis for rejection of the line of pipe by the Owner's Engineer. Any line which has been rejected shall be rebuilt to correct line and grade by the Contractor at his own expense.

3.6 INSTALLATION - CATCH BASINS, MANHOLES AND CONTROL STRUCTURES

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at proper elevation.

C. Place precast reinforced concrete sections with provision for storm sewer pipe sections at the location and elevation specified on the Contract Documents.

D. Level top surface of each precast concrete shaft sections as assembly progresses.

E. Establish elevations and pipe inverts for inlets and outlets as indicated.

F. Lay brick masonry in running bond with full 3/8-inch mortar joints to receive casting assembly. Level casting frame in grout to receive grated inlet or manhole cover.

3.7 PLACING PRE-CAST MANHOLE BARREL SECTIONS

A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.

B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
   1. After completion of slab foundation the first joint of manhole barrel shall be lowered into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole barrel.
   2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

3.8 PIPE JOINTS

A. Mortar Joints (RCP): After each length of RCP is laid, the lower portion of the bell shall be filled with mortar, and the succeeding length shall be laid in place so that the inner surfaces of the abutting lengths are flush. The remainder of the joint shall be completely filled with mortar and sufficient additional mortar used to form a bead around the joint flush with the outside diameter of the bell. The inside of the joint shall be wiped and finished smooth. Joints shall be thoroughly wet before the mortar is placed.

B. Cold Applied Joint Sealer (RCP): Bell and spigot or tongue and groove RCP shall be wiped clean and dry before applying the sealer to the pipe joint. Before the pipes are placed in contact with each other, the spigot end or tongue end of the pope shall be completely covered with an excess of sealer, and then the pipe shall be laid to the established line and grade so that the inside surfaces of abutting pipe are flush.

3.9 INTERFACE WITH EXISTING FACILITIES

A. Requirements: The Contractor shall make all required connections of the proposed drainage facilities into existing drainage facilities, where and as shown on the Contract Documents and/or as approved by the Owner's Engineer.

B. Compliance With Facility Owner Requirements: Connections made into existing drainage facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor will be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum.

3.10 REMOVAL OF EXISTING UTILITIES

A. The Contractor shall remove and legally dispose of off-site all abandoned utilities encountered during installation of the storm drainage facilities. In particular, all components of the existing combined sewer shall be removed from the site and up to the nearest off-site manhole.

3.11 MODIFICATIONS OF EXISTING STRUCTURES

A. General: The Contractor shall alter, reconstruct and/or convert existing structures where and as shown on the Contract Documents, and/or as approved by the Owner's Engineer. In general, alterations shall be performed with the same type of material used in the original construction unless otherwise indicated on the Contract Documents or approved by the Owner's Engineer.

B. Damage to Existing Installations: The Contractor shall exercise extreme care during such alteration, reconstruction and/or conversions so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired by the Contractor at his own expense and to the satisfaction of the Owner's Engineer and Owner of the damaged structure.

3.12 CLEANING AND REPAIR

A. The Contractor will be required to clean the entire drainage system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing storm drains or streams; all debris shall be removed from the system and disposed of in accordance with all governing agencies.

B. After the system has been cleaned, the Contractor shall thoroughly inspect the system along with the Owner’s Engineer and all repairs shown to be necessary shall be promptly made by the Contractor.

C. All Work of cleaning and repair as specified herein shall be performed at the Contractor's expense and to the complete satisfaction of the Owner's Engineer.

3.13 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, the entire drainage system shall be subject to a final inspection in the presence of the Owner’s Engineer and Town Engineer. The Work shall not be considered as complete until all requirements for line, grade, cleanliness, and workmanship have been completed to the satisfaction of the Owner's Engineer and the Town Engineer.

END OF SECTION

SECTION 37100 - UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 320000 - General Requirements

C. Section 312333 - Trench Excavation and Backfill for Utilities

D. Local Utility Companies and Governing Agencies

E. Contract Drawings and Documents

1.2 SCOPE OF WORK

A. Work under this Section shall consist of providing all labor, plant facilities, materials and equipment necessary and required to install the gas, electric, telephone and cable television facilities in accordance with the Contract Documents. This Work shall include but not be limited to:
   1. Installation of on-site utilities consisting of pipe, conduit and all necessary and required accessory items and operations associated with said installation.
   2. Coordination with the utility companies regarding the installation of utilities within the right-of-way and on-site as required, including connections to existing facilities.

1.3 COORDINATION

A. All work under this Section shall be coordinated with the gas, electric and telephone utility company and shall comply with all requirements, details, regulations, etc. of said utility company. The Contractor shall coordinate with each utility to define where his limit of work exists before submitting a bid price for this Section.

B. Work shall be coordinated with the electrical and/or mechanical contractors responsible for building and light standard connections.

1.4 HIGH PERFORMANCE BUILDING GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project’s environmental goals, which include complying with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a

construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated High Performance Building criteria.

B. Comply with Connecticut Standard Guidelines Compliance Manual for High Performance Buildings, September 2011 with additional mandatory building project requirements for schools and the Department of Administrative Services / Office of School Construction Grants & Review High Performance School Construction Bulletin, June 2017.

1.5 SUBMITTALS

A. General: Product Data: Provide manufacturer's certificate for castings, pipe and accessories to certify that products meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. When available, those materials specified by the appropriate utility company shall be used in lieu of those materials specified in this Section.

2.2 ELECTRIC, TELEPHONE AND CABLE CONDUIT

A. Concrete conduit shall comply with all requirements of applicable utility companies.

2.3 MANHOLE/PULL PITS

A. All manholes and pull pits required by the utility company shall comply with all requirements, regulations, specifications, details, and recommendations of said utility company.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. General:

1. The Contractor shall install all pipe, conduit and ductbank in the locations as shown on the Drawings and/or as approved by the Owner's Engineer and utility company. Pipe and conduit shall be of the type and sizes specified and shall be laid accurately to line and grade. Any necessary structures shall be accurately located and properly oriented.

B. Excavation and Backfill:

1. When available, those requirements, specifications and procedures, for excavation and backfill, specified by the appropriate utility company shall be used in lieu of these specifications. When such specifications are not available from said utility company, the requirements of this specification shall apply.
2. The provisions of Section entitled "Trench Excavation and Backfill for Utilities" shall govern Work under this Section.

C. Storage and Handling of Conduit and Pipe:

1. All pipe and conduit shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in handling. Storage of pipe and conduit on the job shall be in accordance with manufacturer's recommendations, subject to the approval of the Owner's Engineer.

D. Damage to Pipe and Conduit:

1. Pipe or conduit which is defective from any cause, including damage caused by handling, and determined by the Owner's Engineer as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Engineer.

2. Pipe or conduit that is damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced as directed by the Owner's Engineer, at the Contractor's expense.

E. Pipe Installation:

1. All piping and conduit shall be laid in accordance with the requirements and procedures specified by the appropriate utility company. When such requirements are not available from said utility company, the requirements of this specification shall apply.

2. Each length of pipe and conduit shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 312333. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing the line. Minimum cover over the top of the pipe or conduit shall comply with the utility specifications and shall never be less than 2-ft.

3. Bedding and Backfilling: The type of materials to be used in bedding and backfilling and the method of placement shall comply with the requirements and procedures specified by the appropriate utility company. When such requirements are not available, the type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of these specifications and as shown on the Details of the Drawings.

4. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.

5. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not

be removed until the trench has been pumped dry and all danger of water entering the pipe has passed.

F. Pipe/Conduit Joints:

1. When available, those specifications and requirements specified by the appropriate utility company shall be used in lieu of these specifications. Where such specifications are not available from said utility company, the requirements of this specification shall apply.

2. All joints are to be made watertight in accordance with the requirements specified herein. Pipe shall be jointed in strict accordance with the Pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench. Assembly of PVC conduit shall be with a solvent type adhesive as recommended by the conduit manufacturer.

G. Manholes/Pull Pits:

1. Any manholes or pull pits required by the appropriate utility shall be fabricated, bedded, located and backfilled in accordance with said utility requirements and recommendations. Final location(s) shall be approved by the Owner’s Engineer.

H. Connection to Existing Facilities:

1. General: The Contractor shall make all required connections of the proposed gas lines into existing gas facilities, where and as shown on the Contract Documents and/or as approved by the gas company. The Contractor shall perform any investigation measures including, but not limited to, exploratory test pits to confirm the point of tie-in and avoidance of other utilities. All investigation measures should be performed a minimum of two weeks prior to the start of gas main installation work. Notify engineer of any conflicts. The Contractor shall be responsible for relocating utilities in conflict.

2. The Contractor shall terminate the upstream end of the electric and telephone conduit at a location specified by the electric and telephone companies.

3. Compliance with Requirements of Owner of Facility: Connections into existing facilities shall be performed in accordance with the requirements of the owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum.

4. Cable pulling and connection of wire and cable to the existing facilities is not covered under this specification and will be done by others.

5. Construction shall conform to all requirements of the Town Engineer and/or any other agencies having jurisdiction.

I. Service Lines:

1. The Contractor shall install gas piping and electric/telephone conduit to points located 5-ft inside the proposed building lines as shown on the Drawings. All pipes and conduit shall be properly sealed with watertight plugs and shall be clearly marked from above.

2. The Contractor will be required to coordinate his work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building. If the Building Contractor has installed his portion of the service lines, Work under this Contract shall also include final connections of the service lines of the building line to the building service line at no additional cost to the Owner.

3.2 INSPECTION AND TESTING

A. The Contractor shall perform all inspection and testing of these installations as required by the appropriate utility company and shall bear all costs arising therefrom.

3.3 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, these installations may be subjected to a final inspection in the presence of the Owner's Engineer, a Town Representative/Engineer or a representative of the utility company. The Work shall not be considered as completed until all requirements for line, grade, cleanliness, tests and workmanship have been met.

3.4 AS-BUILT RECORDS

A. Within 30 days of installation of each utility, Contractor shall maintain records of installed utility lines and provide to owner, owner's engineer and utility companies for purposes of completing as-built plans for the project. Contractor must keep records of and provide locations and elevations to top of conduit at 50 foot intervals along straight sections of utility, and at all bends and appurtenances along the utility lines.

END OF SECTION

LIMITED NESHAP PRE-DEMOLITION HAZARDOUS BUILDING MATERIALS SURVEY REPORT

for

Hillcrest Middle School ("the Project")
530 Daniels Road
Trumbull, Connecticut 06611

Prepared For:

Michael C. Scott, AIA, WELL AP, MCPPO
Partner
TSKP Studio
146 Wyllys Street
Building 1-203
Hartford, CT 06106

Prepared By:

Langan CT, Inc.
555 Long Wharf Drive
New Haven, CT 06511



Matthew A. Myers
Senior Project Manager

2 September 2025
140325901

LANGAN

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ACRONYMS

US EPA	United States Environmental Protection Agency
AHERA	Asbestos Hazard Emergency Response Act
OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulation
NESHAP	National Emission Standards for Hazardous Air Pollutants
HUD	Housing and Urban Development
CT DPH	Connecticut Department of Public Health
CTDEEP	Connecticut Department of Energy and Environmental Protection
RCRA	Resource Conservation and Recovery Act
PLM	Polarized Light Microscopy
TEM	Transmission Electron Microscopy
ACM	Asbestos Containing Materials
HBM	Hazardous Building Materials
LBP	Lead-Based Paint
PCB	Polychlorinated Biphenyls
SF	Square Feet
LF	Linear Feet
ppm	Parts per million
mg/cm^2	Milligrams per square centimeter
XRF	X-ray Fluorescence
TCLP	Toxicity Characteristic Leaching Procedure
AAS	Atomic Absorption Spectrometry

1.0 INTRODUCTION

Langan CT, Inc. (Langan) prepared this Limited National Emissions Standards for Hazardous Air Pollutants (NESHAP) Pre-Demolition Hazardous Building Materials (HBM) Survey Report on behalf of TSKP Studio and Trumbull Public Schools to identify hazardous building materials that may exist at the Hillcrest Middle School, 530 Daniels Farm Road, Trumbull, Connecticut. The 1966, one-story school is approximately 119,000 square feet (SF) with classrooms, offices, multipurpose room, kitchen, media center, gymnasium, pool, planetarium, greenhouse, toilet rooms, storage rooms, and boiler/mechanical rooms. The objectives of this survey/report is to identify the presence or absence of accessible asbestos-containing materials (ACM), lead-based paint (LBP), assume suspect polychlorinated biphenyl (PCB) containing sealant compounds and universal waste so these materials can be properly identified/quantified and assessed in support of possible building demolition.

Details pertaining to the building subject to this survey are summarized in the following table.

PROJECT INFORMATION

Client Name:	Michael C. Scott, AIA, WELL AP, MCPPO Partner TSKP STUDIO 146 Wyllys Street Building 1-203 Hartford, CT 06106	Property Visit Date:	14 -16 and 22 July 2025
Professional's Project #:	140325901	Construction Dates:	1966
Consultant's Project Manager:	Matthew A. Myers	No. Buildings:	One
Phone No.:	203-562-5571	No. of Stories:	One
Email:	mmyers@langan.com	Bldgs. Gross Footage:	Main Building - Approximately 119,000 SF
Property Address:	530 Daniels Farm Road		
Property Town, State:	Trumbull, Connecticut	Property Use:	Public Middle School

The following sections summarize the HBM findings for the building surveyed.

2.0 ASBESTOS-CONTAINING MATERIALS

Terminology

Suspect Asbestos-Containing Materials

Asbestos was historically used in certain types of construction and building materials. Until a material is examined by using polarized light microscopy (PLM) or a similar technique, the building material is considered as a suspect asbestos-containing material. A few examples of these materials include wall and ceiling plasters, sheetrock/taping compound, flooring materials, ceiling panels, thermal system insulation, fireproofing insulation, adhesives, roofing materials, damp-proofing/waterproofing materials, caulking and glazing compounds, etc. Any suspect ACM and/or building material of unknown asbestos content should be assumed to be an asbestos containing material and handled and disposed of accordingly. Demolition, renovation, maintenance or daily activities should not disturb building materials that are found to contain asbestos, assumed to contain asbestos or that have not been tested for possible asbestos content.

Asbestos–Containing Material

A material with an asbestos concentration greater than 1% by weight is considered an ACM by the United States Environmental Protection Agency (EPA). Thus, a material which contains asbestos in concentrations greater than 1% by weight is considered "positive" while a material that does not contain asbestos or asbestos is detected in concentrations less than 1% by weight is considered "negative". The Connecticut Department of Public Health (CT DPH) revised the definition of an asbestos-containing material to be a concentration equal to or greater than 1% by weight. However, the Occupational Safety and Health Administration (OSHA) considers any amount of asbestos as regulated and some landfills/states consider building materials containing less than 1% asbestos as regulated asbestos-containing waste.

Regulatory Guidelines and Requirements

Federal

In accordance with the Clean Air Act (CAA), the U.S. Environmental Protection Agency established the National Emission Standards for hazardous Air Pollutants to protect the public from exposure to airborne pollutants. Asbestos was one of the air pollutants, which was addressed under the NESHAP 40 Code of Federal Regulations (CFR) Part 61. The purpose of the asbestos NESHAP regulations is to protect the public health by minimizing the release of asbestos when facilities, which contain ACM, are being renovated or demolished. EPA is

responsible for enforcing regulations related to asbestos during renovation and demolition activities, however, the CAA allows the EPA to delegate this authority to state and local agencies. Even after EPA delegates responsibility to a state or local agency, EPA retains the authority to oversee agency performance and to enforce NESHAP regulations as appropriate. OSHA considers any amount of asbestos to be regulated.

State

Asbestos in Connecticut is regulated by the State of Connecticut Department of Public Health, under Standards for Asbestos Abatement – Section 19a-333a-1 through 16 of Regulations of Connecticut State Agencies (RCSA) and Licensing and Training Requirements for Persons Engaged in Asbestos Abatement and Asbestos Consulting Services – Section 20-440-1 through 9 and Section 20-441 of RCSA.

Asbestos Survey

During this survey, suspect ACM were separated into three US EPA categories. These categories are: thermal system insulation (TSI), surfacing materials, and miscellaneous materials. TSI includes all materials used to prevent heat gain or loss or water condensation on mechanical systems. Typical examples of TSI are boiler, duct and tank insulation, pipe and pipe fitting insulation. Surfacing materials are sprayed, troweled or otherwise applied to an existing surface and common uses are fireproofing, decorative and acoustical plaster applications. Miscellaneous materials include all ACM not listed as TSI or surfacing and include: flooring materials, ceiling tiles, adhesives, transite cement board, sink undercoating, gypsum board/taping and joint compounds, cove base materials, caulking and glazing compounds, damp-proofing/tars/mastics, roofing materials and other materials. State of Connecticut DPH licensed asbestos inspectors Matthew Myers (#000041), Hilton Hernandez (#000424) and Jared Gorborino (#001240) performed the survey.

ACM Results Summary

Bulk sampling results are included as Tables 1 and 2 below. Analytical asbestos laboratory data can be found in Appendix A.

As required by EPA and CT DPH, samples were analyzed by individual layers (e.g. floor tile & the associated mastic were analyzed as two separate samples, rough and finish coat plasters, etc.). Bulk samples of suspect ACM were analyzed using the PLM analytical methodology in accordance with EPA Protocol 600/R-93/116 and possibly by PLM Point Count. Additional analysis

of non-friable organically bound (NOB) materials (e.g. flooring mastics) using NOB and transmission electron microscopy (TEM) was not performed. The samples were analyzed by EMSL of Cinnaminson, New Jersey, accredited by the National Voluntary Laboratory Program (NVLAP) and American Industrial Hygiene Association (AIHA).

Utilizing the EPA and CT DPH protocols and criteria, the following materials **were determined to be ACM:**

Table 1 – Summary of Asbestos-Containing Materials

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Clock/Speaker Tar (Black) – Miscellaneous Material	Throughout Building	ACM 5% Chrysotile 072304A	80 Clock/Speaker Units
Transite Tabletop and Tabletop Adhesive (Black) – Miscellaneous Materials	Classrooms C1, C5 and C5 Computer Room	ACM 3%-15% Chrysotile 072306A 072307A 0723147A	165 Square Feet (SF)
Laboratory Sink Caulking Compound – Miscellaneous Material	Classroom A17	ACM 4% Chrysotile 0723145A	One Sink (Additional Investigation Recommended – May Be Additional Sinks)
Transite Laboratory Hood and Box – Miscellaneous Material	Classroom A17 and A17 Storage Room	Assumed ACM	82 SF
Laboratory Test Tube Rack and Adhesive – Miscellaneous Materials	Classroom A17	ACM 15% Chrysotile 0723157A and Assumed ACM	16 SF

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Laboratory Countertops – Miscellaneous Materials	Classrooms A17, A17 Prep Room and A12 – Student, Teacher and Perimeter Classrooms A13 and A14 – Teacher and Perimeter Classroom C5 Computer Room	ACM 15%20% Chrysotile 0723149A 0723150A 0723152A 0723154A	1,100 SF
Electrical Insulation – Miscellaneous Material	Auditorium/Cafeteria and Stage	Assumed ACM	11 Spot Lights and Eight Light Trays (80 Linear Feet (LF))
Light Backing Paper – Miscellaneous Material	Gymnasium Storage Room 1	ACM 20% Chrysotile 072318A	One Light Fixture
Black Tar on Concrete Block – Miscellaneous Material	Main Office Conference Room	ACM 4% Chrysotile 072317A	Two SF Visible
Black Duct Paper/Tar – Miscellaneous Material	Main Office and Nurse Areas	ACM 15% Chrysotile 072331A	16 SF Visible
Duct Insulation Pin Adhesive – Miscellaneous Material	Auditorium/Cafeteria Stage, Gymnasium, Gymnasium Storage Closets 1 and 2 and Planetarium Closet	ACM 3% Chrysotile 072334B	1,050 Square Feet of Duct Visible
Dark Red Fire Penetration Sealant – Miscellaneous Material	Throughout Building	ACM 4% Chrysotile 072351A	Unknown
Pipe Fitting and Roof Drain Insulation – Thermal System Insulation	Throughout Building – Visible in Some Locations and Assumed Inside Pipe Chases (Throughout All Rooms/Areas), Behind Fixed Ceilings, etc.	Assumed ACM (Three Samples of Accessible Insulation were No Asbestos Detected)	Unknown – 1,200 Visible, Estimate Additional 2,000 – 3,000 Inaccessible

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Older 9"x9" and 12"x12" Floor Tiles and Black Mastic – Miscellaneous Materials	Planetarium Closet/Mechanical Room, Weight Room, Toilet Room Adjacent Classroom C11 and Throughout Building Underneath Millwork/Cabinetry/Fixed Object/Gypsum Walls	ACM 3%-5% Chrysotile 0723122A - 0723124A	700 SF Visible Hidden Underneath Objects Unknown – Estimate Up To 3,500 SF
Black Mastic Underneath 12"x12" Floor Tiles – Miscellaneous Material (Floor Tiles Contaminated)	Throughout Building	ACM 4%-5% Chrysotile 0723134A 0723136A (Mixed Results)	Unknown – Estimate Up To 60,000 SF
Ceramic Wall and Floor Tile Grouts and Mud Beds – Miscellaneous Materials	Throughout Inside of Pool	ACM <0.25%-1.25% Chrysotile 0723178A,B – 0723180A	Estimate 6,600 SF (Quantity Needs to be Verified)
Rock Wall Damp-Proofing Tar/Paper – Miscellaneous Material (Assume Adjacent Materials/Substrates Contaminated)	Exterior/Interior Classrooms D4, Media Center, Planetarium, Main Entrance, Auditorium/ Cafeteria and Courtyard	ACM 22% Chrysotile 0723199A	12,750 SF

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Damp-Proofing Tar/Paper Behind Brick Walls (including at foundation) – Miscellaneous Material (Assume Adjacent Materials/Substrates Contaminated)	Throughout Exterior	ACM 17%-20% Chrysotile 0723200A 0723201A 0723283A	23,500 SF
Transite Board and Damp-Proofing Tar/Paper Behind Stone Paneling – Miscellaneous Materials (Assume Adjacent Materials/Substrates Contaminated)	Throughout Exterior	ACM 30%-65% Chrysotile 0723203A 0723204A	5,800 SF
Display Case Caulking Compounds (Older) – Miscellaneous Materials	Throughout Corridors	ACM 5% Chrysotile 0723211A	160 LF
Interior Wall, Ceiling, Ceramic Wall Caulking Compounds – Miscellaneous Materials	Throughout Building Interior – All Areas/Rooms/Corridors/Etc.	ACM 3%-8% Chrysotile 0723209A 0723212A – 0723214A	Unknown - ALL

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Interior Door Caulking, Door/Window Wall Caulking and Glazing, Window Caulking, Window Glazing, Door Window Glazing and Miscellaneous Caulking Compounds – Miscellaneous Materials	Throughout Building Interior, Greenhouse (Interior and Exterior)	ACM 3%-6% Chrysotile 0723226A – 0723228A 0723246A 0723247B 0723250A 0723257A 0723258B 0723259 0723260 0723263 – 0723268 0723270 – 0723275	Unknown - ALL
Exterior Window Caulking, Sill (Including Underneath Sills) Caulking, Window Glazing, Wall Caulking, Foundation Caulking, Door Caulking, Door/Window Wall Caulking and Glazing, Vent Caulking and Miscellaneous Caulking Compounds – Miscellaneous Materials	Throughout Exterior	ACM 3%-8% Chrysotile 0723223A 0723232A 0723234B 0723237 0723239 0723240 0723243 0723244	Unknown - ALL
Exterior Rock Wall and Wall Expansion Caulking Compounds – Miscellaneous Materials	Throughout Exterior	ACM 5%-7% Chrysotile 0723218A 0723221A	Unknown - ALL

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Conduit Putty – Miscellaneous Material	Throughout Exterior	ACM 8% Chrysotile 0723220B	5 SF
Dome Black Paper Under Metal Roof – Miscellaneous Material (Assume Adjacent Materials/Substrates Contaminated)	Planetarium Exterior	ACM 30% Chrysotile 0723278A	2,500 SF
Roof Field and Flashing Material (Black Middle Layer) – Miscellaneous Material (Assume Adjacent Materials/Substrates Contaminated)	Exterior Pool and Media Center (Curved Roofs)	ACM 18% Chrysotile 0723279A	18,500 SF
Roof Penetration Flashing Materials – Miscellaneous Materials (All Layers) (Assume Adjacent Materials/Substrates Contaminated)	Exterior Roofs Throughout	ACM 8%-12% Chrysotile 0723293 0723294	1,800 SF

Utilizing the EPA and CT DPH protocols and criteria, the following materials **were determined to be non-ACM or less than one percent asbestos:**

Table 2 – Summary of Non-Asbestos-Containing Materials

Material	Location	Sample ID
Wall Adhesive – Miscellaneous Material	Greenhouse	072301A,B
Kiln – Miscellaneous Material	Classroom C1 Closet	072302A,B

Material	Location	Sample ID
Fire Door Interior Insulation – Miscellaneous Material	Classroom C5 (Additional asbestos-containing door insulation may exist throughout building)	072303A,B
Paper Under Wood Floor (Black) – Miscellaneous Material	Auditorium/Cafeteria Stage	072305A,B
Slate Window Sill and Grout – Miscellaneous Materials	Throughout Building	072308A,B 072309A,B
Paper Behind Acoustical Walls – Miscellaneous Material	Music Practice Rooms Adjacent Classroom D4 and Media Center Recording Room	072310A,B
Roof Debris (Paper and Tar) – Miscellaneous Materials	Classroom D5	072311A,B 072312A,B
Ceramic Floor Material (Black) – Miscellaneous Material	Pool Walkway Core Hole	072313A,B
1"x1" Wall Tiles and Glue Daubs – Miscellaneous Materials	Pool	072314A,B 072315A,B
Stage Curtains – Miscellaneous Material	Auditorium/Cafeteria Stage	072316A,B
Ceiling/Beam Spray Applied Fireproofing – Surfacing Materials	Pool and Media Center	072319A-G – 072320A-E
Ceiling/Wall Plaster - Finish and Rough Coats, One Coat and Textured Ceiling Paint - Surfacing Materials	Throughout Building	072321A-C – 072329A-E
Black Paper In/On Wall – Miscellaneous Material	Main Office and Nurse Areas	072330A,B
Duct Insulation Canvass and Black Paper – Miscellaneous Materials (Asbestos-containing duct pin adhesive exists underneath)	Auditorium/Cafeteria Stage, Gymnasium, Gymnasium Storage Closets 1 and 2 and Planetarium Closet	072332A,B 072333A,B
Duct Seam and Flange Sealants – Miscellaneous Materials	Throughout Building	072335A,B - 072337A,B

Material	Location	Sample ID
Tectum Ceiling Deck – Miscellaneous Material	Throughout Building	072338A,B
Formica and Wood Countertop and Unit Ventilator Adhesives – Miscellaneous Materials	Throughout Building	072339A,B – 072341A,B
Sink and Eyewash Undercoating (Black) – Miscellaneous Materials	Throughout Building	072342 – 072349
Red Fire Penetration Sealant – Miscellaneous Material	Throughout Building	072350A,B
Pipe End Cap Insulation and Fiberglass Pipe Insulation Black/Silver Layer – Thermal System Insulation	Throughout Building	072352A-C 072353A-C
Ceiling Tiles (Multiple Sizes/Types) – Miscellaneous Materials	Throughout Building	072355A,B - 072366A,B
Wall and Ceiling Gypsum Board, Taping/Joint Compound and Textured Ceiling Paint – Miscellaneous and Surfacing Materials	Throughout Building	072367A,B – 072382
Accordion Wall and Adhesive – Miscellaneous Materials	Classroom B-14	072383A,B 072384A,B
Bulletin Boards/Coverings/ Adhesives (Multiple Types) – Miscellaneous Materials	Throughout Building	072385A,B – 072397
Carpet and Vinyl Strip Adhesives – Miscellaneous Materials	Throughout Building	072398A,B 0723111A,B – 0723115A,B
Cove Bases and Adhesives (Multiple Types) – Miscellaneous Materials	Throughout Building	072399A,B – 0723110A,B
Terrazzo Flooring, Mudbed, and Black Material on Fiberboard Spacers – Miscellaneous Materials	Throughout Corridors	0723116A,B – 0723118A,B

Material	Location	Sample ID
12"x12" Self-Stick Floor Tile On Unit Ventilator – Miscellaneous Material	Classroom A-4, Throughout Building	0723119A,B
Floor Tile Under Wall – Miscellaneous Material	Classroom C11	0723120A,B 0723121
12"x12" "Newer" Floor Tiles (Multiple Colors) and Mastics (Dark, Gray and Yellow) – Miscellaneous Materials (Contaminated with asbestos-containing black mastic)	Throughout Building	0723126 - 0723133A,B 0723135A,B 0723137A,B – 0723140A,B
Laboratory Sinks and/or Caulking Compound – Miscellaneous Materials	Throughout Science Rooms Not Listed in Table 1 (Sampled in Classrooms A15, A17, and A14)	0723141A,B – 0723144A,B 0723145AA,BB 0723146A,B
Laboratory Countertops	Throughout Science Rooms Not Listed in Table 1 (Sampled in Classrooms A15, A17, A13 and A14)	0723148A,B 0723151A,B 0723153A,B 0723155 0723156
Ceramic Wall and Floor Tile Grouts and Mud Beds and Glue Dots – Miscellaneous Materials	Throughout Building (Corridors, Kitchen Areas, Gymnasium, Toilet Rooms, Locker Rooms, Greenhouse and Pool Deck Level)	0723158A,B – 0723177A,B 0723182A,B – 0723186A,B
Concrete, Block Wall and Mortar and Brick and Mortar – Miscellaneous and Surfacing Materials	Throughout Building and Pool Area	0723187A,B – 0723195A-C
Rock Wall Mortar – Surfacing Material	Throughout Interior and Exterior	0723196A-C
Faux Stucco Wall/Adhesive and Caulking Compound (Newer) – Miscellaneous Materials	Exterior Boiler Room	0723197A,B 0723198A,B

Material	Location	Sample ID
Stone Panels – Miscellaneous Material (Assume Contaminated)	Exterior	0723202A-C
Pool Perimeter Caulking Compounds (Inside and Outside Pool) – Miscellaneous Materials	Pool	0723205A,B 0723206A,B
Unit Ventilator Caulking Compounds – Miscellaneous Material	Throughout Building	0723207A,B
Exterior Dome Caulking Compound – Miscellaneous Material	Planetarium	0723215A,B
"Newer" Exterior Roof Drain Caulking Compound	Exterior Media Center	0723219A,B
Roof Vent Screw Sealant – Miscellaneous Material	Exterior	0723224A,B
Roof Duct Seam Sealant – Miscellaneous Material	Exterior	0723225A,B
Door Window Glazing Compound – Miscellaneous Material	Exterior	0723231A,B
Roof Gypsum Layer, Black Layer and Black Material on Deck – Miscellaneous Materials	Exterior Gymnasium	0723280A,B – 0723282
Roof Field Bottom Layer Black Material/Tar on Decks – Miscellaneous Materials	Exterior Throughout	0723284A-D - 0723286A,B
Roof Rubber Seam Sealant – Miscellaneous Material	Exterior Throughout	0723287A,B
"Newer" Roof Caulking Compound – Miscellaneous Material	Exterior Media Center	0723288A,B
Roof Perimeter Flashing Black Bottom Layer	Exterior Throughout	0723289A,B – 0723290A-D

DISCLAIMERS: Reasonable care was taken to identify all suspect accessible asbestos containing materials through visual inspection and limited destructive sampling techniques. The building was occupied during this limited survey. It is not currently feasible to uncover all materials that may exist. Additional materials may need to sampled during the selective demolition/demolition process. Some locations/materials were not sampled during this survey due to damage required to inspect certain materials/areas and occupancy.

Interior Hidden Materials - Interior walls/ceilings/floors/other building materials were opened up/accessed in limited locations to investigate for suspect asbestos-containing materials. Additional suspect asbestos-containing materials may be discovered during selective demolition and/or demolition activities despite the inspectors investigating representative areas during the survey. Additional asbestos containing materials may be found:

- Interiors of boilers and walk-in freezers (damp-proofing behind, plastic wall adhesive, etc.), interiors of chimneys, etc. (boiler will need to be sampled prior to demolition);
- Flooring materials/other materials underneath fixed objects (millwork, cabinetry, unit ventilators, etc.), gypsum wallboard and floor leveling materials throughout building;
- Behind water fountains and custodial slop sinks (tar/damp-proofing);
- Damp-proofing behind interior rock walls;
- Materials (damp-proofing, other materials) underneath terrazzo and ceramic floors (limited sampling was performed and could not reach solid concrete underneath sandy material);
- Additional duct pin adhesive and black duct tar/paper that may be currently inaccessible;
- Tar on block walls (found in one area of office – may exist in additional locations);
- Inside HVAC ducts and mechanical systems (sealants and tar-damp-proofing);
- Electrical insulation and light backing insulation (several areas checked);
- Materials inside electric company locked room accessed from exterior;
- HVAC duct vibration isolation cloth (none found and pool and gymnasium appear to have been replaced or inaccessible);
- Materials underneath slate window sills;
- Interior roof debris (sampled in one location);
- Gasketing and tars associated with piping, ducts, etc.
- Adhesives and wall adhesives/glue daubs (and other materials) associated with millwork, cabinetry, shelving, window sills, bulletin boards, behind gypsum board walls/ceilings, on block walls, HVAC ducts, mirrors and wall materials (checked several locations and sampled limited materials);

- Behind fixed ceilings, walls, chases and flooring throughout and above the auditorium/cafeteria/media center ceiling tiles (too high to access) (duct insulation, pipe and pipe fitting insulation, vibration isolation cloth, roofing debris, flooring, etc.);
- Additional older spray applied fireproofing and other materials at pool ceilings (too high to access);
- Vermiculite behind/inside walls, ceilings and chases (checked boiler room wall) and inside planetarium dome;
- Transite cement board, adhesives, pipe insulation, other materials behind radiators, ceilings, soffits, upper gymnasium wall above dividing wall, etc. (checked several locations);
- Damp-proofing and other materials beneath gymnasium wood floor (checked two locations underneath bleachers);
- Pool and media center exterior wall materials and entrance overhangs throughout;
- Science fire blankets, Bunsen burner pads, etc.;
- Inaccessible HVAC duct adhesives, duct pin adhesive, seam and flange sealants and vibration isolation cloths (checked several locations) throughout;
- Fire door/door insulation (checked one location with damage);
- Older interior and exterior hidden caulking and glazing compounds behind newer compounds (checked several locations); and
- Additional asbestos-containing pipe and/or pipe fitting residue/contamination underneath fiberglass insulation (checked several locations).

Foundations/Soil and Buried Piping and Mechanical Conduits – Foundation damp-proofing/tars/mastics may exist under the soil on the building foundations (the building has asphalt/other ground materials that prevented from exposing foundation walls – checked two locations and no damp-proofing was found). Additional damp-proofing materials that have not been investigated/sampled, may exist in other locations, on the inside of foundation walls and underneath floor slabs throughout. It is not known if other materials are buried in the soil adjacent to the building (ex. transite and/or orangeburg piping, etc.). Asbestos containing damp-proofing/tars/mastics/other materials may also exist on piping and mechanical conduits in the subsurface.

3.0 LEAD-BASED PAINT XRF SCREENING

A limited lead-based paint XRF (X-ray Fluorescence) screening survey was performed by a State of Connecticut DPH licensed lead inspector Hilton Hernandez (#002231). LBP was identified

exceeding the HUD/EPA action level of equal to or greater than 1.0 mg/cm^2 on the interior metal ladder (yellow) in custodial office. See Appendix B for the XRF field data sheets.

Toxicity Characteristic Leaching Procedure (TCLP) sampling may need to be performed after the building has been vacated, to determine the proper method of disposal (normal construction debris versus regulated hazardous lead waste) of painted building materials to be demolished. Metal surfaces covered with lead-based paint may be segregated and recycled as scrap metal (without grinding, sawing, sanding or torch cutting).

Contractors should be aware that OSHA has not established a level of lead in a material below which 29 CFR 1926.62 does not apply. Contractor shall comply with exposure assessment criteria, interim worker protection and other requirements of the regulation as necessary to protect workers and occupants/residents.

The information in this report does not constitute a comprehensive lead inspection under the Connecticut Department of Public Health Regulations, Section 19a-111-1 to 11. The survey was an XRF lead screening utilizing an XRF and does not satisfy the testing requirements of US EPA's Renovation, Repair and Painting Rule (RRP) under 40 CFR 745.80 through 92. Reliance on this report for determining RRP or CT DPH applicability is not authorized by Langan.

4.0 PCB SEALANT SOURCE MATERIALS

In recent years, the Unites States Environmental Protection Agency (US EPA) has learned that building sealants (e.g. caulking, glazing, expansion joint and other sealant materials) containing potentially harmful PCBs were used in many buildings in the 1950s through the 1980s. PCBs were added to building sealants for durability, resistance to degradation, and as a softener/plasticizer for application.

Connecticut Department of Energy and Environmental Protection (CTDEEP) has a PCB regulatory limit of 1 ppm and EPA has a regulatory limit of 50 ppm for source materials. The following "older" PCB sealant source materials are assumed to have greater than 50 ppm PCB (PCB Bulk Product Waste):

Table 3 – Summary of Assumed PCB-Containing Source Sealant Materials	
Material	**Location**
Laboratory Sink Caulking Compounds	Throughout Laboratory/Science Rooms
Display Case Caulking Compounds	Throughout Corridors
Interior Wall, Ceiling, Ceramic Wall Caulking Compounds	Throughout Building Interior – All Areas/Rooms/Corridors/Etc.
Interior Door Caulking, Door/Window Wall Caulking and Glazing, Window Caulking, Window Glazing, Door Window Glazing and Miscellaneous Caulking Compounds	Throughout Building Interior, Greenhouse (Interior and Exterior)
Exterior Rock Wall and Wall Expansion Caulking Compounds	Throughout Exterior
Exterior Window Caulking, Sill (Including Underneath Sills) Caulking, Window Glazing, Wall Caulking, Foundation Caulking, Door Caulking, Door/Window Wall Caulking and Glazing, Vent Caulking and Miscellaneous Caulking Compounds	Throughout Exterior
Pool Perimeter Caulking Compounds (Inside and Outside Pool)	Pool
Unit Ventilator Caulking Compounds	Throughout Building
Exterior Dome Caulking Compound	Planetarium
Door Window Glazing Compound – Miscellaneous Material	Exterior

"Newer" sealant compounds were not assumed to contain PCBs.

PCBs can also be found in paints, damp-proofing materials, roofing materials, adhesives, glues, floor mastics, etc. Sampling of these materials and sealant compounds was not authorized at the time of the HBM survey.

5.0 UNIVERSAL WASTE ASSESSMENT

Completion of detailed Universal Waste Assessment (identifying the number and location of Universal Waste items) was not conducted as part of this survey. Universal wastes noted during the visual survey include suspect PCB/DEHP (di (2-ethylhexyl) phthalate) ballasts/capacitors associated with light fixtures, air conditioner and refrigerant coolants, rooftop HVAC units, window air conditioning units, mercury-containing florescent and other mixed used high intensity

light bulbs, smoke detectors and other alarms/sensors containing suspect radioactive materials, batteries and emergency lighting, exit and other signage, possible mercury-containing thermostats, switches, gauges, electronics, paints, wiring, fire extinguishers, cleaning and other chemicals. Laboratory piping and treatment systems may require regulated disposal.

All universal waste that is present in the building that will be impacted by demolition activities, will need to be properly removed, recycled, and/or disposed of at a landfill permitted to accept such waste. The removal, handling, recycling, and disposal must be performed in accordance with applicable Federal, State, and local regulations.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Langan provides the following conclusions and recommendations, based on the findings of this Limited NESHAP Pre-Demolition Hazardous Building Materials Survey:

Both friable and non-friable ACM were identified/assumed throughout the building. Prior to building demolition, the identified ACM and any additional ACM/suspect ACM materials that are found during selective demolition, must be properly removed and disposed in accordance with applicable Federal, State and Local regulations by a State of Connecticut DPH licensed asbestos abatement contractor. A State of Connecticut licensed Asbestos Designer should create abatement specifications and an Asbestos Project Monitor should perform project oversight and air testing in accordance with the Federal and State regulations. These are all requirements of the CT DPH Standards. Additional sampling/destructive sampling/visual investigation is required for materials that have not been sampled to date and the abatement contractor will be required to perform selective demolition throughout the interior and exterior of the building.

Contractors completing demolition and/or abatement activities should be aware that OSHA has not established a level of lead in a material below which 29 CFR 1926.62 does not apply. All contractors working on the project are responsible for having adequate training (RRP or greater amount) and performing their own OSHA compliance requirements. Contractor shall comply with exposure assessment criteria, interim worker protection and other requirements of the regulation as necessary to protect workers and occupants/residents. All contractors must comply with all applicable State and Federal regulations, including but not limited to the lead OSHA regulations.

Toxicity Characteristic Leaching Procedure (TCLP) sampling may need to be performed after the building has been vacated, to determine the proper method of disposal (normal construction

debris versus regulated hazardous lead waste) of painted building materials to be demolished. Metal surfaces covered with lead-based paint may be segregated and recycled as scrap metal (without grinding, sawing, sanding or torch cutting).

"Older" caulking, glazing and sealant compounds to be disturbed by selective demolition/demolition activities are assumed to contain greater than 50 ppm PCB bulk product waste. These materials and other suspect PCB containing materials could be tested at a later date or assumed to contain PCBs (and possibly adjacent building materials and ground surfaces). PCB abatement specification(s) will be required, and if sampling is performed, an EPA PCB compliant plan (requires EPA approval – two to six months is typical for this process) may be required depending upon the sample results. The owner/owners representative and Langan should meet to discuss the testing parameters (what materials is Langan authorized to sample (if any) and when will sampling occur) or what assumptions will be in place to write specifications without sampling (types of source materials to be assumed, extent of adjacent building materials, etc.). Langan recommends that the owner keeps a contingency fund should the contractor's landfill require paint sampling and the painted building materials are found to contain PCBs.

All universal waste that is present in the building that will require removal due to planned demolition activities, will need to be properly removed, recycled, and/or disposed of at a landfill permitted to accept such waste. The removal, handling, recycling and disposal must be performed in accordance with applicable Federal, State, and local regulations. Laboratory piping and treatment systems may require regulated disposal. Langan recommends completion of a universal waste recycling/disposal specification for the project.

7.0 LIMITATIONS

The conclusions and recommendations presented in this report are professional opinions based solely upon Langan's visual observations, laboratory test data, and current regulatory requirements. These conclusions and recommendations are intended exclusively for the purpose stated herein, at the site indicated, and for the project indicated.

It is important to recognize that even the most comprehensive scope of services may fail to detect all hazardous building materials that may be associated with the property. Therefore, Langan cannot act as insurers and cannot "certify" that all hazardous building materials associated with the property have been identified, and no expressed or implied representation or warranty is included or intended in our report, except that our services were performed, within

the limits prescribed by our client, with the customary thoroughness and competence of our profession.

Any suspect material that is not listed in this report must be assumed as ACM, PCBs, LBP, etc. until confirmed otherwise via laboratory testing.

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Appendix A

Asbestos Analytical Laboratory Results and Chains-of-Custody

LANGAN

EMSL Analytical, Inc.

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EMSL Order ID: 042515237
Customer ID: LANG78
Customer PO:
Project ID:

Attn: Matthew Myers
Langan Engineering
Long Wharf Maritime Center
555 Long Wharf Drive
New Haven, CT 06511

Phone: (203) 562-5771
Fax: (203) 789-6142
Collected: 7/23/2025
Received: 7/28/2025
Analyzed: 8/13/2025

Proj: 140325901 / Hillcrest Middle School

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072301A **Lab Sample ID:** **042515237-0001**
Sample Description: Green House/Remnant Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Brown/Black	0.0%	100.0%	None Detected	

Client Sample ID: 072301B **Lab Sample ID:** **042515237-0002**
Sample Description: Green House/Remnant Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072302A **Lab Sample ID:** **042515237-0003**
Sample Description: Classroom C1 - Closet/Kiln

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072302B **Lab Sample ID:** **042515237-0004**
Sample Description: Classroom C1 - Closet/Kiln

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072303A **Lab Sample ID:** **042515237-0005**
Sample Description: Classroom C5/Fire Door Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	5.0%	95.0%	None Detected	

Client Sample ID: 072303B **Lab Sample ID:** **042515237-0006**
Sample Description: Classroom C5/Fire Door Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	10.0%	90.0%	None Detected	

Client Sample ID: 072304A **Lab Sample ID:** **042515237-0007**
Sample Description: Classroom C1/Clock/Speaker Tar (Black)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	0.0%	95.0%	**5% Chrysotile**	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072304B ***Lab Sample ID:*** **042515237-0008**
Sample Description: Classroom C3/Clock/Speaker Tar (Black)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072305A ***Lab Sample ID:*** **042515237-0009**
Sample Description: Stage/Cafe/Black Paper under Stage Floor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	50.0%	50.0%	None Detected	

Client Sample ID: 072305B ***Lab Sample ID:*** **042515237-0010**
Sample Description: Stage/Cafe/Black Paper under Stage Floor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	65.0%	35.0%	None Detected	

Client Sample ID: 072306A ***Lab Sample ID:*** **042515237-0011**
Sample Description: Classroom C5/Transite Tabletop

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Gray	0.0%	90.0%	**10% Chrysotile**	

Client Sample ID: 072306B ***Lab Sample ID:*** **042515237-0012**
Sample Description: Classroom C5/Transite Tabletop

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072307A ***Lab Sample ID:*** **042515237-0013**
Sample Description: Classroom C1/Black Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 072307B ***Lab Sample ID:*** **042515237-0014**
Sample Description: Classroom C1/Black Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072308A ***Lab Sample ID:*** **042515237-0015**
Sample Description: Classroom C1/Slate Window Sill

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Gray/Black	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072308B ***Lab Sample ID:*** **042515237-0016**
Sample Description: Classroom C5/Slate Window Sill

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/Black	0.0%	100.0%	None Detected	

Client Sample ID: 072309A ***Lab Sample ID:*** **042515237-0017**
Sample Description: Classroom C1/Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072309B ***Lab Sample ID:*** **042515237-0018**
Sample Description: Classroom C5/Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072310A ***Lab Sample ID:*** **042515237-0019**
Sample Description: B Recording /Acoustical Wall - Paper Behind (Tan/Black)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Brown/Black	45.0%	55.0%	None Detected	

Client Sample ID: 072310B ***Lab Sample ID:*** **042515237-0020**
Sample Description: Band Practice Room/Acoustical Wall - Paper Behind (Tan/Black)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/Black	75.0%	25.0%	None Detected	

Client Sample ID: 072311A ***Lab Sample ID:*** **042515237-0021**
Sample Description: Classroom D5/Roof Debris - Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Brown	70.0%	30.0%	None Detected	

Client Sample ID: 072311B ***Lab Sample ID:*** **042515237-0022**
Sample Description: Classroom D5/Roof Debris - Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	80.0%	20.0%	None Detected	

Client Sample ID: 072312A ***Lab Sample ID:*** **042515237-0023**
Sample Description: Classroom D5/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072312B ***Lab Sample ID:*** **042515237-0024**
Sample Description: Classroom D5/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072313A ***Lab Sample ID:*** **042515237-0025**
Sample Description: Pool Floor - Walkway/Black Material in Floor Cove

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	3.0%	97.0%	None Detected	

Client Sample ID: 072313B ***Lab Sample ID:*** **042515237-0026**
Sample Description: Pool Floor - Walkway/Black Material in Floor Cove

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072314A ***Lab Sample ID:*** **042515237-0027**
Sample Description: Pool/Wall Tile 1x1

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072314B ***Lab Sample ID:*** **042515237-0028**
Sample Description: Pool/Wall Tile 1x1

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072315A ***Lab Sample ID:*** **042515237-0029**
Sample Description: Pool/Wall Tile Glue Daubs

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072315B ***Lab Sample ID:*** **042515237-0030**
Sample Description: Pool/Wall Tile Glue Daubs

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072316A ***Lab Sample ID:*** **042515237-0031**
Sample Description: Stage/Fire Curtains

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Tan/Black/Blue	60.0%	40.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072316B ***Lab Sample ID:*** **042515237-0032**
Sample Description: Stage/Fire Curtains

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan/Black/Blue	70.0%	30.0%	None Detected	

Client Sample ID: 072317A ***Lab Sample ID:*** **042515237-0033**
Sample Description: Conference Rm Main Office/Black Tar on 1 CMU Block

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Black	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 072317B ***Lab Sample ID:*** **042515237-0034**
Sample Description: Conference Rm Main Office/Black Tar on 1 CMU Block

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072318A ***Lab Sample ID:*** **042515237-0035**
Sample Description: Gym Storage Room 1/Light Fixture Backing Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	Gray/White	10.0%	70.0%	**20% Chrysotile**	

Client Sample ID: 072318B ***Lab Sample ID:*** **042515237-0036**
Sample Description: Gym Storage Room 1/Light Fixture Backing Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072319A ***Lab Sample ID:*** **042515237-0037**
Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072319B ***Lab Sample ID:*** **042515237-0038**
Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072319C ***Lab Sample ID:*** **042515237-0039**
Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	90.0%	10.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072319D ***Lab Sample ID:*** **042515237-0040**

Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072319E ***Lab Sample ID:*** **042515237-0041**

Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/04/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072319F ***Lab Sample ID:*** **042515237-0042**

Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072319G ***Lab Sample ID:*** **042515237-0043**

Sample Description: Pool/Ceiling Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	95.0%	5.0%	None Detected	

Client Sample ID: 072320A ***Lab Sample ID:*** **042515237-0044**

Sample Description: Media Center / Library/Ceiling Beam Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072320B ***Lab Sample ID:*** **042515237-0045**

Sample Description: Media Center / Library/Ceiling Beam Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072320C ***Lab Sample ID:*** **042515237-0046**

Sample Description: Media Center / Library/Ceiling Beam Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	90.0%	10.0%	None Detected	

Client Sample ID: 072320D ***Lab Sample ID:*** **042515237-0047**

Sample Description: Media Center / Library/Ceiling Beam Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	90.0%	10.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072320E ***Lab Sample ID:*** **042515237-0048**

Sample Description: Media Center / Library/Ceiling Beam Spray Applied Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072321A ***Lab Sample ID:*** **042515237-0049**

Sample Description: Kitchen/Plaster Ceiling White Finish Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072321B ***Lab Sample ID:*** **042515237-0050**

Sample Description: Kitchen/Plaster Ceiling White Finish Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072321C ***Lab Sample ID:*** **042515237-0051**

Sample Description: Kitchen/Plaster Ceiling White Finish Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072322A ***Lab Sample ID:*** **042515237-0052**

Sample Description: Kitchen/Plaster Ceiling Gray Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072322B ***Lab Sample ID:*** **042515237-0053**

Sample Description: Kitchen/Plaster Ceiling Gray Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072322C ***Lab Sample ID:*** **042515237-0054**

Sample Description: Kitchen/Plaster Ceiling Gray Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072323A ***Lab Sample ID:*** **042515237-0055**

Sample Description: Stage / Cafe/Plaster (One Coat)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 072323B ***Lab Sample ID:*** **042515237-0056**
Sample Description: Stage / Cafe/Plaster (One Coat)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072323C ***Lab Sample ID:*** **042515237-0057**
Sample Description: Stage / Cafe/Plaster (One Coat)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072324A ***Lab Sample ID:*** **042515237-0058**
Sample Description: Media Center / Library/Brown Coat Plaster Behind Spray on

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072324B ***Lab Sample ID:*** **042515237-0059**
Sample Description: Media Center / Library/Brown Coat Plaster Behind Spray on

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072324C ***Lab Sample ID:*** **042515237-0060**
Sample Description: Media Center / Library/Brown Coat Plaster Behind Spray on

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072324D ***Lab Sample ID:*** **042515237-0061**
Sample Description: Media Center / Library/Brown Coat Plaster Behind Spray on

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072324E ***Lab Sample ID:*** **042515237-0062**
Sample Description: Media Center / Library/Brown Coat Plaster Behind Spray on

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072325A ***Lab Sample ID:*** **042515237-0063**
Sample Description: Planetarium/One coat Plaster Around Dome

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

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Client Sample ID: 072325B ***Lab Sample ID:*** **042515237-0064**
Sample Description: Planetarium/One coat Plaster Around Dome

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072325C ***Lab Sample ID:*** **042515237-0065**
Sample Description: Planetarium/One coat Plaster Around Dome

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072326A ***Lab Sample ID:*** **042515237-0066**
Sample Description: Weight Room/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072326B ***Lab Sample ID:*** **042515237-0067**
Sample Description: Boys Locker Room/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072326C ***Lab Sample ID:*** **042515237-0068**
Sample Description: Custodial Office Toilet Room/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072326D ***Lab Sample ID:*** **042515237-0069**
Sample Description: Gym Storage #1/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072326E ***Lab Sample ID:*** **042515237-0070**
Sample Description: Equipment Room (by Locker Room)/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072326F ***Lab Sample ID:*** **042515237-0071**
Sample Description: Back Storage (by Custodial)/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 072326G ***Lab Sample ID:*** **042515237-0072**

Sample Description: Storage Back Right/Plaster Ceiling White Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072327A ***Lab Sample ID:*** **042515237-0073**

Sample Description: Weight Room/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327B ***Lab Sample ID:*** **042515237-0074**

Sample Description: Boys Locker Room/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327C ***Lab Sample ID:*** **042515237-0075**

Sample Description: Custodial Office Toilet Room/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327D ***Lab Sample ID:*** **042515237-0076**

Sample Description: Gym Storage #1/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327E ***Lab Sample ID:*** **042515237-0077**

Sample Description: Equipment Room (by Locker Room)/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327F ***Lab Sample ID:*** **042515237-0078**

Sample Description: Back Storage (by Custodial)/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072327G ***Lab Sample ID:*** **042515237-0079**

Sample Description: Storage Back Right/Plaster Ceiling Tan Rough Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

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Client Sample ID: 072328A ***Lab Sample ID:*** **042515237-0080**

Sample Description: Elective/Track/Boiler Room/Charcoal Plaster/Cement Gray Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072328B ***Lab Sample ID:*** **042515237-0081**

Sample Description: Elective/Track/Boiler Room/Charcoal Plaster/Cement Gray Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072328C ***Lab Sample ID:*** **042515237-0082**

Sample Description: Elective/Track/Boiler Room/Charcoal Plaster/Cement Gray Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072328D ***Lab Sample ID:*** **042515237-0083**

Sample Description: Elective/Track/Boiler Room/Charcoal Plaster/Cement Gray Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072328E ***Lab Sample ID:*** **042515237-0084**

Sample Description: Elective/Track/Boiler Room/Charcoal Plaster/Cement Gray Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072329A ***Lab Sample ID:*** **042515237-0085**

Sample Description: Elective/Track/Boiler Room/Textured White Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072329B ***Lab Sample ID:*** **042515237-0086**

Sample Description: Elective/Track/Boiler Room/Textured White Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072329C ***Lab Sample ID:*** **042515237-0087**

Sample Description: Elective/Track/Boiler Room/Textured White Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 072329D ***Lab Sample ID:*** **042515237-0088**

Sample Description: Elective/Track/Boiler Room/Textured White Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072329E ***Lab Sample ID:*** **042515237-0089**

Sample Description: Elective/Track/Boiler Room/Textured White Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072330A ***Lab Sample ID:*** **042515237-0090**

Sample Description: Main Office End Room/Black Paper on Wall Above CTS Going Down

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	50.0%	50.0%	None Detected	

Client Sample ID: 072330B ***Lab Sample ID:*** **042515237-0091**

Sample Description: Main Office End Room/Black Paper on Wall Above CTS Going Down

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	65.0%	35.0%	None Detected	

Client Sample ID: 072331A ***Lab Sample ID:*** **042515237-0092**

Sample Description: Main Office Toilet/Duct Black Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Black	20.0%	65.0%	**15% Chrysotile**	

Client Sample ID: 072331B ***Lab Sample ID:*** **042515237-0093**

Sample Description: Main Office Toilet/Duct Black Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072332A ***Lab Sample ID:*** **042515237-0094**

Sample Description: Stage/Duct Insulation - Canvas

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown	85.0%	15.0%	None Detected	

Client Sample ID: 072332B ***Lab Sample ID:*** **042515237-0095**

Sample Description: Planetarium/Duct Insulation - Canvas

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown	95.0%	5.0%	None Detected	

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Client Sample ID: 072333A ***Lab Sample ID:*** **042515237-0096**

Sample Description: Stage/Duct Insulation Black Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 072333B ***Lab Sample ID:*** **042515237-0097**

Sample Description: Planetarium/Duct Insulation Black Paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	60.0%	40.0%	None Detected	

Client Sample ID: 072334A ***Lab Sample ID:*** **042515237-0098**

Sample Description: Stage/Duct Pin Adhesive Dark Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072334B ***Lab Sample ID:*** **042515237-0099**

Sample Description: Planetarium/Duct Pin Adhesive Dark Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 072335A ***Lab Sample ID:*** **042515237-0100**

Sample Description: Classroom C5 Storage 3/Duct Seam on Flange Sealant White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072335B ***Lab Sample ID:*** **042515237-0101**

Sample Description: Classroom C5 Storage 3/Duct Seam on Flange Sealant White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072336A ***Lab Sample ID:*** **042515237-0102**

Sample Description: Stage/Duct Flange Sealant Tan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 072336B ***Lab Sample ID:*** **042515237-0103**

Sample Description: Classroom C5 Storage 3/Duct Flange Sealant Tan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	0.0%	100.0%	None Detected	

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Client Sample ID: 072337A ***Lab Sample ID:*** **042515237-0104**

Sample Description: Classroom C5/Duct Seam Sealant Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072337B ***Lab Sample ID:*** **042515237-0105**

Sample Description: Classroom C5/Duct Seam Sealant Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 072338A ***Lab Sample ID:*** **042515237-0106**

Sample Description: Classroom C5/Tectum Ceiling Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/White	10.0%	90.0%	None Detected	

Client Sample ID: 072338B ***Lab Sample ID:*** **042515237-0107**

Sample Description: Classroom C5/Tectum Ceiling Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: 072339A ***Lab Sample ID:*** **042515237-0108**

Sample Description: Classroom A1/Formica/Adhesive Top on Unit Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Insufficient Material	

Client Sample ID: 072339B ***Lab Sample ID:*** **042515237-0109**

Sample Description: Classroom A2/Formica/Adhesive Top on Unit Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/Yellow	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072340A ***Lab Sample ID:*** **042515237-0110**

Sample Description: Classrooms/Formica Countertop Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072340B ***Lab Sample ID:*** **042515237-0111**

Sample Description: Classrooms/Formica Countertop Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Red	0.0%	100.0%	None Detected	

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Client Sample ID: 072341A ***Lab Sample ID:*** **042515237-0112**

Sample Description: Classroom C3/Wood Countertop Backsplash Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 072341B ***Lab Sample ID:*** **042515237-0113**

Sample Description: Classroom C3/Wood Countertop Backsplash Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072342 ***Lab Sample ID:*** **042515237-0114**

Sample Description: Classroom C1/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	5.0%	95.0%	None Detected	

Client Sample ID: 072343 ***Lab Sample ID:*** **042515237-0115**

Sample Description: Classroom C2/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072344 ***Lab Sample ID:*** **042515237-0116**

Sample Description: Classroom C3/Eyewash Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072345 ***Lab Sample ID:*** **042515237-0117**

Sample Description: Classroom C3/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072346 ***Lab Sample ID:*** **042515237-0118**

Sample Description: Classroom A-16/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072347 ***Lab Sample ID:*** **042515237-0119**

Sample Description: Media Work Rm/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 072348 ***Lab Sample ID:*** **042515237-0120**
Sample Description: Teachers/Faculty Rm/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072349 ***Lab Sample ID:*** **042515237-0121**
Sample Description: Nurse Office/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 072350A ***Lab Sample ID:*** **042515237-0122**
Sample Description: Throughout/Red Fire Sealant (Penetration)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Red	8.0%	92.0%	None Detected	

Client Sample ID: 072350B ***Lab Sample ID:*** **042515237-0123**
Sample Description: Throughout/Red Fire Sealant (Penetration)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Red	0.0%	100.0%	None Detected	

Client Sample ID: 072351A ***Lab Sample ID:*** **042515237-0124**
Sample Description: Throughout/Dark Fire Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 072351B ***Lab Sample ID:*** **042515237-0125**
Sample Description: Throughout/Dark Fire Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 072352A ***Lab Sample ID:*** **042515237-0126**
Sample Description: Boiler Room/Pipe End Cap Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	35.0%	65.0%	None Detected	

Client Sample ID: 072352B ***Lab Sample ID:*** **042515237-0127**
Sample Description: Boiler Room/Pipe End Cap Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	40.0%	60.0%	None Detected	

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Client Sample ID: 072352C ***Lab Sample ID:*** **042515237-0128**
Sample Description: Boiler Room/Pipe End Cap Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: 072353A ***Lab Sample ID:*** **042515237-0129**
Sample Description: Throughout/Fiberglass Pipe Insulation Black Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black/Silver	20.0%	80.0%	None Detected	

Client Sample ID: 072353B ***Lab Sample ID:*** **042515237-0130**
Sample Description: Throughout/Fiberglass Pipe Insulation Black Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black/Silver	15.0%	85.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072353C ***Lab Sample ID:*** **042515237-0131**
Sample Description: Throughout/Fiberglass Pipe Insulation Black Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/Black/Silver	35.0%	65.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072354A ***Lab Sample ID:*** **042515237-0132**
Sample Description: Classroom C1/Pipe Fitting Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	10.0%	90.0%	None Detected	

Client Sample ID: 072354B ***Lab Sample ID:*** **042515237-0133**
Sample Description: Corridors/Pipe Fitting Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	15.0%	85.0%	None Detected	

Client Sample ID: 072354C ***Lab Sample ID:*** **042515237-0134**
Sample Description: Corridors/Pipe Fitting Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	25.0%	75.0%	None Detected	

Client Sample ID: 072355A ***Lab Sample ID:*** **042515237-0135**
Sample Description: Cafeteria/2x2 Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/Silver	70.0%	30.0%	None Detected	

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Client Sample ID: 072355B ***Lab Sample ID:*** **042515237-0136**
Sample Description: Cafeteria/2x2 Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray	65.0%	35.0%	None Detected	

Client Sample ID: 072356A ***Lab Sample ID:*** **042515237-0137**
Sample Description: Classroom C1/2x2 Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White	80.0%	20.0%	None Detected	

Client Sample ID: 072356B ***Lab Sample ID:*** **042515237-0138**
Sample Description: Classroom C3/2x2 Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072357A ***Lab Sample ID:*** **042515237-0139**
Sample Description: Classroom A-12 prep/Newer Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White	80.0%	20.0%	None Detected	

Client Sample ID: 072357B ***Lab Sample ID:*** **042515237-0140**
Sample Description: Planetarium/Newer Ceiling Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072358A ***Lab Sample ID:*** **042515237-0141**
Sample Description: Classroom A17 prep/2x4 Ceiling Tiles Rough

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White	80.0%	20.0%	None Detected	

Client Sample ID: 072358B ***Lab Sample ID:*** **042515237-0142**
Sample Description: Classroom A17 prep/2x4 Ceiling Tiles Rough

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072359A ***Lab Sample ID:*** **042515237-0143**
Sample Description: Toilet Adjacent C-11/2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray/White	80.0%	20.0%	None Detected	

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Client Sample ID: 072359B ***Lab Sample ID:*** **042515237-0144**
Sample Description: Toilet Adjacent C-11/2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072360A ***Lab Sample ID:*** **042515237-0145**
Sample Description: Corridors/Ceiling Tiles (Rough)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	80.0%	20.0%	None Detected	

Client Sample ID: 072360B ***Lab Sample ID:*** **042515237-0146**
Sample Description: Corridors/Ceiling Tiles (Rough)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072361 ***Lab Sample ID:*** **042515237-0147**
Sample Description: Storage Room D-6/2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072362 ***Lab Sample ID:*** **042515237-0148**
Sample Description: Kitchen Office/2x4 Ceiling Tile (Small)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072363 ***Lab Sample ID:*** **042515237-0149**
Sample Description: Planetarium/Old Wormhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072364 ***Lab Sample ID:*** **042515237-0150**
Sample Description: Classroom A12 Prep/Old Wormhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072365 ***Lab Sample ID:*** **042515237-0151**
Sample Description: Classroom A17 Prep/Old Wormhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

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Client Sample ID: 072366A ***Lab Sample ID:*** **042515237-0152**

Sample Description: Teachers/Faculty Room/Old Wormhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072366B ***Lab Sample ID:*** **042515237-0153**

Sample Description: Teachers/Faculty Room/Old Wormhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: 072367A ***Lab Sample ID:*** **042515237-0154**

Sample Description: Baler Room/Gypsum Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray	18.0%	82.0%	None Detected	

Client Sample ID: 072367B ***Lab Sample ID:*** **042515237-0155**

Sample Description: Baler Room/Gypsum Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: 072368A ***Lab Sample ID:*** **042515237-0156**

Sample Description: Baler Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	3.0%	97.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072368B ***Lab Sample ID:*** **042515237-0157**

Sample Description: Baler Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	3.0%	97.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072368C ***Lab Sample ID:*** **042515237-0158**

Sample Description: Baler Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072369A ***Lab Sample ID:*** **042515237-0159**

Sample Description: Media Center / Library/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	15.0%	85.0%	None Detected	

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Client Sample ID: 072369B ***Lab Sample ID:*** **042515237-0160**
Sample Description: Media Center / Library/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: 072370A ***Lab Sample ID:*** **042515237-0161**
Sample Description: Media Center / Library/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072370B ***Lab Sample ID:*** **042515237-0162**
Sample Description: Media Center / Library/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072370C ***Lab Sample ID:*** **042515237-0163**
Sample Description: Media Center / Library/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072371A ***Lab Sample ID:*** **042515237-0164**
Sample Description: Data Room in Classroom C9/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Pink	17.0%	83.0%	None Detected	

Client Sample ID: 072371B ***Lab Sample ID:*** **042515237-0165**
Sample Description: Data Room in Classroom C9/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Tan	15.0%	85.0%	None Detected	

Client Sample ID: 072372A ***Lab Sample ID:*** **042515237-0166**
Sample Description: Data Room in Classroom C9/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072372B ***Lab Sample ID:*** **042515237-0167**
Sample Description: Data Room in Classroom C9/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 072372C ***Lab Sample ID:*** **042515237-0168**
Sample Description: Data Room in Classroom C9/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072373 ***Lab Sample ID:*** **042515237-0169**
Sample Description: Library AV Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	15.0%	85.0%	None Detected	

Client Sample ID: 072374 ***Lab Sample ID:*** **042515237-0170**
Sample Description: Library AV Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072375 ***Lab Sample ID:*** **042515237-0171**
Sample Description: Kitchen Office/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	10.0%	90.0%	None Detected	

Client Sample ID: 072376 ***Lab Sample ID:*** **042515237-0172**
Sample Description: Kitchen Office/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072377 ***Lab Sample ID:*** **042515237-0173**
Sample Description: Custodial office Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: 072378 ***Lab Sample ID:*** **042515237-0174**
Sample Description: Custodial office Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072379 ***Lab Sample ID:*** **042515237-0175**
Sample Description: Classroom A17 Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	20.0%	80.0%	None Detected	

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Client Sample ID: 072380 ***Lab Sample ID:*** **042515237-0176**
Sample Description: Classroom A17 Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072381 ***Lab Sample ID:*** **042515237-0177**
Sample Description: Classroom C5 / Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: 072382 ***Lab Sample ID:*** **042515237-0178**
Sample Description: Classroom C5 / Storage Room/Taping/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/08/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072383A ***Lab Sample ID:*** **042515237-0179**
Sample Description: Classroom B-14/Accordian Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072383B ***Lab Sample ID:*** **042515237-0180**
Sample Description: Classroom B-14/Accordian Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072384A ***Lab Sample ID:*** **042515237-0181**
Sample Description: Classroom B-14/Accordian Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White/Clear	0.0%	100.0%	None Detected	

Client Sample ID: 072384B ***Lab Sample ID:*** **042515237-0182**
Sample Description: Classroom B-14/Accordian Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 072385A ***Lab Sample ID:*** **042515237-0183**
Sample Description: Classroom B-14/Corkboard Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Yellow/Clear	0.0%	100.0%	None Detected	

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Client Sample ID: 072385B ***Lab Sample ID:*** **042515237-0184**

Sample Description: Classroom B-14/Corkboard Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	12.0%	88.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072386A ***Lab Sample ID:*** **042515237-0185**

Sample Description: Classroom B-15 / Throughout/Dark Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	5.0%	95.0%	None Detected	

Client Sample ID: 072386B ***Lab Sample ID:*** **042515237-0186**

Sample Description: Classroom B-15 / Throughout/Dark Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	12.0%	88.0%	None Detected	

Client Sample ID: 072387A ***Lab Sample ID:*** **042515237-0187**

Sample Description: Classroom B-15 / Throughout/Dark Brown Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072387B ***Lab Sample ID:*** **042515237-0188**

Sample Description: Classroom B-15 / Throughout/Dark Brown Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072388A ***Lab Sample ID:*** **042515237-0189**

Sample Description: Classroom C11 / Throughout/Corkboard Bulletin Board Only

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072388B ***Lab Sample ID:*** **042515237-0190**

Sample Description: Classroom C11 / Throughout/Corkboard Bulletin Board Only

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	80.0%	20.0%	None Detected	

Client Sample ID: 072389A ***Lab Sample ID:*** **042515237-0191**

Sample Description: Media/Library AV Room/Tan Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	3.0%	97.0%	None Detected	

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Client Sample ID: 072389B ***Lab Sample ID:*** **042515237-0192**
Sample Description: Media/Library AV Room/Tan Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	5.0%	95.0%	None Detected	

Client Sample ID: 072390A ***Lab Sample ID:*** **042515237-0193**
Sample Description: Media/Library AV Room/Tan Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072390B ***Lab Sample ID:*** **042515237-0194**
Sample Description: Media/Library AV Room/Tan Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072391A ***Lab Sample ID:*** **042515237-0195**
Sample Description: Classroom A10 / Throughout/Dark Green Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Green	3.0%	97.0%	None Detected	

Client Sample ID: 072391B ***Lab Sample ID:*** **042515237-0196**
Sample Description: Classroom A10 / Throughout/Dark Green Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Green	15.0%	85.0%	None Detected	

Client Sample ID: 072392A ***Lab Sample ID:*** **042515237-0197**
Sample Description: Classroom A10 / Throughout/Dark Green Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072392B ***Lab Sample ID:*** **042515237-0198**
Sample Description: Classroom A10 / Throughout/Dark Green Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	6.0%	94.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072393A ***Lab Sample ID:*** **042515237-0199**
Sample Description: Planetarium Classroom A-13/Medium Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	4.0%	96.0%	None Detected	

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Client Sample ID: 072393B ***Lab Sample ID:*** **042515237-0200**

Sample Description: Planetarium Classroom A-13/Medium Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072394A ***Lab Sample ID:*** **042515237-0201**

Sample Description: Planetarium Classroom A-13/Medium Brown Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	5.0%	95.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072394B ***Lab Sample ID:*** **042515237-0202**

Sample Description: Planetarium Classroom A-13/Medium Brown Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	10.0%	90.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072394 ***Lab Sample ID:*** **042515237-0203**

Sample Description: Media Library Work Room/Medium Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 072395 ***Lab Sample ID:*** **042515237-0204**

Sample Description: Media Library Work Room/Medium Brown Bulletin Board

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	8.0%	92.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072396 ***Lab Sample ID:*** **042515237-0205**

Sample Description: Kitchen/Medium Brown Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 072397 ***Lab Sample ID:*** **042515237-0206**

Sample Description: Kitchen/Medium Brown Bulletin Board Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	5.0%	95.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 072398A ***Lab Sample ID:*** **042515237-0207**

Sample Description: Planetarium/Carpet Strip Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 072398B ***Lab Sample ID:*** **042515237-0208**
Sample Description: Planetarium/Carpet Strip Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 072399A ***Lab Sample ID:*** **042515237-0209**
Sample Description: Throughout/Cove Base Adhesive Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 072399B ***Lab Sample ID:*** **042515237-0210**
Sample Description: Throughout/Cove Base Adhesive Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723100A ***Lab Sample ID:*** **042515237-0211**
Sample Description: Classroom A17 / Throughout/Dark/Black Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723100B ***Lab Sample ID:*** **042515237-0212**
Sample Description: Classroom A17 / Throughout/Dark/Black Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723101A ***Lab Sample ID:*** **042515237-0213**
Sample Description: Classroom A17 / Throughout/Dark/Black Cove Base Dark Brown Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723101B ***Lab Sample ID:*** **042515237-0214**
Sample Description: Classroom A17 / Throughout/Dark/Black Cove Base Dark Brown Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	3.0%	97.0%	None Detected	

Client Sample ID: 0723102 ***Lab Sample ID:*** **042515237-0215**
Sample Description: Classroom C1 Closet/Gray Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723103 ***Lab Sample ID:*** **042515237-0216**

Sample Description: Classroom C1 Closet/Gray Cove Base Adhesive Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723104 ***Lab Sample ID:*** **042515237-0217**

Sample Description: Classroom B15/Gray Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723105 ***Lab Sample ID:*** **042515237-0218**

Sample Description: Classroom B15/Gray Cove Base Dark Brown Adhesive only

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/12/2025	Brown	3.0%	97.0%	None Detected	Recommend TEM.

Client Sample ID: 0723106 ***Lab Sample ID:*** **042515237-0219**

Sample Description: Throughout/Tan Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723107 ***Lab Sample ID:*** **042515237-0220**

Sample Description: Throughout/Tan Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723108 ***Lab Sample ID:*** **042515237-0221**

Sample Description: Throughout/Tan Cove Base Dark Brown Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Brown	3.0%	97.0%	None Detected	Recommend TEM.

Client Sample ID: 0723109A ***Lab Sample ID:*** **042515237-0222**

Sample Description: Classroom C1/Blue Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723109B ***Lab Sample ID:*** **042515237-0223**

Sample Description: Science Classroom/Blue Cove Base

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Black/Blue	0.0%	100.0%	None Detected	

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Client Sample ID: 0723110A ***Lab Sample ID:*** **042515237-0224**

Sample Description: Classroom C1/Blue Cove Base Dark Brown Adhesive Only

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723110B ***Lab Sample ID:*** **042515237-0225**

Sample Description: Science Classroom/Blue Cove Base Dark Brown Adhesive Only

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723111A ***Lab Sample ID:*** **042515237-0226**

Sample Description: Classroom D4/Vinyl Strip Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Clear	0.0%	100.0%	None Detected	

Client Sample ID: 0723111B ***Lab Sample ID:*** **042515237-0227**

Sample Description: Classroom D4/Vinyl Strip Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Red	6.0%	94.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723112A ***Lab Sample ID:*** **042515237-0228**

Sample Description: Classroom D4/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723112B ***Lab Sample ID:*** **042515237-0229**

Sample Description: Classroom D4/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White/Yellow	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723113A ***Lab Sample ID:*** **042515237-0230**

Sample Description: Library / Media /Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White/Green	0.0%	100.0%	None Detected	

Client Sample ID: 0723113B ***Lab Sample ID:*** **042515237-0231**

Sample Description: Library / Media /Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White/Green	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723114A ***Lab Sample ID:*** **042515237-0232**
Sample Description: Planetarium/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Yellow/Clear	5.0%	95.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723114B ***Lab Sample ID:*** **042515237-0233**
Sample Description: Planetarium/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Yellow	5.0%	95.0%	None Detected	

Client Sample ID: 0723115A ***Lab Sample ID:*** **042515237-0234**
Sample Description: Conference Room/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723115B ***Lab Sample ID:*** **042515237-0235**
Sample Description: Guidance Area/Carpet Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723116A ***Lab Sample ID:*** **042515237-0236**
Sample Description: Corridors/Terrazzo Flooring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	2.0%	98.0%	None Detected	

Client Sample ID: 0723116B ***Lab Sample ID:*** **042515237-0237**
Sample Description: Corridors/Terrazzo Flooring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	2.0%	98.0%	None Detected	

Client Sample ID: 0723117A ***Lab Sample ID:*** **042515237-0238**
Sample Description: Corridors/Terrazzo Flooring Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723117B ***Lab Sample ID:*** **042515237-0239**
Sample Description: Corridors/Terrazzo Flooring Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray/White	0.0%	100.0%	None Detected	

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Client Sample ID: 0723118A ***Lab Sample ID:*** **042515237-0240**

Sample Description: Corridors/Terrazzo Flooring Black Material on Metal Spacers

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Black	5.0%	95.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723118B ***Lab Sample ID:*** **042515237-0241**

Sample Description: Corridors/Terrazzo Flooring Black Material on Metal Spacers

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Black	15.0%	85.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723119A ***Lab Sample ID:*** **042515237-0242**

Sample Description: Classroom A-4/12x12 Self Stick Floor Tile on Unit Ventilator

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723119B ***Lab Sample ID:*** **042515237-0243**

Sample Description: Classroom A-4/12x12 Self Stick Floor Tile on Unit Ventilator

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723120A ***Lab Sample ID:*** **042515237-0244**

Sample Description: Classroom C11/Old Floor Tile Under Wall to C11

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723120B ***Lab Sample ID:*** **042515237-0245**

Sample Description: Classroom C11/Old Floor Tile Under Wall to C11

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723121 ***Lab Sample ID:*** **042515237-0246**

Sample Description: Classroom C11/Old Floor Tile Under Wall to C11

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723122A ***Lab Sample ID:*** **042515237-0247**

Sample Description: Planetarium Mech Rm/9x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Tan	0.0%	95.0%	**5% Chrysotile**	

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Client Sample ID: 0723122B **Lab Sample ID:** **042515237-0248**
Sample Description: Classroom A16 (under cabinet)/9x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/07/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723122C **Lab Sample ID:** **042515237-0249**
Sample Description: Weight Room/9x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/07/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723123A **Lab Sample ID:** **042515237-0250**
Sample Description: Planetarium Mech Rm/9x9 Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Black	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 0723123B **Lab Sample ID:** **042515237-0251**
Sample Description: Classroom A16 (under cabinet)/9x9 Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/07/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723123C **Lab Sample ID:** **042515237-0252**
Sample Description: Weight Room/9x9 Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/07/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723124A **Lab Sample ID:** **042515237-0253**
Sample Description: Toilet near Classroom C11/OLD 12X12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan/White	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723124B **Lab Sample ID:** **042515237-0254**
Sample Description: Toilet near Classroom C11/OLD 12X12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723125A **Lab Sample ID:** **042515237-0255**
Sample Description: Toilet near Classroom C11/OLD 12X12 Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/12/2025	Brown/Gray/Yellow	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

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Client Sample ID: 0723125B ***Lab Sample ID:*** **042515237-0256**

Sample Description: Toilet near Classroom C11/OLD 12X12 Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/12/2025	Brown/Yellow	0.0%	100.0%	**<1% Chrysotile**	Result includes a small amount of inseparable attached material
400 PLM Pt Ct	8/12/2025				Insufficient Material	

Client Sample ID: 0723126 ***Lab Sample ID:*** **042515237-0257**

Sample Description: Classroom C3/Darker Floor Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723127 ***Lab Sample ID:*** **042515237-0258**

Sample Description: Cafeteria/Darker Floor Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723128 ***Lab Sample ID:*** **042515237-0259**

Sample Description: Office Storage/Darker Floor Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723129 ***Lab Sample ID:*** **042515237-0260**

Sample Description: Storage Rm adjacent custodial office/Darker Floor Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723130 ***Lab Sample ID:*** **042515237-0261**

Sample Description: Classroom A4 Storage/Darker Floor Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723131A ***Lab Sample ID:*** **042515237-0262**

Sample Description: Classroom C-6/Throughout/12X12 Gray/Light Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723131B ***Lab Sample ID:*** **042515237-0263**

Sample Description: Classroom C-6/Throughout/12X12 Gray/Light Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723132A ***Lab Sample ID:*** **042515237-0264**

Sample Description: Classroom C-6/Throughout/12X12 Gray/Light Blue Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723132B ***Lab Sample ID:*** **042515237-0265**

Sample Description: Classroom C-6/Throughout/12X12 Gray/Light Blue Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723133A ***Lab Sample ID:*** **042515237-0266**

Sample Description: Classroom B-14/12X12 White Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723133B ***Lab Sample ID:*** **042515237-0267**

Sample Description: Classroom A-5/12X12 White Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723134A ***Lab Sample ID:*** **042515237-0268**

Sample Description: Classroom B-14/12x12 White Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723134B ***Lab Sample ID:*** **042515237-0269**

Sample Description: Classroom A-5/12x12 White Floor Tile Gray Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723135A ***Lab Sample ID:*** **042515237-0270**

Sample Description: Classroom A-14/12X12 Off white/Tan Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723135B ***Lab Sample ID:*** **042515237-0271**

Sample Description: Classroom B-8/12X12 Off white/Tan Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2025	Tan	0.0%	100.0%	None Detected	

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Client Sample ID: 0723136A ***Lab Sample ID:*** **042515237-0272**

Sample Description: Classroom A-19/12X12 Off white/Tan Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723136B ***Lab Sample ID:*** **042515237-0273**

Sample Description: Classroom B-8/12X12 Off white/Tan Floor Tile Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723137A ***Lab Sample ID:*** **042515237-0274**

Sample Description: Classroom C-4/12X12 Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723137B ***Lab Sample ID:*** **042515237-0275**

Sample Description: Classroom B-10/12X12 Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723138A ***Lab Sample ID:*** **042515237-0276**

Sample Description: Classroom C-4/12X12 Blue Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723138B ***Lab Sample ID:*** **042515237-0277**

Sample Description: Classroom B-10/12X12 Blue Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723139A ***Lab Sample ID:*** **042515237-0278**

Sample Description: Classrooms/12X12 Black Lighter Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723139B ***Lab Sample ID:*** **042515237-0279**

Sample Description: Classrooms/12X12 Black Lighter Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Blue	0.0%	100.0%	None Detected	

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Client Sample ID: 0723140A ***Lab Sample ID:*** **042515237-0280**

Sample Description: Classrooms/12X12 Black Lighter Blue Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723140B ***Lab Sample ID:*** **042515237-0281**

Sample Description: Classrooms/12X12 Black Lighter Blue Floor Tile Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723141A ***Lab Sample ID:*** **042515237-0282**

Sample Description: Classroom A15/Black Labtop Sink

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723141B ***Lab Sample ID:*** **042515237-0283**

Sample Description: Classroom A15/Black Labtop Sink

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723142A ***Lab Sample ID:*** **042515237-0284**

Sample Description: Classroom A17/Black Lab Top Sink Perimeter

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723142B ***Lab Sample ID:*** **042515237-0285**

Sample Description: Classroom A17/Black Lab Top Sink Perimeter

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723143A ***Lab Sample ID:*** **042515237-0286**

Sample Description: Classroom A17/Sink Countertop on wheels

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723143B ***Lab Sample ID:*** **042515237-0287**

Sample Description: Classroom A17/Sink Countertop on wheels

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 0723144A ***Lab Sample ID:*** **042515237-0288**
Sample Description: Classroom A-14/Lab Sink Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	3.0%	97.0%	None Detected	

Client Sample ID: 0723144B ***Lab Sample ID:*** **042515237-0289**
Sample Description: Classroom A-14/Lab Sink Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	3.0%	97.0%	None Detected	

Client Sample ID: 0723145A ***Lab Sample ID:*** **042515237-0290**
Sample Description: Classroom A-17/Lab Sink Caulk Perimeter

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723145B ***Lab Sample ID:*** **042515237-0291**
Sample Description: Classroom A-17/Lab Sink Caulk Perimeter

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723145AA ***Lab Sample ID:*** **042515237-0292**
Sample Description: Lab Sink Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan	2.0%	98.0%	None Detected	

Client Sample ID: 0723145BB ***Lab Sample ID:*** **042515237-0293**
Sample Description: Lab Sink Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan	3.0%	97.0%	None Detected	

Client Sample ID: 0723146A ***Lab Sample ID:*** **042515237-0294**
Sample Description: Classroom A-17/Lab Sink Caulk Student Desks on wheels

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723146B ***Lab Sample ID:*** **042515237-0295**
Sample Description: Classroom A-17/Lab Sink Caulk Student Desks on wheels

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 0723147A ***Lab Sample ID:*** **042515237-0296**

Sample Description: Classroom C1/Lab Countertops 'Transite'

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/White	0.0%	85.0%	**15% Chrysotile**	

Client Sample ID: 0723147B ***Lab Sample ID:*** **042515237-0297**

Sample Description: Classroom C1/Lab Countertops 'Transite'

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723148A ***Lab Sample ID:*** **042515237-0298**

Sample Description: Classroom A-15/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723148B ***Lab Sample ID:*** **042515237-0299**

Sample Description: Classroom A-15/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723149A ***Lab Sample ID:*** **042515237-0300**

Sample Description: Classroom A-17 Student/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	85.0%	**15% Chrysotile**	

Client Sample ID: 0723149B ***Lab Sample ID:*** **042515237-0301**

Sample Description: Classroom A-17 Student/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723150A ***Lab Sample ID:*** **042515237-0302**

Sample Description: Classroom A-17 Perimeter/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	85.0%	**15% Chrysotile**	

Client Sample ID: 0723150B ***Lab Sample ID:*** **042515237-0303**

Sample Description: Classroom A-17 Perimeter/Lab Countertops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

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Client Sample ID: 0723151A ***Lab Sample ID:*** **042515237-0304**

Sample Description: Classroom A-17/Brown/Black Lab Desk Rolling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723151B ***Lab Sample ID:*** **042515237-0305**

Sample Description: Classroom A-17/Brown/Black Lab Desk Rolling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723152A ***Lab Sample ID:*** **042515237-0306**

Sample Description: Classroom C5 Computer Room/Black Tabletops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	80.0%	**20% Chrysotile**	

Client Sample ID: 0723152B ***Lab Sample ID:*** **042515237-0307**

Sample Description: Classroom C5 computer room/Black Tabletops

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723153A ***Lab Sample ID:*** **042515237-0308**

Sample Description: Classroom A13/Student Tabletop

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723153B ***Lab Sample ID:*** **042515237-0309**

Sample Description: Classroom A13/Student Tabletop

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723154 ***Lab Sample ID:*** **042515237-0310**

Sample Description: Classroom A17 Prep Rm/lab counter top

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	85.0%	**15% Chrysotile**	

Client Sample ID: 0723155 ***Lab Sample ID:*** **042515237-0311**

Sample Description: Classroom A14/Student table top

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 0723156 ***Lab Sample ID:*** **042515237-0312**
Sample Description: Classroom A14/Rolling Lab Tabletop

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723157A ***Lab Sample ID:*** **042515237-0313**
Sample Description: Classroom A-17/Lab test tube rack

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	85.0%	**15% Chrysotile**	

Client Sample ID: 0723157B ***Lab Sample ID:*** **042515237-0314**
Sample Description: Classroom A-17/Lab test tube rack

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723158A ***Lab Sample ID:*** **042515237-0315**
Sample Description: Main Office Corridor/Ceramic Wall Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723158B ***Lab Sample ID:*** **042515237-0316**
Sample Description: Main Office Corridor/Ceramic Wall Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723159A ***Lab Sample ID:*** **042515237-0317**
Sample Description: Main Office Corridor/Ceramic Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723159B ***Lab Sample ID:*** **042515237-0318**
Sample Description: Main Office Corridor/Ceramic Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723160A ***Lab Sample ID:*** **042515237-0319**
Sample Description: Kitchen Office/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723160B ***Lab Sample ID:*** **042515237-0320**
Sample Description: Kitchen Office/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723161A ***Lab Sample ID:*** **042515237-0321**
Sample Description: Kitchen Office/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Red	0.0%	100.0%	None Detected	

Client Sample ID: 0723161B ***Lab Sample ID:*** **042515237-0322**
Sample Description: Kitchen Office/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Red	0.0%	100.0%	None Detected	

Client Sample ID: 0723162A ***Lab Sample ID:*** **042515237-0323**
Sample Description: Kitchen Office/Ceramic Cove Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723162B ***Lab Sample ID:*** **042515237-0324**
Sample Description: Kitchen Office/Ceramic Cove Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723163A ***Lab Sample ID:*** **042515237-0325**
Sample Description: Kitchen Storage at Freezer/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723163B ***Lab Sample ID:*** **042515237-0326**
Sample Description: Kitchen Storage at Freezer/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723164A ***Lab Sample ID:*** **042515237-0327**
Sample Description: Kitchen Storage at Freezer/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 0723164B ***Lab Sample ID:*** **042515237-0328**
Sample Description: Kitchen Storage at Freezer/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723165A ***Lab Sample ID:*** **042515237-0329**
Sample Description: Kitchen/Older Ceramic Tile Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723165B ***Lab Sample ID:*** **042515237-0330**
Sample Description: Kitchen/Older Ceramic Tile Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723166A ***Lab Sample ID:*** **042515237-0331**
Sample Description: Kitchen/Old Ceramic Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723166B ***Lab Sample ID:*** **042515237-0332**
Sample Description: Kitchen/Old Ceramic Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723167A ***Lab Sample ID:*** **042515237-0333**
Sample Description: Kitchen/Newer Ceramic Tile Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723167B ***Lab Sample ID:*** **042515237-0334**
Sample Description: Kitchen/Newer Ceramic Tile Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723168A ***Lab Sample ID:*** **042515237-0335**
Sample Description: Kitchen/Newer Ceramic Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Tan	0.0%	100.0%	None Detected	

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Client Sample ID: 0723168B ***Lab Sample ID:*** **042515237-0336**

Sample Description: Kitchen/Newer Ceramic Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723169A ***Lab Sample ID:*** **042515237-0337**

Sample Description: Gym, toilet rm (C-C), Corridor Practice/Ceramic Wall Grout White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723169B ***Lab Sample ID:*** **042515237-0338**

Sample Description: Gym, toilet rm (C-C), Corridor Practice/Ceramic Wall Grout White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723170A ***Lab Sample ID:*** **042515237-0339**

Sample Description: Corridor - Practice Rm A/Ceramic Wall Mudbed Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723170B ***Lab Sample ID:*** **042515237-0340**

Sample Description: Corridor - Practice Rm A/Ceramic Wall Mudbed Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723171A ***Lab Sample ID:*** **042515237-0341**

Sample Description: Toilet Rm C-5/Ceramic Wall Mud Bed White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723171B ***Lab Sample ID:*** **042515237-0342**

Sample Description: Cust Closet by Cafe/Ceramic Wall Mud Bed White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723172A ***Lab Sample ID:*** **042515237-0343**

Sample Description: Toilets, Lockers etc/Ceramic Floor Grout Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723172B ***Lab Sample ID:*** **042515237-0344**

Sample Description: Toilets, Lockers etc/Ceramic Floor Grout Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723173A ***Lab Sample ID:*** **042515237-0345**

Sample Description: Toilets, Lockers etc/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723173B ***Lab Sample ID:*** **042515237-0346**

Sample Description: Toilets, Lockers etc/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723174A ***Lab Sample ID:*** **042515237-0347**

Sample Description: Greenhouse/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723174B ***Lab Sample ID:*** **042515237-0348**

Sample Description: Greenhouse/Ceramic Floor Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723175A ***Lab Sample ID:*** **042515237-0349**

Sample Description: Greenhouse/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723175B ***Lab Sample ID:*** **042515237-0350**

Sample Description: Greenhouse/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723176A ***Lab Sample ID:*** **042515237-0351**

Sample Description: Locker Rm Equipment Rm/Ceramic Mud Bed Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723176B ***Lab Sample ID:*** **042515237-0352**

Sample Description: Locker Rm Equipment Rm/Ceramic Mud Bed Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723177A ***Lab Sample ID:*** **042515237-0353**

Sample Description: Locker Rm Equipment Rm/Mud Bed White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723177B ***Lab Sample ID:*** **042515237-0354**

Sample Description: Locker Rm Equipment Rm/Mud Bed White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723178A ***Lab Sample ID:*** **042515237-0355**

Sample Description: Inside Pool/Ceramic Floor, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/White	0.0%	98.0%	**2% Chrysotile**	
400 PLM Pt Ct	8/07/2025	Gray/White	0.00%	99.25%	**0.75% Chrysotile**	

Client Sample ID: 0723178B ***Lab Sample ID:*** **042515237-0356**

Sample Description: Inside Pool/Ceramic Floor, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	**<1% Chrysotile**	Result includes a small amount of inseparable attached material
400 PLM Pt Ct	8/10/2025	Gray/White	0.00%	99.75%	**0.25% Chrysotile**	Result includes a small amount of inseparable attached material

Client Sample ID: 0723179A ***Lab Sample ID:*** **042515237-0357**

Sample Description: Inside Pool/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	100.0%	**<1% Chrysotile**	
400 PLM Pt Ct	8/07/2025	White	0.00%	99.75%	**0.25% Chrysotile**	

Client Sample ID: 0723179B ***Lab Sample ID:*** **042515237-0358**

Sample Description: Inside Pool/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	**<1% Chrysotile**	Result includes a small amount of inseparable attached material
400 PLM Pt Ct	8/10/2025	Gray/White	0.0%	100.0%	**<0.25% Chrysotile**	Result includes a small amount of inseparable attached material

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Client Sample ID: 0723180A ***Lab Sample ID:*** **042515237-0359**
Sample Description: Inside Pool/Wall, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	97.0%	**3% Chrysotile**	
400 PLM Pt Ct	8/13/2025	White	0.0%	98.8%	**1.25% Chrysotile**	

Client Sample ID: 0723180B ***Lab Sample ID:*** **042515237-0360**
Sample Description: Inside Pool/Wall, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Positive Stop (Not Analyzed)				

Client Sample ID: 0723181A ***Lab Sample ID:*** **042515237-0361**
Sample Description: Inside Pool/Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723181B ***Lab Sample ID:*** **042515237-0362**
Sample Description: Inside Pool/Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723182A ***Lab Sample ID:*** **042515237-0363**
Sample Description: Pool Deck/Ceramic Floor, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723182B ***Lab Sample ID:*** **042515237-0364**
Sample Description: Pool Deck/Ceramic Floor, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723183A ***Lab Sample ID:*** **042515237-0365**
Sample Description: Pool Deck/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/White/Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723183B ***Lab Sample ID:*** **042515237-0366**
Sample Description: Pool Deck/Ceramic Floor Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723184A ***Lab Sample ID:*** **042515237-0367**
Sample Description: Pool Deck/Ceramic Wall, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723184B ***Lab Sample ID:*** **042515237-0368**
Sample Description: Pool Deck/Ceramic Wall, Mud Bed

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723185A ***Lab Sample ID:*** **042515237-0369**
Sample Description: Pool Deck/Ceramic Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723185B ***Lab Sample ID:*** **042515237-0370**
Sample Description: Pool Deck/Ceramic Wall Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723186A ***Lab Sample ID:*** **042515237-0371**
Sample Description: Pool Deck/Ceramic Wall Glue Dots

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723186B ***Lab Sample ID:*** **042515237-0372**
Sample Description: Pool Deck/Ceramic Wall Glue Dots

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 0723187A ***Lab Sample ID:*** **042515237-0373**
Sample Description: Pool/Wall Concrete

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723187B ***Lab Sample ID:*** **042515237-0374**
Sample Description: Pool/Wall Concrete

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723188A ***Lab Sample ID:*** **042515237-0375**
Sample Description: Pool/Floor Concrete

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723188B ***Lab Sample ID:*** **042515237-0376**
Sample Description: Pool/Floor Concrete

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723189A ***Lab Sample ID:*** **042515237-0377**
Sample Description: Classroom C1/Block Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/Silver/Gold	0.0%	100.0%	None Detected	

Client Sample ID: 0723189B ***Lab Sample ID:*** **042515237-0378**
Sample Description: Planetarium Mech. Closet/Block Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: 0723190A ***Lab Sample ID:*** **042515237-0379**
Sample Description: Corridor (0-3)/Smaller Block Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723190B ***Lab Sample ID:*** **042515237-0380**
Sample Description: Corridor (0-3)/Smaller Block Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723191A ***Lab Sample ID:*** **042515237-0381**
Sample Description: Classroom C1/Block Wall Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723191B ***Lab Sample ID:*** **042515237-0382**
Sample Description: Planetarium Mech Rm/Block Wall Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723191C ***Lab Sample ID:*** **042515237-0383**
Sample Description: Corridor Near D-3/Block Wall Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723192A ***Lab Sample ID:*** **042515237-0384**
Sample Description: Elect/Trash Room/Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Red	0.0%	100.0%	None Detected	

Client Sample ID: 0723192B ***Lab Sample ID:*** **042515237-0385**
Sample Description: Elect/Trash Room/Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Red	0.0%	100.0%	None Detected	

Client Sample ID: 0723193A ***Lab Sample ID:*** **042515237-0386**
Sample Description: Elect/Trash Room/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723193B ***Lab Sample ID:*** **042515237-0387**
Sample Description: Elect/Trash Room/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723193C ***Lab Sample ID:*** **042515237-0388**
Sample Description: Elect/Trash Room/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723194A ***Lab Sample ID:*** **042515237-0389**
Sample Description: Exterior/Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723194B ***Lab Sample ID:*** **042515237-0390**
Sample Description: Exterior/Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723195A ***Lab Sample ID:*** **042515237-0391**
Sample Description: Exterior/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723195B ***Lab Sample ID:*** **042515237-0392**
Sample Description: Exterior/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723195C ***Lab Sample ID:*** **042515237-0393**
Sample Description: Exterior/Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723196A ***Lab Sample ID:*** **042515237-0394**
Sample Description: Interior/Rockwell Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723196B ***Lab Sample ID:*** **042515237-0395**
Sample Description: Exterior/Rockwell Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	5.0%	95.0%	None Detected	

Client Sample ID: 0723196C ***Lab Sample ID:*** **042515237-0396**
Sample Description: Exterior/Rockwell Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723197A ***Lab Sample ID:*** **042515237-0397**
Sample Description: Exterior (Boiler Rm)/Fake Stucco Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Tan/White/Blue	20.0%	80.0%	None Detected	

Client Sample ID: 0723197B ***Lab Sample ID:*** **042515237-0398**
Sample Description: Exterior (Boiler Rm)/Fake Stucco Wall Adhesive

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan/White/Blue	15.0%	85.0%	None Detected	

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Client Sample ID: 0723198A ***Lab Sample ID:*** **042515237-0399**
Sample Description: Exterior (Boiler Rm)/Wall Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723198B ***Lab Sample ID:*** **042515237-0400**
Sample Description: Exterior (Boiler Rm)/Wall Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723199A ***Lab Sample ID:*** **042515237-0401**
Sample Description: Exterior (Boiler Rm)/Rock Wall Black Damproofing Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Gray/Black	0.0%	78.0%	**22% Chrysotile**	

Client Sample ID: 0723199B ***Lab Sample ID:*** **042515237-0402**
Sample Description: Exterior (Boiler Rm)/Rock Wall Black Damproofing Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723200A ***Lab Sample ID:*** **042515237-0403**
Sample Description: Exterior/Black Dampproof Paper Behind Brick Wall (middle)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	0.0%	83.0%	**17% Chrysotile**	

Client Sample ID: 0723200B ***Lab Sample ID:*** **042515237-0404**
Sample Description: Exterior/Black Dampproof Paper Behind Brick Wall (middle)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723201A ***Lab Sample ID:*** **042515237-0405**
Sample Description: Exterior/Tar Paper (at Foundation)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/Black	0.0%	80.0%	**20% Chrysotile**	

Client Sample ID: 0723201B ***Lab Sample ID:*** **042515237-0406**
Sample Description: Exterior/Tar Paper (at Foundation)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

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Client Sample ID: 0723202A ***Lab Sample ID:*** **042515237-0407**

Sample Description: Above/Below Window/Door/Stone Panels Stone Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White/Yellow/Clear	0.0%	100.0%	None Detected	

Client Sample ID: 0723202B ***Lab Sample ID:*** **042515237-0408**

Sample Description: Above/Below Window/Door/Stone Panels Stone Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/07/2025	Brown/Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723202C ***Lab Sample ID:*** **042515237-0409**

Sample Description: Above/Below Window/Door/Stone Panels Stone Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723203A ***Lab Sample ID:*** **042515237-0410**

Sample Description: Above/Below Window/Door/Stone Panels "Transite" Behind

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/White	0.0%	35.0%	**65% Chrysotile**	

Client Sample ID: 0723203B ***Lab Sample ID:*** **042515237-0411**

Sample Description: Above/Below Window/Door/Stone Panels "Transite" Behind

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723204A ***Lab Sample ID:*** **042515237-0412**

Sample Description: Above/Below Window/Door/Stone Panels Black Paper Behind

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	0.0%	70.0%	**30% Chrysotile**	

Client Sample ID: 0723204B ***Lab Sample ID:*** **042515237-0413**

Sample Description: Above/Below Window/Door/Stone Panels Black Paper Behind

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723205A ***Lab Sample ID:*** **042515237-0414**

Sample Description: Pool/Perimeter Caulk Inside Pool (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 0723205B ***Lab Sample ID:*** **042515237-0415**

Sample Description: Pool/Perimeter Caulk Inside Pool (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723206A ***Lab Sample ID:*** **042515237-0416**

Sample Description: Pool/Perimeter Caulk - Outside Deck (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723206B ***Lab Sample ID:*** **042515237-0417**

Sample Description: Pool/Perimeter Caulk - Outside Deck (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723207A ***Lab Sample ID:*** **042515237-0418**

Sample Description: Classroom C-3/Unit Ventilator Caulk (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/White/Blue	0.0%	100.0%	None Detected	

Client Sample ID: 0723207B ***Lab Sample ID:*** **042515237-0419**

Sample Description: Classroom B-11/Unit Ventilator Caulk (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723208A ***Lab Sample ID:*** **042515237-0420**

Sample Description: Classroom C-2/Interior Wall/Wall Caulk (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723208B ***Lab Sample ID:*** **042515237-0421**

Sample Description: Classroom A8/Interior Wall/Wall Caulk (newer)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723209A ***Lab Sample ID:*** **042515237-0422**

Sample Description: Classroom A16/Int. Well/Ceiling Caulk (Red)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White/Red	0.0%	94.0%	**6% Chrysotile**	

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Client Sample ID: 0723209B ***Lab Sample ID:*** **042515237-0423**

Sample Description: Classroom A17/Int. Well/Ceiling Caulk (Red)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723210A ***Lab Sample ID:*** **042515237-0424**

Sample Description: Classroom A10/Int. Well/Ceiling Caulk (White/Gray)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723210B ***Lab Sample ID:*** **042515237-0425**

Sample Description: Classroom B20/Int. Well/Ceiling Caulk (White/Gray)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723211A ***Lab Sample ID:*** **042515237-0426**

Sample Description: Corridor (Planterium)/Display Case Caulk (older)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723211B ***Lab Sample ID:*** **042515237-0427**

Sample Description: Corridor (C1)/Display Case Caulk (older)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723212A ***Lab Sample ID:*** **042515237-0428**

Sample Description: Corridor - Main office/Ceramic Wall Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Yellow	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723212B ***Lab Sample ID:*** **042515237-0429**

Sample Description: Corridor - Main office/Ceramic Wall Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723213A ***Lab Sample ID:*** **042515237-0430**

Sample Description: Teachers Room/Wall Caulk - Thick newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/White	0.0%	97.0%	**3% Chrysotile**	

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Client Sample ID: 0723213B ***Lab Sample ID:*** **042515237-0431**

Sample Description: Teachers Room/Wall Caulk - Thick newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723214A ***Lab Sample ID:*** **042515237-0432**

Sample Description: Planetarium Mech Closet/Wall Caulk yellow OLDER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Yellow	0.0%	92.0%	**8% Chrysotile**	

Client Sample ID: 0723214B ***Lab Sample ID:*** **042515237-0433**

Sample Description: Planetarium Mech Closet/Wall Caulk yellow OLDER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723215A ***Lab Sample ID:*** **042515237-0434**

Sample Description: Exterior/Dome Caulk newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723215B ***Lab Sample ID:*** **042515237-0435**

Sample Description: Exterior/Dome Caulk newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723216A ***Lab Sample ID:*** **042515237-0436**

Sample Description: Exterior/Rock Wall Caulk (roof level)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723216B ***Lab Sample ID:*** **042515237-0437**

Sample Description: Exterior/Rock Wall Caulk (roof level)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723217A ***Lab Sample ID:*** **042515237-0438**

Sample Description: Cafe Ext (Roof Level)/Rock Wall Caulk white newer at bottom

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 0723217B ***Lab Sample ID:*** **042515237-0439**

Sample Description: Cafe Ext (Roof Level)/Rock Wall Caulk white newer at bottom

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723218A ***Lab Sample ID:*** **042515237-0440**

Sample Description: Cafe Ext (Roof Level)/Expansion Wall Caulk (Gray) (mortar?)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	8.0%	85.0%	**7% Chrysotile**	

Client Sample ID: 0723218B ***Lab Sample ID:*** **042515237-0441**

Sample Description: Cafe Ext (Roof Level)/Expansion Wall Caulk (Gray) (mortar?)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723219A ***Lab Sample ID:*** **042515237-0442**

Sample Description: Media Center / Library Ext/Roof Drain Caulk - White newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723219B ***Lab Sample ID:*** **042515237-0443**

Sample Description: Media Center / Library Ext/Roof Drain Caulk - White newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723220A ***Lab Sample ID:*** **042515237-0444**

Sample Description: Exterior/Conduit Putty

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723220B ***Lab Sample ID:*** **042515237-0445**

Sample Description: Exterior/Conduit Putty

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	92.0%	**8% Chrysotile**	

Client Sample ID: 0723221A ***Lab Sample ID:*** **042515237-0446**

Sample Description: Exterior/Wall Expansion Caulking Brown Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	10.0%	85.0%	**5% Chrysotile**	

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Client Sample ID: 0723221B ***Lab Sample ID:*** **042515237-0447**

Sample Description: Exterior/Wall Expansion Caulking Brown Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025			Positive Stop (Not Analyzed)		

Client Sample ID: 0723222A ***Lab Sample ID:*** **042515237-0448**

Sample Description: Exterior/Vent Caulk at D12 old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723222B ***Lab Sample ID:*** **042515237-0449**

Sample Description: Exterior/Vent Caulk at D12 old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723223A ***Lab Sample ID:*** **042515237-0450**

Sample Description: Upper Vent/Vent Caulk old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	6.0%	86.0%	**8% Chrysotile**	

Client Sample ID: 0723223B ***Lab Sample ID:*** **042515237-0451**

Sample Description: Upper Vent/Vent Caulk old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025			Positive Stop (Not Analyzed)		

Client Sample ID: 0723224A ***Lab Sample ID:*** **042515237-0452**

Sample Description: Exterior/Roof Vent Screw Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723224B ***Lab Sample ID:*** **042515237-0453**

Sample Description: Exterior/Roof Vent Screw Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723225A ***Lab Sample ID:*** **042515237-0454**

Sample Description: Locker Room Roof/Duct Seam Sealant new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	0.0%	100.0%	None Detected	

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Client Sample ID: 0723225B ***Lab Sample ID:*** **042515237-0455**

Sample Description: Locker Room Roof/Duct Seam Sealant new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723226A ***Lab Sample ID:*** **042515237-0456**

Sample Description: Interior Main Entry/Door/Window Wall Gray Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	8.0%	87.0%	**5% Chrysotile**	

Client Sample ID: 0723226B ***Lab Sample ID:*** **042515237-0457**

Sample Description: Interior Main Entry/Door/Window Wall Gray Caulk new

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723227A ***Lab Sample ID:*** **042515237-0458**

Sample Description: Greenhouse/Window Glazing older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	7.0%	89.0%	**4% Chrysotile**	

Client Sample ID: 0723227B ***Lab Sample ID:*** **042515237-0459**

Sample Description: Greenhouse/Window Glazing older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723228A ***Lab Sample ID:*** **042515237-0460**

Sample Description: Exterior Stone Panels Windows/Window Glazing older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723228B ***Lab Sample ID:*** **042515237-0461**

Sample Description: Exterior Stone Panels Windows/Window Glazing older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723229A ***Lab Sample ID:*** **042515237-0462**

Sample Description: Exterior Stone Panels Windows/Window/Stone Panel Caulk on Panel

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/White	0.0%	100.0%	None Detected	

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Client Sample ID: 0723229B ***Lab Sample ID:*** **042515237-0463**

Sample Description: Exterior Stone Panels Windows/Window/Stone Panel Caulk on Panel

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723230A ***Lab Sample ID:*** **042515237-0464**

Sample Description: Exterior Stone Panels Windows/Window/Stone Panel Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White/Peach	0.0%	100.0%	None Detected	

Client Sample ID: 0723230B ***Lab Sample ID:*** **042515237-0465**

Sample Description: Exterior Stone Panels Windows/Window/Stone Panel Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723231A ***Lab Sample ID:*** **042515237-0466**

Sample Description: Media Pool/Door Window Glazing Red Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723231B ***Lab Sample ID:*** **042515237-0467**

Sample Description: Media Pool/Door Window Glazing Red Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723232A ***Lab Sample ID:*** **042515237-0468**

Sample Description: D4 Room by Door 3/Window Caulking majority Brown/Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	8.0%	87.0%	**5% Chrysotile**	

Client Sample ID: 0723232B ***Lab Sample ID:*** **042515237-0469**

Sample Description: D4 Room by Door 3/Window Caulking majority Brown/Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723233A ***Lab Sample ID:*** **042515237-0470**

Sample Description: D4 Room by Door 3/Window Caulking majority white

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

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Client Sample ID: 0723233B ***Lab Sample ID:*** **042515237-0471**

Sample Description: D4 Room by Door 3/Window Caulking majority white

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	0.0%	100.0%	None Detected	

Client Sample ID: 0723234A ***Lab Sample ID:*** **042515237-0472**

Sample Description: Door 10/Door Caulk Dark Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723234B ***Lab Sample ID:*** **042515237-0473**

Sample Description: Door 10/Door Caulk Dark Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	5.0%	89.0%	**6% Chrysotile**	

Client Sample ID: 0723235A ***Lab Sample ID:*** **042515237-0474**

Sample Description: Door 10/Door/Window System Caulk white

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723235B ***Lab Sample ID:*** **042515237-0475**

Sample Description: Door 10/Door/Window System Caulk white

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723236 ***Lab Sample ID:*** **042515237-0476**

Sample Description: Exterior media/roof/Window Glaze old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723237 ***Lab Sample ID:*** **042515237-0477**

Sample Description: media/side/Door/Window System Glaze old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan/Black	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 0723238 ***Lab Sample ID:*** **042515237-0478**

Sample Description: Door 4/Door/Window System Glaze old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723239 ***Lab Sample ID:*** **042515237-0479**
Sample Description: pool upper wide/Window Glaze old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	7.0%	90.0%	**3% Chrysotile**	

Client Sample ID: 0723240 ***Lab Sample ID:*** **042515237-0480**
Sample Description: pool hall/Window Glaze old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	7.0%	90.0%	**3% Chrysotile**	

Client Sample ID: 0723241 ***Lab Sample ID:*** **042515237-0481**
Sample Description: ped near Door 19/Window Glaze White Newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723242 ***Lab Sample ID:*** **042515237-0482**
Sample Description: D4/Window Glaze White Newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 0723243 ***Lab Sample ID:*** **042515237-0483**
Sample Description: Rm A5/Window Glazing Older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	10.0%	85.0%	**5% Chrysotile**	

Client Sample ID: 0723244 ***Lab Sample ID:*** **042515237-0484**
Sample Description: Newer office/Window Glazing Older

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	5.0%	92.0%	**3% Chrysotile**	

Client Sample ID: 0723245A ***Lab Sample ID:*** **042515237-0485**
Sample Description: Interior C5 comp lab/Door Window Glaze gray Black soft

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723245B ***Lab Sample ID:*** **042515237-0486**
Sample Description: C5 comp lab/Door Window Glaze gray Black soft

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

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Client Sample ID: 0723246A ***Lab Sample ID:*** **042515237-0487**

Sample Description: A-18 AV Room records B closet/Door Window Glaze Thick white old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/Tan/White	0.0%	94.0%	**6% Chrysotile**	

Client Sample ID: 0723246B ***Lab Sample ID:*** **042515237-0488**

Sample Description: AV Room records B closet/Door Window Glaze Thick white old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723247A ***Lab Sample ID:*** **042515237-0489**

Sample Description: sporadic Throughout A2 corridor/Door Window Glaze Thin White old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723247B ***Lab Sample ID:*** **042515237-0490**

Sample Description: A2 corridor Conf. Rm/Door Window Glaze Thin White old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 0723248A ***Lab Sample ID:*** **042515237-0491**

Sample Description: Planetarium Rear/Door Caulk gray newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723248B ***Lab Sample ID:*** **042515237-0492**

Sample Description: Planetarium Rear/Door Caulk gray newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723249A ***Lab Sample ID:*** **042515237-0493**

Sample Description: Pool/Door Caulk gray newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723249B ***Lab Sample ID:*** **042515237-0494**

Sample Description: Pool/Door Caulk gray newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723250A ***Lab Sample ID:*** **042515237-0495**

Sample Description: C5 corridor/Door Caulk Thin Hard granular

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	White/Black/Green	0.0%	94.0%	**6% Chrysotile**	

Client Sample ID: 0723250B ***Lab Sample ID:*** **042515237-0496**

Sample Description: A-18 corridor/Door Caulk Thin Hard granular

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Positive Stop (Not Analyzed)				

Client Sample ID: 0723251 ***Lab Sample ID:*** **042515237-0497**

Sample Description: A-15 prep/Door Caulk yellow hard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Yellow	0.0%	100.0%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: 0723252 ***Lab Sample ID:*** **042515237-0498**

Sample Description: A-16 prep/Door Caulk yellow soft

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black/Yellow	0.0%	100.0%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: 0723253 ***Lab Sample ID:*** **042515237-0499**

Sample Description: Double door C9/Door Caulk gray soft

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	0.0%	100.0%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: 0723254 ***Lab Sample ID:*** **042515237-0500**

Sample Description: C5/Door Caulk Brown/Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Red	0.0%	100.0%	None Detected	

Client Sample ID: 0723255A ***Lab Sample ID:*** **042515237-0501**

Sample Description: Interior, Corridor, Door 15, to caulk/Door Caulk, Tan/Gray, newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723255B ***Lab Sample ID:*** **042515237-0502**

Sample Description: Interior, Corridor, Door 15, to caulk/Door Caulk, Tan/Gray, newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723256A ***Lab Sample ID:*** **042515237-0503**

Sample Description: C4 w/Door, permiter/Window Caulk, Gray/Newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723256B ***Lab Sample ID:*** **042515237-0504**

Sample Description: C4 w/Door, permiter/Window Caulk, Gray/Newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723257A ***Lab Sample ID:*** **042515237-0505**

Sample Description: A 17 prep Room/Window Caulk paint, granular

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Tan/Green	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723257B ***Lab Sample ID:*** **042515237-0506**

Sample Description: A 17 prep Room/Window Caulk paint, granular

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025			Positive Stop (Not Analyzed)		

Client Sample ID: 0723258A ***Lab Sample ID:*** **042515237-0507**

Sample Description: Coffee Room, Locker Rm, Door/Window wall to outside/Window Caulk Dark Gray, squish

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723258B ***Lab Sample ID:*** **042515237-0508**

Sample Description: Coffee Room, Locker Rm, Door/Window wall to outside/Window Caulk Dark Gray, squish

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723258C ***Lab Sample ID:*** **042515237-0509**

Sample Description: Coffee Room, Locker Rm, Door/Window wall to outside/Window Caulk Dark Gray, squish

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025			Positive Stop (Not Analyzed)		

Client Sample ID: 0723259 ***Lab Sample ID:*** **042515237-0510**

Sample Description: Classroom C-6/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan	0.0%	96.0%	**4% Chrysotile**	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723260 ***Lab Sample ID:*** **042515237-0511**
Sample Description: PA Room/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723261A ***Lab Sample ID:*** **042515237-0512**
Sample Description: Classroom C2/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/05/2025	Gray/White	5.0%	93.0%	**2% Chrysotile**	
400 PLM Pt Ct	8/05/2025	Gray/White	0.00%	99.50%	**0.50% Chrysotile**	Point Count performed on NOB material without gravimetric reduction at client request. Asbestos results may be under-reported.

Client Sample ID: 0723261B ***Lab Sample ID:*** **042515237-0513**
Sample Description: C3/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 0723262 ***Lab Sample ID:*** **042515237-0514**
Sample Description: Kitchen Office/Window Glaze, newer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723263 ***Lab Sample ID:*** **042515237-0515**
Sample Description: AV Room/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723264 ***Lab Sample ID:*** **042515237-0516**
Sample Description: A13 to ceiling/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 0723265 ***Lab Sample ID:*** **042515237-0517**
Sample Description: A12/Window Glaze, old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	0.0%	95.0%	**5% Chrysotile**	

Client Sample ID: 0723266 ***Lab Sample ID:*** **042515237-0518**
Sample Description: Girls Locker Office/Window Glaze, Gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Gray	15.0%	80.0%	**5% Chrysotile**	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723267 ***Lab Sample ID:*** **042515237-0519**

Sample Description: Pool Office/Window Glaze, Gray old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Gray	5.0%	90.0%	**5% Chrysotile**	

Client Sample ID: 0723268 ***Lab Sample ID:*** **042515237-0520**

Sample Description: A-14 prep/Window Glaze, Gray old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Tan	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723269 ***Lab Sample ID:*** **042515237-0521**

Sample Description: A-1 perimeter/Window Glaze, Gray old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723270 ***Lab Sample ID:*** **042515237-0522**

Sample Description: A-1 perimeter/Window Glaze, Gray old

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	5.0%	92.0%	**3% Chrysotile**	

Client Sample ID: 0723271 ***Lab Sample ID:*** **042515237-0523**

Sample Description: Media to ceiling, work Rm & adjacent media coll side/Window Glaze, tan, gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray/Red	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 0723272 ***Lab Sample ID:*** **042515237-0524**

Sample Description: Media to ceiling, work Rm & adjacent media coll side/Window Glaze, tan, gray

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown/Tan	0.0%	96.0%	**4% Chrysotile**	

Client Sample ID: 0723273 ***Lab Sample ID:*** **042515237-0525**

Sample Description: Interior, Corridor/Window Glazing, GLD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray/Tan	5.0%	92.0%	**3% Chrysotile**	

Client Sample ID: 0723274 ***Lab Sample ID:*** **042515237-0526**

Sample Description: Door 13, Door/Window System, Corridor/Window Glazing, GLD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Brown	0.0%	95.0%	**5% Chrysotile**	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 275 ***Lab Sample ID:*** **042515237-0527**

Sample Description: Door/Window System, Door/Window/Window Glazing, Black Granular

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Tan	0.0%	97.0%	**3% Chrysotile**	

Client Sample ID: 276A ***Lab Sample ID:*** **042515237-0528**

Sample Description: Guidance to 101-80/Window Glazing, Black Squishy

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	5.0%	95.0%	None Detected	

Client Sample ID: 276B ***Lab Sample ID:*** **042515237-0529**

Sample Description: Guidance to 101-80/Window Glazing, Black Squishy

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	3.0%	97.0%	None Detected	

Client Sample ID: 277A ***Lab Sample ID:*** **042515237-0530**

Sample Description: Door/Wall System, Corridor, DPS/Window Glazing, Gray Squishy

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 277B ***Lab Sample ID:*** **042515237-0531**

Sample Description: Door/Wall System, Corridor, DPS/Window Glazing, Gray Squishy

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 278A ***Lab Sample ID:*** **042515237-0532**

Sample Description: Roofs, Planetarium Dome/Black Paper under metal

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black	15.0%	55.0%	**30% Chrysotile**	

Client Sample ID: 278B ***Lab Sample ID:*** **042515237-0533**

Sample Description: Roofs, Planetarium Dome/Black Paper under metal

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 0723279A ***Lab Sample ID:*** **042515237-0534**

Sample Description: Pool/Media/Roof, Field & Flash, Middle Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black/Silver	27.0%	55.0%	**18% Chrysotile**	

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Client Sample ID: 0723279B ***Lab Sample ID:*** **042515237-0535**

Sample Description: Pool/Media/Roof, Field & Flash, Middle Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025			Positive Stop (Not Analyzed)		

Client Sample ID: 0723280A ***Lab Sample ID:*** **042515237-0536**

Sample Description: Gym Roof/Gypsum Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White	20.0%	80.0%	None Detected	

Client Sample ID: 0723280B ***Lab Sample ID:*** **042515237-0537**

Sample Description: Gym Roof/Gypsum Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	White	13.0%	87.0%	None Detected	

Client Sample ID: 0723281A ***Lab Sample ID:*** **042515237-0538**

Sample Description: Gym Roof/Black Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray/Black	15.0%	85.0%	None Detected	

Client Sample ID: 0723281B ***Lab Sample ID:*** **042515237-0539**

Sample Description: Gym Roof/Black Layer

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2025	Black	10.0%	90.0%	None Detected	

Client Sample ID: 0723282 ***Lab Sample ID:*** **042515237-0540**

Sample Description: Gym Roof/Field, Bottom Black Material on Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 0723283A ***Lab Sample ID:*** **042515237-0541**

Sample Description: Wall/Damp, Black Material Behind Brick at Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray/White	15.0%	65.0%	**20% Chrysotile**	

Client Sample ID: 0723283B ***Lab Sample ID:*** **042515237-0542**

Sample Description: Wall/Damp, Black Material Behind Brick at Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025			Positive Stop (Not Analyzed)		

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EMSL Order ID: 042515237
Customer ID: LANG78
Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723284A ***Lab Sample ID:*** **042515237-0543**

Sample Description: Classroom Portion/Field, Bottom Large Black Material on Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black	25.0%	75.0%	None Detected	

Client Sample ID: 0723284B ***Lab Sample ID:*** **042515237-0544**

Sample Description: Classroom Portion/Field, Bottom Large Black Material on Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black	25.0%	75.0%	None Detected	

Client Sample ID: 0723284C ***Lab Sample ID:*** **042515237-0545**

Sample Description: Classroom Portion/Field, Bottom Large Black Material on Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black	25.0%	75.0%	None Detected	

Client Sample ID: 0723284D ***Lab Sample ID:*** **042515237-0546**

Sample Description: Classroom Portion/Field, Bottom Large Black Material on Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	10.0%	90.0%	None Detected	

Client Sample ID: 0723285 ***Lab Sample ID:*** **042515237-0547**

Sample Description: Boys Lockers/Bottom Layer Tar on Concrete Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	10.0%	90.0%	None Detected	

Client Sample ID: 0723286A ***Lab Sample ID:*** **042515237-0548**

Sample Description: Pool/Media/Bottom Layer Tar on Concrete Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Gray/Black	30.0%	70.0%	None Detected	

Client Sample ID: 0723286B ***Lab Sample ID:*** **042515237-0549**

Sample Description: Pool/Media/Bottom Layer Tar on Concrete Deck

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Brown/Black	5.0%	95.0%	None Detected	

Client Sample ID: 0723287A ***Lab Sample ID:*** **042515237-0550**

Sample Description: Roofs/Top Rubber Rolled Seam Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723287B ***Lab Sample ID:*** **042515237-0551**

Sample Description: Roofs/Top Rubber Rolled Seam Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723288A ***Lab Sample ID:*** **042515237-0552**

Sample Description: Roof Media/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723288B ***Lab Sample ID:*** **042515237-0553**

Sample Description: Roof Media/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: 0723289A ***Lab Sample ID:*** **042515237-0554**

Sample Description: Roof Gym/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Tan/Black	10.0%	90.0%	None Detected	

Client Sample ID: 0723289B ***Lab Sample ID:*** **042515237-0555**

Sample Description: Roof Gym/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723290A ***Lab Sample ID:*** **042515237-0556**

Sample Description: Roof Gym A/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	35.0%	65.0%	None Detected	

Client Sample ID: 0723290B ***Lab Sample ID:*** **042515237-0557**

Sample Description: Roof Gym B/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Brown/Black	45.0%	55.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: 0723290C ***Lab Sample ID:*** **042515237-0558**

Sample Description: Roof Gym D/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	30.0%	70.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: 0723290D ***Lab Sample ID:*** **042515237-0559**
Sample Description: Roof Gym E/Bottom Layer Perimeter Flashing Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723291 ***Lab Sample ID:*** **042515237-0560**
Sample Description: Roof Gym A/Penetration Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 0723292 ***Lab Sample ID:*** **042515237-0561**
Sample Description: Roof Gym A/Penetration Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: 0723293 ***Lab Sample ID:*** **042515237-0562**
Sample Description: Roof Gym B/Penetration Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/06/2025	Black	10.0%	78.0%	**12% Chrysotile**	

Client Sample ID: 0723294 ***Lab Sample ID:*** **042515237-0563**
Sample Description: Roof Gym D/Penetration Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	0.0%	92.0%	**8% Chrysotile**	

Client Sample ID: 0723295 ***Lab Sample ID:*** **042515237-0564**
Sample Description: Roof Gym L/Penetration Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/11/2025	Black	0.0%	100.0%	None Detected	

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EMSL Order ID: 042515237
Customer ID: LANG78
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Summary Test Report for Asbestos Analysis of Bulk Material

Analyst(s):

Andrea Doughty	PLM (87)
Brian Napper II	PLM (34)
Hunter Kelly	PLM (66) 400 PLM Pt Ct (2)
Jannat Fareen	PLM (47)
Kiara Secula	PLM (28)
Megan Peters	PLM (110) 400 PLM Pt Ct (1)
Michael Bocchicchio	PLM (8)
Nicholas Wood	PLM (138) 400 PLM Pt Ct (2)
Will DiBella	400 PLM Pt Ct (1)

Reviewed and approved by:

Samantha Sweeney

Samantha Sweeney, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This is a summary report; official reports are available on LabConnect or upon request and relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA LAP, LLC-IHLAP Lab 100194, PA ID# 68-00367, LA #04127

Report amended: 08/14/202508:06:00 Replaces initial report from: 08/11/202512:21:47 Reason Code: Client-Additional Analysis

OrderID: 042515237

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Company: Langan CT	**EMSL-Bill to:** ☐ Same ☒ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*
Street: 555 Long Wharf Drive	
City: New Haven **State/Province:** CT	**Zip/Postal Code:** 06511 **Country:** USA
Report To (Name): Matthew Myers	**Telephone #:** 203.562.5771
Email Address: mmyers@langan.com	**Fax #:** 203.789.6142 **Purchase Order:**
Project Name/Number: 140325901	**Please Provide Results:** ☐ Fax ☒ Email Public School
U.S. State Samples Taken: CT	**CT Samples:** ☐ Commercial/Taxable ☒ Residential/Tax Exempt

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☒ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PLM - Bulk (reporting limit)

- ☒ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- Point Count ☒ 400 (<0.25%) ☐ 1000 (<0.1%) **If <3%**
- Point Count w/Gravimetric ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☐ NY ELAP Method 198.1 (friable in NY)
- ☐ NY ELAP Method 198.6 NOB (non-friable-NY)
- ☐ OSHA ID-191 Modified
- ☐ Standard Addition Method

TEM – Bulk

- ☐ TEM EPA NOB – EPA 600/R-93/116 Section 2.5.5.1
- ☐ NY ELAP Method 198.4 (TEM)
- ☐ Chatfield Protocol (semi-quantitative)
- ☐ TEM % by Mass – EPA 600/R-93/116 Section 2.5.5.2
- ☐ TEM Qualitative via Filtration Prep Technique
- ☐ TEM Qualitative via Drop Mount Prep Technique

Other

- ☐ Hillcrest Middle School

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☒ **Check For Positive Stop – Clearly Identify Homogenous Group** **Date Sampled:** 7/14, 15, 16, 22 23

Samplers Name: Hilton Hernandez & Javed Gouberina **Samplers Signature:** (HH) (JG)

Sample #	HA #	Sample Location	Material Description
072301A		Green house	Remnant wall tellesma
01B		↓	↓
02A		Classroom C1 - Closet	Kiln
02B		↓	↓
03A		Classroom C5	Fire Door Insulation
03B		↓	↓
04A		Classroom C1	Clock/Speaker Tar (Black)
↓B		↓ C3	↓ ↓
05A		Stage/Cafe	Black Paper under Stage Wood Floor
↓B		↓	↓

Client Sample # (s): - **Total # of Samples:** 562

Relinquished (Client): **Date:** **Time:**

Received (Lab): Shirley FX **Date:** 7/28/22 **Time:** 0930

Comments/Special Instructions: Samples 100A+B not recd- 7/28/22

Bill To: Langan_InvoiceCapture@ Concur Solutions.com

562 SAH
564

OrderID: 042515237

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Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	HA #	Sample Location	Material Description
0723BGA		Classroom C5	"Transite" Tabletop
B		"	"
07A		" C1	Black Adhesive
B		" "	" "
08A		" C1	Slate window sill
B		" C5	"
09A		" C1	Grout
B		" C5	"
10A		B Recording (media?)	Acoustical Wall - Paper Behind (tan/Black)
B		Band Practice C Room	"
11A		Classroom D5	Roof Debris - Paper
B		"	" "
12A		"	Tar
B		"	"
13A		Pool Floor - walkway	Black Material in Floor Cove
B		"	"
14A		Pool	Wall Tile 1x1
B		"	"
15A		"	Glue Dabs
B		"	"
16A		Stage	Five Curtains
B		"	"
17A		Conference Rm Main Office	Black Tar on 1 CMU Block
B		" "	"

*Comments/Special Instructions:

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Sample #	HA #	Sample Location	Material Description
072318A		Gym Storage Room 1	Light Fixture Backing Paper
B		↓	1
19A		Pool	Ceiling Spray Applied Fireproofing
B			
C			
D			
E			
F			
G			
20A		Media Center / Library	Ceiling / Beam
B			
C			
D			
E			
21A		Kitchen	Plaster Ceiling — White Finish Coat
B			
C			Gray Rough Coat
22A			
B			
C			
23A		Stage / Cafe	Plaster (one coat)
B			
C			

*Comments/Special Instructions:

OrderID: 042515237

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Sample #	HA #	Sample Location	Material Description
672324A		Media Center / Library	Brown Coat Plaster Behind Spray on
B		↓	Dont analyze white Spray on stuck to it ↓
C			
D			
E			
25A		Planetarium	One coat Plaster Around Dome
B		↓	↓
C			
26A		Weight Room	Plaster Ceiling White Coat Finish
B		Boys Locker Room	
C		Custodial office Toilet Room	
D		Gym Storage #1	
E		Equipment Room (by Locker Room)	
F		Back Storage (by Custodial)	
G		Storage Back Right ↓	↓
27A		Weight Room	Tan Rough Coat
B		Boys Locker Room	
C		Custodial office toilet Room	
D		Gym Storage #1	
E		Equipment Room (by Locker Room)	
F		Back Storage (by Custodial)	
G		Storage Back Right ↓	↓

***Comments/Special Instructions:**

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Sample #	HA #	Sample Location	Material Description
022378A		Electric/Track / Barber Room	One coat plaster/cement gray ceiling
B		↓	↓
C		↓	↓
D		↓	↓
E		↓	↓
29A		↓	Textured white paint
B		↓	↓
C		↓	↓
D		↓	↓
E		↓	↓
30A		Main office End Room	Black Paper on wall above ceiling going in CTS down
B		↓ ↓	↓
31A		[redacted] Toilet	Duct Black Paper (copper in to duct)
B		↓ ↓	
32A		Stage	Duct Insulation - Canvas
B		Planetarium	↓ ↓
33A		Stage	- Black Paper
B		Planetarium	↓ ↓
34A		Stage	Duct Pin Adhesive Dark Brown
B		Planetarium	↓ ↓
35A		Classroom C5 Storage 3	Duct [redacted] Seam or Flange Sealant white
B		↓	↓
36A		Stage	Duct Flange Sealant tan
B		Classroom C5 Storage 3	↓

***Comments/Special Instructions:**

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Sample #	HA #	Sample Location	Material Description
572337A		Classroom C5	Duct Seam Sealant Gray
B		↓	↓
38A		↓	Tectum Ceiling Deck
B			↓
39A		Classroom A1	Formica/Adhesive Top on Unit Vent
B		↓ A2	↓
40A		Classrooms	Formica Countertop Adhesive
B		↓	↓
41A		Classroom C3	Wooden countertop Backsplash Adhesive
B		↓	↓
42		Classroom C1	Black Sink Undercoating
43		↓ C2	↓
44		↓ C3	eyewash black undercoating
45		↓ C3	Black Sink undercoating
46		↓ A-16	
47		media Work Rm	~~Teachers Room (Faculty)~~
48		teachers/Faculty Rm	also
49		Nurse Office	↓
50A		Throughout	Red Fire Sealant (Penetration)
B		↓	↓
51A		↓	Dark
B		↓	↓
52A/B		Boiler Room	Pipe End Cap Insulation
C		↓	↓

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Sample #	HA #	Sample Location	Material Description
072353A		Throughout	Fiberglass Pipe Insulation Black Lagging
B		↓	↓
C		↓	↓
54A		Classroom C1	Pipe Fitting Insulation
B		Corridors	↓
C		↓	↓
55A		Cafeteria	2x2 Ceiling tiles
B		↓	↓
56A		Classroom C1	↓
B		↓ C3	↓
57A		↓ A-12 prep	"Newer" Ceiling tiles
B		Planetarium	↓
58A		Classroom A17 prep	2x4 ceiling tiles Rough
B		↓	↓
59A		Toilet Adjacent C-11	2x4 ceiling tile
B		↓	
60A		Corridors	ceiling tiles (Rough)
B		↓	↓ ↓
61A		~~Classroom~~ Room D-6	2x4 ceiling tile
62B		Kitchen office	↓ (small worm)
63		Planetarium	old wormhole ceiling tile
64		Classroom A12 prep	↓
65		↓ A17 prep	↓
66A B		Teachers/Faculty Rm	↓

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Sample #	HA #	Sample Location	Material Description
072367A		Baler Room	Gypsum Board
B		↓	+
68A		↓	↓ Taping / Joint compound
B		↓	↓
C		↓	↓
69A		Media Center / Library	↓
B		↓	↓
70A		↓	↓ Taping / Joint Compound
B		↓	↓
C		↓	↓
71A		~~Electric~~ Data Room in Classroom C9	↓
B		↓	↓
72A		↓	↓ Taping Joint Compound
B		↓	↓
C		↓	↓
73		Library AV Room	↓
74		↓	↓ Taping / Joint Compound
75		Kitchen Office	↓
76		+	↓ Taping Joint Compound
77		Custodial Office Storage Room	↓
78		↓	↓ Taping / Joint Compound
79		Classroom A17 Storage Room	↓
80		↓	↓ Taping / Joint Compound
81		Classroom C5 / ~~Storage Room~~	↓
82		+	↓ Taping Joint Compound

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Sample #	HA #	Sample Location	Material Description
07) 383A		Classroom B-14	Accordian Wall [illegible]
83B		↓	↓
84A		↓	↓ Adhesive
84B		↓	↓
85A		↓	Cork board Adhesive
B		↓	↓
86A		Classroom B-15 / Throughout	Dark Brown Bulletin Board
B		↓	↓
87A		↓	↓ Adhesive
B		↓	↓
88A		Classroom C11 / Throughout	Corkboard Bulletin Board Only
B		↓	↓
89A		Media / Library AV Room	Tan Bulletin Board
B		↓	↓
90A		↓	↓ Adhesive
B		↓	↓
91A		[illegible] Classroom A10 / Throughout	Dark Green Bulletin Board
B		↓	↓
92A		↓	↓ Adhesive
B		↓	↓
93A		Planetarium	Medium Brown Bulletin Board
B		Classroom A13	↓
94A		Planetarium	↓ Adhesive
B		Classroom A-13	↓

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Sample #	HA #	Sample Location	Material Description
0723994		Media / Library Work Room	Medium Brown Bulletin Board
95 B		↓	↓ Adhesive
96 A		Kitchen	↓
97 B		↓	↓ Adhesive
98 A		Planetarium	Carpet Strip Adhesive
B		↓	↓
99 A		Throughout	Cove Base Adhesive Yellow
B		↓	↓
100 A		Classroom A17 / Throughout	Dark/Black Cove Base
B		↓	↓
101 A		↓	↓ Dark Brown Adhesive only
B		↓	↓
102 B		Classroom C1 Closet	Gray Cove Base
103 B		↓	↓ Adhesive Yellow
104		Classroom B15	↓
105		↓	↓ Dark Brown Adhesive only
106		Throughout	Tan Cove Base
107		↓	↓
108		↓	↓ Dark Brown Adhesive
109 A		Classroom C1	Blue Cove Base
B		Science Classroom	↓
110 A		Classroom C1	↓ Dark Brown Adhesive outlay
B		5 Grade Classroom	↓ ↓
111 A B		Classroom D4 ↓	Vinyl ~~Strip~~ Floor Carpet Adhesive ↓

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072312 A		Classroom D4	Carpet Adhesive
B		↓	↓
113A		Library / Media	↓
B		↓	
114A		Planetarium	↓
B		↓	
115A		Conference Room	↓
B		Guidance Area	
116A		Corridors	Terrazzo Floors
B		↓	↓
117A		↓	↓ Mud Bed
B			↓
118A			↓ Black Material on Fiberboard at metal spacers
B		↓	
119A		Classroom A-4	12x12 self stick Floor Tile on
B		↓	↓ unit ventilator
120A		Classroom C11	old floor tile under wall to C11
B		↓	↓
121		↓	
122A		Planetarium Mech Rm	9x9 Floor Tile
B		Classroom A16 (under cabinet)	↓
C		Weight Room	
123A		~~Planetarium Mech Rm~~	Black Mastic
B		Classroom A16 (under Cabinet)	↓ ↓
C		Weight Room	

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023124A		Toilet near Classroom C11	OLD 12x12 Floor Tile
B		↓	↓
125A		↓	↓ Mastic
B		↓	↓
126		Classroom C3	Darker Floor Mastic
127		Cafeteria	↓
128		Office Storage	↓
129		Storage Rm adjacent custodia office	↓
130		Classroom A4 Storage	↓
131A		Classroom C-6 / Throughout	12x12 Gray / Light Blue Floor Tile
B		↓	↓
132A		↓	↓ Mastic
B		↓	↓
133A		Classroom B-14	12x12 White Floor Tile
B		↓ A-5	↓
134A		↓ B-14	↓ Black Mastic
B		↓ A-5	Gray Mastic
135A		Classroom A-14	12x12 Off White / Tan Floor Tile
B		↓ B-8	↓
136A		↓ A-14	↓ Black Mastic
B		↓ B-8	↓
137A		↓ C-4	12x12 Blue Floor Tile
B		↓ B-16	↓
138A		↓ C-4	↓ mastic (paint black)
B		↓ B-10	↓

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0723139A		Classrooms	12x12 Lighter Blue Floor Tile
B		"	"
140A		"	" Black Mastic
B		"	" "
141A		Classroom A15	Black Lab top Sink
B		"	"
142A		" A17	" Sink perimeter
B		" "	" " "
143A		" "	" Sink countertop on wheels
B		" "	" " "
144A		Classroom A-14	Lab Sink caulk perimeter gray mastic Sink
B		"	"
145A		" A-17	" perimeter
B	145AA 145BB	" "	Lab sink caulk student Desks
146A		" "	" on wheels
B		" "	" "
147A		Classroom C1	Lab countertops 'transite'
B		"	" "
148A		Classroom A-15	Lab countertops
B		" "	"
149A		" A-17 'student	"
B		" "	"
150A		" A-17 Perimeter	"
B		" "	"

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Sample #	HA #	Sample Location	Material Description
072315 1A		Classroom A-17	Brown/Black Lab Desk Rolling
B		↓	↓
152A		Classroom C5 computer room	Black table tops
B		↓ ↓	↓
153A		Classroom A13	Student lab table top
B		↓	↓
154		Classroom A17 Prep Rm	lab countertop
155		↓ A14	Student lab table top
156		↓ AH	rolling ↓ ↓
157A		↓ A-17	Lab test tube rack
B		↓ ↓	↓
158A		Main Office Corridor	~~Cove Base~~ ~~Mastic~~ Ceramic Wall Mud Bed
B		↓	↓ ↓
159A		↓	↓ Grout
B		↓	↓ ↓
160A		Kitchen office	Ceramic Floor Mud Bed
B		↓	↓ ↓
161A		↓	↓ Grout
B		↓	↓ ↓
162A		↓	Ceramic Cove Grout
B		↓	↓ ↓
163A		Kitchen Storage at freezer	Ceramic Floor Mud Bed
B		↓	↓ ↓
164A		↓	↓ Grout
B		↓	↓ ↓

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0723165A		Kitchen	Older Ceramic Tile Mud Bed
B		↓	↓ ↓
166A		↓	↓ Grout
B		↓	↓ ↓
167A		↓	newer ceramic tile mud bed
B		↓	↓ ↓
168A		↓	↓ Grout
B		↓	↓ ↓
169A		Gym, Toilet Rm (C-5), Corridor Practice A, Cust closet by cafe	Ceramic wall grout white
B		↓	↓
170A		Corridor - Practice Rm A	ceramic wall mudbed Gray
B		↓	↓ ↓ ↓ whitish
171A		Toilet Rm C-5	↓ ↓
B		Cust Closet by Cafe	↓ ↓
172A		Toilets, Lockers etc Blocker	Ceramic Floor grout Gray
B		↓ Gym Outs toilet door 9	↓ ↓ ↓ ↓
173A		↓	↓ Mud Bed ↓
B		↓ goes to	↓ ↓ ↓
174A		Green house	Ceramic Floor Mud Bed
B		↓	↓
175A		↓	↓ Grout
B		↓	↓ ↓
176 A/B		Locker Rm Equipment Rm	Mud Bed ↓ Gray ↓
177 A/B		↓	↓ whitish Layer? ↓

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Sample #	HA #	Sample Location	Material Description
0723178A		Inside Pool	Ceramic Floor Floor / Mud Bed
B			↓ / ↓
179A			↓ / Grout
B			↓ / ↓
180A			Wall / Mud Bed
B			↓ / ↓
181A			↓ / Grout
B			↓ / ↓
182A		Pool Deck	Ceramic Floor / MudBed
B			↓ / ↓
183A			↓ / Grout
B			↓ / ↓
184A			Ceramic Wall / mudbed
B			↓ / ↓
185A			↓ / Grout
B			↓ / ↓
186A			↓ / Glue Dots
B			↓ / ↓
187A		Pool	Wall Concrete
B		↓	↓
188A		↓	Floor Concrete
B		↓	↓
189A		Classroom C1	Block Wall
B		Planetarium Mech. Closet	↓

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Sample #	HA #	Sample Location	Material Description
872390A		Corridor (D-3)	smaller Block wall
B		↓	↓
191A		Classroom C1	Block wall Mortar
B		Planetarium Mech Rm	↓
C		Corridor near D-3	↓
192A		Elect/ Trash Room	Brick
B		↓	↓
193A		↓	Mortar
B		↓	↓
C		↓	↓
194A		Exterior	Brick
B		↓	↓
195A		↓	Mortar
B		↓	↓
C		↓	↓
196A		Interior	Rockwall Mortar
B		Exterior	↓ ↓
C		↓	↓
197A		Exterior (Baler Rm)	Fake Stucco wall /Adhesive
B		↓ ↓	↓
198A		↓ ↓	↓ wall caulking
+B		↓ ↓	↓
199A		↓	Rock Wall Black Dampproofing
B		↓	↓ Tar

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Sample #	HA #	Sample Location	Material Description
0713200A		Exterior	Black Dampproof paper (middle) tar Behind Brick wall
B		↓	↓
201A		↓	tar / paper (at Foundation)
B		↓	↓
202A		Above/Below window/Door	Stone Panels Stone mortar
B		↓	↓ ↓
C			
203A		↓	"Tvanside" Behind
B		↓	↓ ↓
204A			Black Paper behind
↓ B		↓	↓ ↓
205A		Pool	Perimeter Caulk Dside Pool (newer)
B		↓	↓
206A		↓	Perimeter Caulk - Outside Deck (newer)
B		↓	↓
207A		Classroom C-3	Unit Ventilator Caulk (newer)
B		↓ B-11	↓ ↓
208A		↓ C-2	Interior wall/wall Caulk (newer)
B		↓ A8	↓ ↓
209A		↓ A16	Int. wall/ceiling Caulk (Area)
B		↓ A17	↓
210A		↓ A10	↓ (white gray)
B		↓ B20	↓
211A		Corridor (Planetarium)	Display Case Caulk (cooler)
B		↓ (C1)	↓

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Sample #	HA #	Sample Location	Material Description
0723212A		Corridor - Main Office	Ceramic Wall Caulk new?
B		↓	↓
213 A		Teachers Room	Wall Caulk - Thick Newer
B		↓	
214 A		Planetarium Mech Closet	Wall Caulk Yellow OLDER
B		↓ ↓	↓
215 A		↓ Exterior	Dome Caulk newer?
B		↓ ↓	↓
216 A		↓ ↓	Rock wall Caulk (roof level)
B			↓
217 A		Cafe Ext (Roof Level)	Rock wall Caulk white newer at bottom
B		↓ ↓ ↓ ↓	↓
218 A			Expansion wall Grout board (mortar?)
B		↓ ↓ ↓ ↓	↓ ↓ ↓
219 A		Media Center / Library Ext	Roof Drain Caulking White newer
B		↓ ↓	↓
220 A		Exterior ~~Caulk Spec~~	Conduit Putty
B		↓	↓
221 A		↓	Wall Expansion Caulking Brown Red
B		↓	↓
222 A		↓	Vent Caulk at DT2 old?
B		↓	↓
223 A		↓ Upper Vent	Vent Caulk old?
B		↓ ↓	↓

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Sample #	HA #	Sample Location	Material Description
0723224A		Exterior	Roof vent Screw Caulk newer
B		↓	↓
225A		↓	Duct Seam Sealant newer
B		↓ Locker Room Roof ↓	↓
226A		Interior Main Entry	Door/window wall Gray Caulk newer ↓
B		↓ ↓	↓
227A		↓ Greenhouse	Window Glazing Older
B		↓	↓ ↓
228A		Exterior	↓ ↓
B		↓ ↓	
229A		↓ Stone panels/windows	Window/stone panel Caulk
B		↓	white ↓ on Panel
230A		↓ ↓	↓ Caulk
B		↓	↓
231A		↓	Door Window Glazing Red/Gray
B		↓	↓ ↓
232A		↓ media	Window Caulking Brown/Red
B		↓ pool	↓ majority
233A		↓ B4 Room	↓ White S
B		↓ by Door 3	↓ ↓ Ha
234A		↓	Door Caulk Dark Gray
B		↓	↓ ↓
235A		↓ Door 10	Door/window System Caulk white
B		↓ ↓	↓ ↓

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(some were some Brown/Red as wc)

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Sample #	HA #	Sample Location	Material Description
0723236		Exterior media/roof	Window Glaze old
237		media side	Door/window System Glaze old
238		Door 4	↓ gray
239		pool upper wide	Window Glaze old
240		pool hall	↓ ↓
241		pool near Door 19	↓ white newer
242		D4	↓ ↓
243		Rm A5	↓ older
244		Nurse office	↓ ↓
245A		Interior Door-3 also? C5 comp lab	Door Window Glaze gray Black Sketch
B		A-18	↓
246A		AV Room recordy B close	thick white old
B		↓	↓ ↓
247A		sporadic throughout A2 / corridor	old white Thin
B		Conf. Rm	↓ ↓
248A		Planetarium Rear	Door Caulk gray newer
B		↓	↓ ↓
249A		Pool	↓ ↓
B		↓	↓
250A		C5 corridor	Thin Hard granular
B		A-18 room	↓
251		A-15 prep	yellow hard?
252		A-16 prep	yellow soft
253		Double Door C9	gray soft
254		↓ C5	Brown / Red

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Sample #	HA #	Sample Location	Material Description		
0723255A		Interior Corridor Door 15 to outside	Door Caulk	Tan/Gray	newer
B			↓		
256A		C4 w/door perimeter	Window Caulk	Gray/Newer	
B			↓	↓	
257A		A17 prep Room	↓	or paint?	granular
B		↓			↓
258A		Coffee Bags Locker Rm	↓	Dark Gray	sqiuish
B					
C		Door/window wall to outside			
259		Classroom C-6	Window Glaze	old	
260		PA Room	↓	↓	
261A		Classroom C2	↓	old	(perimeter wall)
B		↓ C3	↓	↓	↓
262		Kitchen Office	↓		newer
263		AV Room	↓	OLD	
264		A13 to side facing	↓	↓	
265		A12 ↓	↓	↓	
266		Girls Locker Office	↓	Gray	
267		Pool office	↓	↓	old
268		A-14 prep	↓	↓	↓
269		A-1 perimeter	↓	↓	↓
270		media to corridor	↓	↓	↓
271		work Rm & adjacent	↓	tan/gray	↓
272		media corr. side	↓	↓	↓

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Sample #	HA #	Sample Location	Material Description
072327B		Interior (Corridors) Corridor	Window Glazing GLD
0723274		Door 13 Door/window System	↓
273		Door Doors/windows	↓ ? Black Granules
276A		Guidance to Corridors	Black Squishy
B		↓	↓
277A		Door/Wall System Corridors DRS	gray Squishy
B		↓ 16	↓
278A		Roofs Planetarium Dome	Black Paper under metal
B		↓	↓
279A		Pool / Media	Roof Fiebal & Flash Tar middle layer
B		↓	↓
280A		Gym Roof	~~Stucco~~ Gypsum Layer
B		↓	↓
281A			Black Layer
B			↓
282			Fietel Bottom Black Material on Deck
283A		B. Wall	Black damp material Behind Brick at vent
B		↓	↓
284A		Classroom portion	Fietel Bottom Layer Black Material on Deck
B		↓	↓
C			↓
D			↓
285		Boys Locker	↓
286A		Pool / Media	Bottom Layer Tar on concrete Deck
B			

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Sample #	HA #	Sample Location	Material Description
0723287A		Roofs	Field Top Rubber Rolled Seam Sealant
B		↓	↓
288A		↓ Media	White Caulk newer
B		↓	↓ ↓
289A		Gym	Bottom Layer Perimeter Flashing
B		↓	↓ Black ↓
290A			A
B			B
C			D
D			E
291			A Penetration Flashing
292			A
293			B
294			D
295			L

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Appendix B

XRF Field Data Sheets

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name: Town of Trumbull

Site Address: Hillcrest middle School Trumbull

Project No. 140325901

Survey Date 7/21/25

Total Assays Reported:

Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
1	Calibration							0.9	
2	"							0.9	
3	"							1.0	
4	Wall	CMU	Light Blue	main office				-0.4	
5	Wall	CMU	Light Blue	main office				-0.3	
6	Door	~~Wood~~ Wood	~~Brown~~ Brown	main office				-0.1	
7	Door Frame	metal	Brown	main office				+0.5	
8	Hall	Ceramic	Brown/white	main office Outside				0.1	
9	~~Ceramic~~ Wall	Ceramic	Cream	main office Bath				-0.1	
10	Wall	CMU	white	main office Bath				-0.2	
11	Radiator	metal	Brown	main office Bath				0.1	
12	Door Frame	metal	Brown	main office Bath				0.4	
13	Door	wood	Brown	main office Bath				-0.1	
14	Wall	CMU upper	White	Gym outside				-0.2	
15	"	CMU Lower	tan	"				-0.2	
16	Wall	CMU	Blue	Boys Locker Rm				-0.3	
17	Locker	metal	Blue	"				0.0	
18	Locker Frame	metal	tan	"				0.1	
19	Ceiling	Plaster	White	"				-0.4	
20	Floor	Ceramic	Tan	Boys Locker Rm.				0.0	
21	Divider	wood	L. Blue	Gym				0.1	
22	Divider	wood	white	Gym				0.0	
23	Arch/support	wood	Dark Brown	Gym				0.1	
24	Bleacher	wood	Li. Brown	"				-0.1	
25	Floor	wood	L. Brown	"				0.2	

Notes: N = Negative
P = Positive

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name:

Site Address

Project No.

Survey Date

Total Assays Reported:

Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
26	Terracotta tile	Ceramic	Brown/Red	Corridor adjacent Door 19				-0.1	
27	Wall	Ceramic	Blue/white	Pool Room			-	-0.1	
28	Floor	Ceramic	Blue/white	"				0.0	
29	Corridor Radiator	Metal	Brown	outside ~~Pool~~ Cafe				0.0	
30	Wall upper	CMU	off white	outside Cafe				-0.3	
31	Wall Lower	CMU	~~Pan~~	"				-0.3	
32	Acoustical wall	metal	Brown/gold	Practice A				-0.1	
33	Door Frame	"	Brown	"				0.1	
34	Door	wood	Brown	"				-0.1	
35	Terrazzo	Rock	Grey	outside Cafe				0.1	
36	~~Roof~~ Wall Lower	CMU	cream	Cafe				-0.4	
37	~~Roof~~ Wall Upper	CMU	Brown	Cafe				-0.3	
38	window Frames	metal	Brown	Cafe				0.3	
39	Ladder	metal	yellow	Custodian office				2.0	(P)
40	Radiator	metal	off white	Custodian Bathroom				0.1	
41	Stall	metal	Blue	"				0.3	
42	Door	metal	Red	Boiler Rm				0.1	
43	Ceiling	Plaster	off white	Corridor outside Custodian office				-0.4	
44	Gypsum wall	gypsum	off white	"				0.2	
45	Ceiling metal	metal	off white	Corridor outside Cafe				-0.1	
46	Roof Deck	metal	Gray	"				0.0	
47	Truss Beam	metal	Red	"				0.1	
48	Ceiling	Plaster	off white	Kitchen				-0.2	
49	Wall	CMU	yellow	"				-0.2	
50	Gypsum wall	gypsum	yellow	"				-0.1	

Notes: N = Negative
P = Positive

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name:

Site Address

Project No.

Survey Date

Total Assays Reported:

Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
51	Floor	Ceramic	orange/tan	Kitchen				0.1	
52	Column	metal	Gray	Kitchen				0.3	
53	Wall	CMU	Purple	Kitchen				-0.2	
54	Locker	metal	L. Blue	Outside Rm B3				0.0	
55	Wall	CMU	off white	Rm B4				0.3	
56	Ceiling	metal	white	Rm B4				0.1	
57	Unit Ventilator	metal	tan	Rm B4				0.3	
58	Radiator	metal	white	Rm B4				0.2	
59	Locker	metal	L. Blue	Corridor B12				0.0	
60	Ceiling	metal	white	Rm B9				0.1	
61	wall	CMU	white	Rm B9				0.1	
62	Unit Ventilator	metal	tan	B9				0.3	
63	Radiator	metal	white	Rm B9				0.1	
64	Ceiling Frame	metal	white	Outside C9				0.0	
65	Upper wall	CMU	off white	Outside C9				-0.1	
66	Lower wall	CMU	tan	Outside C9				-0.2	
67	Terrazzo	Rock	Gray/tan	Outside C11				0.0	
68	Roof Deck	metal	Tan	Boys Bathroom near C-5				0.2	
69	wall	Ceramic	tan	"				0.1	
70	Toilet	Ceramic	white	"				-0.4	
71	Sky Light	metal	Green	Corridor Outside C-1				0.0	
72	Sky Light	metal	Green	Corridor Outside H-14				0.0 0.1	
73	I Beam	metal	Green	"				0.3	
74	Roof Deck	metal	Gray	Outside Guidance office				0.0	
75	Truss Beam	metal	Red	"				0.0	

Notes: N = Negative
P = Positive

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name:

Site Address

Project No.

Survey Date

Total Assays Reported:

Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
76	Exterior OverHang	wood	White	outside Guidance				0.2	
77	Over Hang Support Column	metal	Brown	"				0.7	
78	Window Frame	metal	Brown	"				0.1	
79	Over Hang Support Colum	metal	Brown	outside Gym				0.6	
80	Window Frame	metal	Brown	outside Nurse office				0.0	
81	Overhang White Beam	metal	White	Walkway / overhang Front				0.2	
82	"	"	"	"				0.4	
83	Exterior Overhang	wood	White	outside gym				0.8	
84	Canopy Courtyard	wood	off White	Courtyard				0.0	
85	"	"	"	"				"	
86	Light Post	metal	Brown	Courtyard				0.2	
87	"	"	"	"				0.0	
88	Door Frame Arch	Concrete	Gray	Courtyard				0.2	
89	"	"	"	"				0.1	
90	Wall	CMU	Blue	Library				-0.1	
91	Wall gypsum	gypsum	Blue	Library				-0.1	
92	Wall	CMU	Dark Blue	Planetarium				-0.2	
93	"	"	"	"				-0.1	
94	Planetarium wall	Plaster	Black	"				0.0	
95	"	"	"	"				-0.1	
96	Planetarium Shell	metal	White	Planetarium				0.0	
97	"	"	"	"				-0.2	
98	Pool arches	Concrete	White	Ext. Entry				0.1	
99	"	"	"	"				0.1	
100	Gate	metal	yellow	Ext. By pool				0.1	
101	"	"	"	"				0.0	

Notes: N = Negative
P = Positive

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name:

Site Address

Project No.

Survey Date

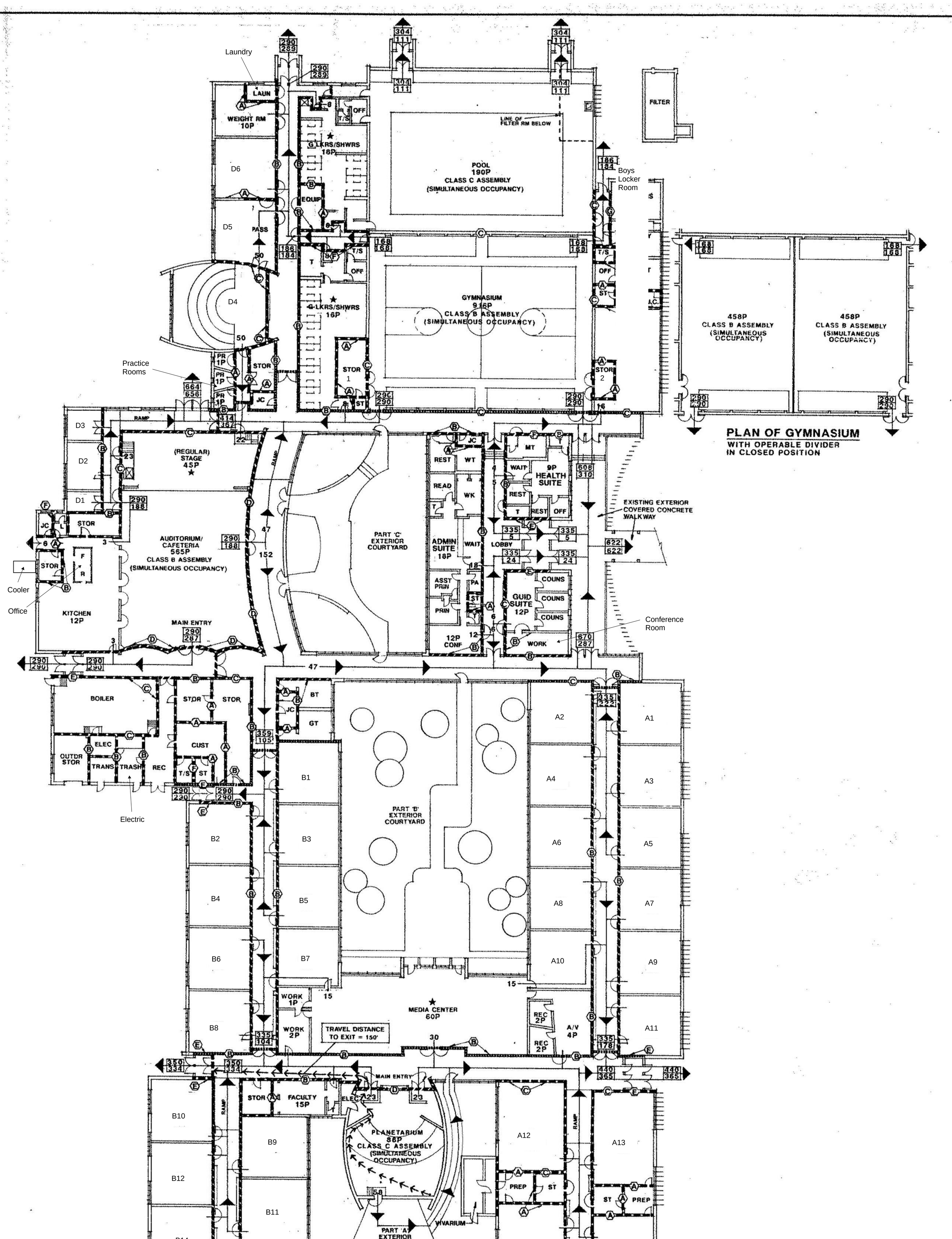
Total Assays Reported:

Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
102	Ext. Door	Metal	Red	Door 12				0.1	
103	Ext Door Frame	"	"	"				0.3	
104	Ext Door	"	Brown	Door 10				0.0	
105	Ext Door Frame	"	"	"				0.1	
106	I-Beam Barrier	"	Yellow	@ power generator				1.2	
107	Boiler Room Door	"	Red	Boiler Room Exterior				-0.1	
108	Boiler Room Door Frame	"	"	"				-0.1	
109	Boiler Room Exterior wall	"	"	"				-0.1	
110	Calibration							~~1.0~~ 1.1	
111	"							1.1	
112	"							1.0	

Notes: N = Negative
P = Positive

Appendix C

Building Drawing


Laundry
Practice Rooms
Cooler
Office
Electric
Boys Locker Room
Conference Room
LAUN
WEIGHT RM 10P
D6
D5
D4
D3
D2
D1
PASS
STOR
JC
OFF
T/S
G LKRS/SHWRS 16P
EQUIP
PR 1P
PR 1P
PR 1P
JC
STOR
STOR 1
STOR 2
LINE OF FILTER RM BELOW
FILTER
POOL 190P CLASS C ASSEMBLY (SIMULTANEOUS OCCUPANCY)
GYMNASIUM 915P CLASS B ASSEMBLY (SIMULTANEOUS OCCUPANCY)
458P CLASS B ASSEMBLY (SIMULTANEOUS OCCUPANCY)
458P CLASS B ASSEMBLY (SIMULTANEOUS OCCUPANCY)
PLAN OF GYMNASIUM
WITH OPERABLE DIVIDER
IN CLOSED POSITION
RAMP
(REGULAR) STAGE 45P
AUDITORIUM/ CAFETERIA 565P CLASS B ASSEMBLY (SIMULTANEOUS OCCUPANCY)
KITCHEN 12P
MAIN ENTRY
PART 'C' EXTERIOR COURTYARD
REST
WT
READ
WK
ADMIN SUITE 18P
WAIT
ASST PRIN
PRIN
PA
12P CONF
9P HEALTH SUITE
REST
REST
OFF
LOBBY
GUID SUITE 12P
COUNS
COUNS
COUNS
WORK
MT
EXISTING EXTERIOR COVERED CONCRETE WALKWAY
BORLER
OUTDR STOR
ELEC
TRANS
TRASH
REC
CUST
BT
GT
PART 'B' EXTERIOR COURTYARD
B1
B2
B3
B4
B5
B6
B7
B8
B10
B12
B14
B16
B18
B20
B9
B11
B13
B15
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
WORK 1P
WORK 2P
MEDIA CENTER 60P
REC 2P
REC 2P
A/V 4P
TRAVEL DISTANCE TO EXIT = 150'
STOR
FACULTY 15P
ELEC
PLANETARIUM 86P CLASS C ASSEMBLY (SIMULTANEOUS OCCUPANCY)
PART 'A' EXTERIOR COURTYARD
VIVARIUM
PREP
ST
STOR
PREP
C11
C9
C7
C5
C6
C4
C2
C3
C1
STOR
STOR
PIN
SPR
● SCIENCE LABS USING HAZARDOUS CHEMICALS.

Appendix D

Langan Certifications and Accreditations

LANGAN

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A

ASBESTOS CONSULTANT-INSP/MGMT PLANNER

MATTHEW A. MYERS

CERTIFICATE NO.
000041

CURRENT THROUGH
04/30/26

VALIDATION NO.
03-189921

SIGNATURE

MANISHA JUTHANI-MD, COMMISSIONER

QuES&T

Quality Environmental Solutions & Technologies, Inc.
1376 Route 9, Wappingers Falls, NY 12590
Phone (845) 298-6031 Fax (845) 298-6251

HEREBY CERTIFIES THAT

MATTHEW MYERS

HAS SUCCESSFULLY COMPLETED A TRAINING SEMINAR IN:

NYS/EPA INSPECTOR REFRESHER

MEETING THE REQUIREMENTS OF NYSDOH 10 NYCRR, PART 73 AND TSCA TITLE II AND HAS BEEN AWARDED THIS CERTIFICATE BY:

Michael E. O'Rourke

MICHAEL O'ROURKE
TRAINING DIRECTOR

NOTE: Official record of successful completion is DOH 2832 Certificate of Completion of Asbestos Safety Training

NOTE: DOH 2832 - A $20 fee shall be charged for replacement of Certificate of Completion DOH 2832

ON THIS DATE: 03/05/2025

CERTIFICATE NUMBER:972235 **EXPIRATION DATE: 03/05/2026**

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Dear HILTON HERNANDEZ,

Attached you will find your validated certificate for the coming year. Should you have any questions about your certificate renewal, please do not hesitate to write or call:

Department of Public Health
P.O. Box 340308
M.S.#12MQA
Hartford, CT 06134-0308

(860) 509-7603
oplc.dph@ct.gov
www.ct.gov/dph/license

Sincerely,

MANISHA JUTHANI, MD, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

1000237-0000241-0000001 of 0000001-C01-a1d00101-0764-00239

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-178495	000424	01/31/26

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A
ASBESTOS CONSULTANT-INSPECTOR

HILTON HERNANDEZ

CERTIFICATE NO.
000424

CURRENT THROUGH
01/31/26

VALIDATION NO
03-178495

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

INSTRUCTIONS:

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2. Display the large card in a prominent place in your office or place of business.
3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
4. The employer's copy is for persons who must demonstrate current licensure/certification in order to retain employment or privileges. The employer's card is to be presented to the employer and kept by them as a part of your personnel file. Only one copy of this card can be supplied to you.

WALLET CARD

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-178495	000424	01/31/26

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

CERTIFICATE OF ACHIEVEMENT

This certifies that

Hilton Hernandez

has successfully completed the

4 Hour Asbestos Site Inspector Refresher Training
Asbestos Accreditation Under TSCA Title II
40 CFR Part 763



conducted by:
ATLAS Technical Consultants, LLC
73 William Franks Drive
West Springfield, MA 01089
(413) 781-0070

Training held via Live Webinar

Exam Score: 92%

Principal Instructor: Thomas Dion

March 20, 2025
Date of Course

March 20, 2026
Expiration Date

Regional Training Director: Judith LaVallee

SIAR - 7995
Certificate Number

March 20, 2025
Examination Date

Dear HILTON HERNANDEZ,

Attached you will find your validated certificate for the coming year. Should you have any questions about your certificate renewal, please do not hesitate to write or call:

Department of Public Health
P.O. Box 340308
M.S.#12MQA
Hartford, CT 06134-0308

(860) 509-7603
oplc.dph@ct.gov
www.ct.gov/dph/license

Sincerely,

MANISHA JUTHANI, MD, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

1001880-0001887-0000001 of 0000001-C01-a1d00101-0864-01883

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A
LEAD INSPECTOR RISK ASSESSOR

HILTON HERNANDEZ

CERTIFICATE NO
002231

CURRENT THROUGH
01/31/26

VALIDATION NO
03-185970

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-185970	002231	01/31/26

PROFESSION
LEAD INSPECTOR RISK ASSESSOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

INSTRUCTIONS:

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2. Display the large card in a prominent place in your office or place of business.
3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
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WALLET CARD

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-185970	002231	01/31/26

PROFESSION
LEAD INSPECTOR RISK ASSESSOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

CERT#: L-600-Virtual.1489

CHEMSCOPE TRAINING DIVISION

LEAD INSPECTOR/RISK ASSESSOR REFRESHER
8-HOUR TRAINING CERTIFICATE

Hilton Hernandez

21 Alderson Avenue, Plainville CT

Has attended an 8-hour course on the subject discipline on
02/25/2025 and passed a written examination.

The above individual has successfully completed the above training course approved in accordance with the Department of Public Health Standards established pursuant to Section 20-477 of the Connecticut General Statutes. Course topics include all required topics of State of Connecticut DPH and EPA.

Under civil and criminal penalties of law for the making or submission of false or fraudulent statements or representations (U.S.C. 1001 and 15 U.S. C. 2615), I certify that this training complies with all applicable requirements of Title IV of TSCA, 40 CFR part 745 and any other applicable Federal, State or local requirements.

Examination Score: 100%
Exam Date: 02/25/2025
Expiration Date: 02/25/2026

Daniel Sullivan
Training Manager

Chem Scope, Inc.
15 Moulthrop Street
North Haven CT 06473
Phone: 203.865.5605
www.chem-scope.com

1000976 SP 0664 -C01-P00978-I

JARED L GORBORINO
190 NORTHVIEW DR
SOUTH WINDSOR CT 06074-3519

Dear JARED L GORBORINO,

Attached you will find your validated certificate for the coming year. Should you have any questions about your certificate renewal, please do not hesitate to write or call:

Department of Public Health
P.O. Box 340308
M.S.#12MQA
Hartford, CT 06134-0308

(860) 509-7603
oplc.dph@ct.gov
www.ct.gov/dph/license

Sincerely,

MANISHA JUTHANI, MD, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
JARED L GORBORINO

VALIDATION NO.	CERTIFICATE NO.	CURRENT THROUGH
03-173142	001240	12/31/25

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A
ASBESTOS CONSULTANT-INSPECTOR

JARED L GORBORINO

CERTIFICATE NO.
001240

CURRENT THROUGH
12/31/25

VALIDATION NO.
03-173142

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

INSTRUCTIONS:

1. Detach and sign each of the cards on this form
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3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
4. The employer's copy is for persons who must demonstrate current licensure/certification in order to retain employment or privileges. The employer's card is to be presented to the employer and kept by them as a part of your personnel file. Only one copy of this card can be supplied to you.

WALLET CARD

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
JARED L GORBORINO

VALIDATION NO.	CERTIFICATE NO.	CURRENT THROUGH
03-173142	001240	12/31/25

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

ATLAS

CERTIFICATE OF ACHIEVEMENT

This certifies that

Jared Gorborino

has successfully completed the

24 Hour Asbestos Site Inspector Initial Training
Asbestos Accreditation Under TSCA Title II
40 CFR Part 763



conducted by:
ATLAS Technical Consultants, LLC
73 William Franks Drive
West Springfield, MA 01089
(413) 781-0070

Gregory J. Morsch

Principal Instructor: Gregory Morsch

August 26-28, 2024
Date of Course

August 28, 2025
Expiration Date

Gregory J. Morsch

Regional Training Director: Gregory Morsch

SI-2188
Certificate Number

August 28, 2024
Examination Date

SOIL MANAGEMENT PLAN

For

HILLCREST MIDDLE SCHOOL
530 Daniels Farm Road
Trumbull, Connecticut

Prepared for:

TKSP Studio
One Hartford Square West
Building 1-203
Hartford, CT 06106

Prepared By:

Langan, CT, Inc.
555 Long Wharf Drive
New Haven, Connecticut 06511

DRAFT

David V. Granucci, LEP
Senior Project Engineer

DRAFT

Jamie P. Barr, LEP
Principal/Vice President

March 2026
Langan Project No. 140325901

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ATTACHMENTS

TABLES

Table 1 Soil Analytical Results Summary (December 2025)

FIGURES

Figure 1 Site Location Map
Figure 2 Phase II Investigation Map

APPENDICES

Appendix A Previous Report

DRAFT

1.0 INTRODUCTION

This Soil Management Plan (SMP) has been prepared on behalf of TKSP Studio ("Client") for renovation and expansion of Hillcrest Middle School at 530 Daniels Farm Road in Trumbull, Fairfield County, Connecticut (hereafter referred to as the "Site"). This SMP describes the procedures for the handling and management of soils for the proposed project. Specific components of this plan include, but are not limited to excavation, documentation and management, offsite soil recycling/disposal, onsite soil reuse, stockpiling of excavated soils, and import of backfill soil.

The Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulations (RSRs) do not apply to the Site unless and until the Site is entered into a formal CTDEEP remediation program. However, the RSRs can serve as suitable benchmarks for analyses and are helpful for the purposes of characterizing soil for potential offsite receiving facilities, and for assisting with managing the risk of improper management of potentially contaminated soils. Soil management activities will follow best management environmental practices, using the RSRs as a guide, for the duration of this proposed redevelopment project.

1.1 Site Description

The Site is part of an approximately 88-acre parcel identified by the Trumbull Tax Assessor as Parcel ID 12708 (530 Daniels Farm Road). The parcel consists of Hillcrest Middle School (the Site) in the southwest and Trumbull High School in the northeast, and surrounding athletic fields and courts. The Site is developed with a 112,342-square foot school building and associated asphalt parking areas, landscaped areas and grass-covered athletic fields. The location of the Site is depicted on Figure 1 (Site Location Map).

1.2 Purpose

The purpose of this SMP is to provide guidance and procedures for documenting and managing the excavation and export of soils (see Section 2.1 for classification definitions), import of soil for backfill, construction of stockpiles, and re-use of onsite soil during the Hillcrest Middle School redevelopment project, in accordance with CTDEEP regulations.

1.3 Proposed Redevelopment

As it pertains to this SMP, the Hillcrest Middle School development project includes the phased construction of a new middle school and subsequent demolition of the existing school. Also included are site parking, landscaping, new playing fields, site lighting, stormwater management, and utility improvements to support the project. The extents of the work area are shown in the 26 March 2026 Phase I drawings.

DRAFT

It is our understanding that the majority of soils generated during excavation activities will be reused onsite; however, if there are soils that cannot be reused onsite, soils shall be recycled or disposed of at an offsite facility permitted to accept such soil (refer to Sections 2.1 and 2.8).

1.4 Limited Phase II Environmental Site Investigation

Langan was retained by Trumbull Public Schools to perform a Phase II Environmental Site Investigation (ESI) for the Site, targeting the seven areas of concern (AOCs) and Recognized Environmental Concerns (RECs) at the Site identified in a Phase I Environmental Site Assessment (ESA) prepared by Eagle Environmental, Inc. (Eagle) and dated June 2024. The AOCs and RECs identified by Eagle during their Phase I ESA consist of the following:

- AOC-1/REC-1: Historical Technical Auto Repair Classroom
- AOC-2/REC-2: 10,000-Gallon Fuel Oil Underground Storage Tanks (USTs)
- AOC-3: Flammable Cabinet and Drum Storage
- AOC-4: Suspected Transformer Room
- AOC-5: Diesel Generator
- AOC-6: Former Paint-Mixing and Spray Booth
- AOC-7: Historical Agricultural Use

The investigation activities described herein were completed in general accordance with the Connecticut Department of Energy and Environmental Protection (CTDEEP) 2007 Site Characterization Guidance Document and Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113.

The Phase II ESI was conducted between 6 and 7 August 2025, and included the completion of a geophysical survey, a visual inspection of AOCs 3 through 5 (conducted to determine whether future subsurface investigation would be needed at one or more of those AOCs), advancement of five soil borings in the vicinity of AOCs 1 and 2, and collection and analysis of 18 grab soil samples and one duplicate soil sample (one associated with AOC-1, two with AOC-2, three with AOC-6 and the remaining 12 with AOC-7).

Visual Observations of AOCs

Based on the visual condition of AOCs 3 through 5, Langan concluded there was no evidence that releases had occurred in relation to these AOCs. As a result, these AOCs were not investigated.

Soil Investigation of AOCs 1 and 2

Five soil borings (LB-01, LB-01A, LB-01B, LB-02 and LB-03) were advanced by Lakewood Environmental Services Corp. (Lakewood), LLC of Smithtown, New York under the supervision

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of a Langan field engineer on 6 August 2025. Boring locations were selected to evaluate the subsurface conditions around AOC-1/REC-1 (Historical Technical Auto Repair Classroom) and AOC-2/REC-2 (historical USTs). Borings LB-01, LB-01A and LB-01B were advanced to assess AOC-1/REC-1 and to attempt to install an overburden groundwater monitoring well. Soil borings LB-01A and LB-01B were offsets of LB-01 advanced in attempt to find overburden groundwater. Soil borings LB-02 and LB-03 were advanced in the area of the historical USTs (AOC-2/REC-2).

The five soil borings were completed using a Geoprobe direct-push drill rig. Soil samples were collected from each environmental boring using a 5-foot macrocore sample barrel with dedicated acetate liners. Soil samples retrieved from each boring were visually classified for soil type, grain size and texture. Each soil sample was screened for total organic vapors using a PID equipped with a 10.6-electron volt (-eV) lamp. Soil samples were also evaluated for visual and olfactory indications of environmental impact. Refusal was encountered between 4.5 and 11 feet below ground surface at all five borings. Groundwater was not encountered in any of the boreholes. A Phase II Investigation Map is provided as Figure 2.

To assess AOC-2/REC-2, one discrete (grab) soil sample (composed of 2 x 8 oz. lab-supplied jars and one Terracore set) were collected from each of the two borings in the area of the former USTs (LB-02 and LB-03) at depths of approximately 6.5 to 8 feet below ground surface (bgs) based on anticipated potential release depth and tank bottom depths. To assess AOC-1/REC-1, a grab soil sample was collected from LB-01 at a depth of approximately 2.5 to 4.5 feet bgs, and to correspond to the maximum depth of overburden soils before refusal was encountered. Samples were submitted to York Analytical Laboratory (York), a Connecticut-certified laboratory, for the following analyses:

- Volatile organic compounds (VOCs) (EPA method 8260C) (Samples LB-01 through LB-03)
- Semi-volatile organic compounds (SVOCs) (EPA method 8270D) (Sample LB-01)
- Polycyclic aromatic hydrocarbons (PAHs) (EPA method 8270D) (Samples LB-02 and LB-03)
- ETPH (CT ETPH method) (Samples LB-01 through LB-03)

Samples were collected and analyzed in accordance with Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113. Quality assurance and quality control (QA/QC) samples included the collection of one duplicate soil sample and one trip blank.

VOCs, SVOCs and ETPH were not detected at concentrations exceeding the laboratory reporting limits in soil sample LB-01. VOCs, PAHs and ETPH were not detected at concentrations exceeding the laboratory reporting limits in soil samples LB-02 or LB-03. A summary of sample results is provided as Table 1.

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Soil Investigation of AOCs 6 and 7

Fifteen shallow soil samples (SS-01 through SS-03, and AG-01 through AG-12) were collected from shallow soil boring advanced by Lakewood using a hand auger to 2 feet bgs. The shallow soil borings were advanced under the supervision of a Langan field engineer on 6 and 7 August 2025. Soil samples were collected by Langan field staff.

The hand auger locations for soil samples SS-01 through SS-03 were selected to evaluate the shallow subsurface conditions associated with AOC-6 (former paint-mixing and spray booth). These locations consisted of the soil immediately beneath a suspected former exhaust penetration on the north side of the building (SS-01), a location of suspected surficial ground disturbance from the dumping of classroom or other wastewater (SS-02) and beneath the downspout of the roof leader associated with rooftop stormwater drainage in the area of AOC-6 (SS-03).

The hand auger locations for soil samples AG-01 through AG-12 were selected to evaluate the surrounding grass-field areas of the Site for potential residual impacts from pesticides associated with the Site's reported historical use as agricultural land (AOC-7). The AOC-7 sample locations were spread throughout the grassy areas of the Site to provide sufficient coverage for this purpose.

Shallow soil samples were collected from each hand auger boring. The shallow borings were installed using a steel hand auger that was decontaminated between each use. Each soil sample was screened for total organic vapors using a PID equipped with a 10.6-electron volt (-eV) lamp. Soil samples were also evaluated for visual and olfactory indications of environmental impact.

One discrete (grab) soil sample (composed of 2x 8-oz. lab-supplied jars and one Terracore set) were collected from each of the shallow borings. Shallow soil samples were submitted to York Analytical Laboratory (York), a Connecticut-certified for one or more of the following analyses, as noted:

- VOCs (EPA method 8260C) (Samples SS-01 through SS-03)
- ETPH (CT ETPH method) (Samples SS-01 through SS-03)
- Pesticides (EPA method 8081B) (Samples AG-01 through AG-12)
- Total metals (Samples SS-01 through SS-03)

Quality assurance and quality control (QA/QC) samples included the collection of one duplicate soil sample and one trip blank. Additionally, samples LB-02 and LB-03 were collected and analyzed in accordance with Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113, and the CTDEEP Site Characterization Guidance Document (SCGD).

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VOCs were not detected at concentrations exceeding laboratory reporting limits in soil sample SS-01, SS-02 or SS-03. Total metals, including arsenic, barium, beryllium, cadmium, lead, mercury and vanadium, were detected in one of more of samples SS-01, SS-02 and/or SS-03 at concentrations exceeding laboratory reporting limits but below applicable CTDEEP RSRs soil criteria. The pesticide total DDT was identified at concentrations exceeding the Pollutant Mobility Criteria for GA/GAA Areas (GA/GAA PMC) in soil samples AG-01, its duplicate (DUP) and AG-04. Total DDT was detected in AG-12 at a concentration exceeding the laboratory reporting limit but below applicable CTDEEP RSRs soil criteria. No other pesticides were detected at concentrations above the laboratory reporting limits. A summary of sample results is provided as Table 1.

Based on these findings, Langan did not recommend additional investigation at the Site.

Langan was not provided with a copy of Eagle's June 2024 Phase I ESA; however, the draft Phase II ESI (dated 16 December 2025) is included as Appendix A.

2.0 SOIL MANAGEMENT PLAN

This section presents the procedures for the handling and management of soils for the proposed development project. Specific components of this plan include but are not limited to excavation, documentation and management, offsite soil disposal, onsite soil re-use and import of backfill. This plan is based on current limited knowledge of Site conditions and may be augmented with additional data collected during the proposed redevelopment activities.

2.1 Soil Classification Definitions

Soil to be excavated for redevelopment of the Site is expected to meet one of the definitions noted below:

Natural or Native Soil – Soil in which all substances naturally occurring therein are present in in the environment in forms that have not been influenced by human activity. For the purposes of this project, natural soils are suitable for unrestricted reuse on- or offsite, assuming the soil also meets geotechnical specifications.

Clean Fill – As defined by the CTDEEP Solid Waste Regulations: "(1) natural soil, (2) rock, brick, ceramics, concrete, and asphalt paving fragments which are virtually inert and pose neither a pollution threat to ground or surface waters nor a fire hazard and (3) polluted soil as defined in subdivision (65) of subsection (a) of section 22a-133k-1 of the Regulations of Connecticut State Agencies … which soil has been treated to reduce the concentration of pollutants to levels which do not exceed the applicable pollutant mobility criteria (PMC) and direct exposure criteria (DEC) established in sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies (and which soil is reused in accordance with

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R.C.S.A. subdivision (3) of subsection (h) of section 22a-133k-2 of such regulations." Soils imported to the Site must meet the definition of clean fill.

Polluted Soils – According to the CTDEEP RSRs, polluted soil is soil affected by a release of a non-naturally occurring substance at a concentration above the laboratory analytical detection limit for such substance, but below the applicable CTDEEP RSR criteria in accordance with RCSA 22a-133k-1(a)(65). Polluted soil falls within the definition of clean fill (see above).

Contaminated Soils – Soils containing concentrations of compounds that exceed CTDEEP RSR criteria.

Contaminated Debris – Construction, building or other debris that is visibly contaminated or contains concentrations of compounds that exceed CTDEEP RSR criteria. Unless otherwise indicated by the Client and Langan, contaminated debris cannot be reused onsite and must be disposed of at an offsite disposal facility.

Hazardous Materials – Includes all soil/fill soil that exceeds regulatory limits for hazardous substances as defined in 40 CFR, Part 261.20 Subpart C – Characteristics of Hazardous Waste. This soil cannot be reused onsite and must be disposed of at an offsite disposal facility. Based on previously completed soil investigation and remediation, soils meeting the definition of hazardous materials are not expected to be encountered at the Site during redevelopment.

Unforeseen Conditions – An unforeseen condition is a condition not previously ascertained or anticipated by Langan or the Client.

Using these standard definitions, the following group classifications were developed for this development project:

Group 1: Clean Fill

- Group 1-A: Naturally deposited soils or fill soils that contain no detectable substances other than metals at or below background conditions typical for natural soils and meet the Residential Direct Exposure Criteria (RDEC) and GA/GAA PMC. These soils are suitable for unrestricted reuse on- or offsite, assuming the soil also meets geotechnical specifications.
- Group 1-B: Naturally-deposited soils or placed fill that contain substances at concentrations above laboratory detection limits ("polluted soil"), but below CTDEEP RDEC and GA/GAA PMC and that are not otherwise a hazardous waste; in accordance with the RSRs (RCSA 22a-133k-2(h)(3)) and Connecticut's Solid Waste Regulations (RCSA Section 22a-209-1 to 22a-209-17). These soils are suitable for unrestricted

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reuse onsite (if proposed by the Contractor and accepted in writing by the Client and Langan) and may be managed offsite at a disposal facility permitted to accept such soil. Non-regulated facilities may require approval by CTDEEP to accept polluted soils.

Group 2: Contaminated Soils

- Group 2: Soils that contain substances at concentrations above the applicable RDEC or GA/GAA PMC, and that are not otherwise a hazardous waste. Removal of soil exceeding RSR criteria is recommended for this project; however, soils with asphalt debris that exceed RDEC and GA/GAA PMC but are below the Industrial/Commercial Direct Exposure Criteria (I/C DEC) may be reused onsite below asphalt parking or buildings if proposed by the Contractor and accepted in writing by the Client and Langan. Other contaminated soils should be managed/disposed at an offsite disposal facility permitted to accept such soil. If excess contaminated soils are slated for removal from the Site, additional characterization may be necessary. Any soil exported should be managed/disposed at an offsite disposal facility permitted to accept such soil.

Group 3: Hazardous/Other Soils

- Group 3: Soils that are considered a hazardous waste, or that otherwise do not meet the definition of a Group 1 or 2 soil, shall not be re-used at the Site, and must be properly disposed of offsite at a licensed disposal facility. Hazardous materials were not identified at the site during the Phase II investigation and are not expected to be encountered during redevelopment based on the previous reports.

Soils associated with the historical agricultural usage of the Site that were found to contain concentrations of pesticides above GA/GAA PMC are identified as Group 2 soils. If necessary, these soils may be analyzed by Synthetic Precipitation Leaching Procedure (SPLP), which may allow them to be reclassified as Group 1-B.

Group Soil Handling

Excavated soils classified as Group 1-A may be reused across the Site with no restrictions. Excavated soils classified as Group 1-B, that have originated on the Site, can be reused onsite for construction purposes upon approval by the Client provided that the following conditions are met:

- Such soil is not placed below the water table;
- Such soil is not placed in an area subject to erosion, and
- Best efforts are made to place these soils below a minimum of 12-inches of Clean Fill as defined above or an impervious surface (i.e. asphalt, concrete, etc.)

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Group 2 soil exceeding the I/C DEC is not suitable for reuse onsite and should be disposed of at an appropriate permitted/licensed offsite disposal facility. Group 2 soils exceeding the RDEC but below the I/C DEC can be handled as described above in Group 1-B.

Group 3 soil, if encountered, shall not be reused under any circumstance, and should be disposed offsite at a properly permitted/licensed hazardous waste disposal facility.

Please note that soils may require reclassification prior to or during excavation depending on the results of field screening (using a PID), visual/olfactory observations, and/or results of additional laboratory chemical testing performed.

2.2 Utility Markout

Buried utilities (e.g., electric, gas, water, sewers, telephone, etc.) should be located by the respective utilities. Connecticut Call-Before-You-Dig (CBYD) should be contacted by the Contractor prior to intrusive activities on the Site.

2.3 Erosion Control Measures

Stormwater pollution prevention and erosion control measures shall be implemented as specified in the project construction documents and in accordance with local, state, and federal regulations.

2.4 Dust and Odor Control Measures

The Contractor shall always ensure all stockpiles, haul roads, access roads and equipment storage areas are either covered or free from visible dust that would cause a hazard or nuisance. The Contractor shall also continuously monitor the exterior of the work area for visible emissions of water, dust, or debris. The Contractor shall carry out dust and particulate control measures as necessary to prevent the generation of dust and particulate matter during project activities. Dust and debris shall be confined within the work area boundaries and temporarily uncovered stockpiles should be kept moist as a measure to control dust generation.

Methods that may be applied to control dust emissions both on- and offsite may include, but are not limited to:

- Installing gravel pads at vehicle egress points.
- Application of wetting agents to soil, stockpiles, excavation faces, buckets, and equipment during excavation or roadways. These wetting agents should be water soluble, non-toxic, non-reactive, non-volatile, and non-foaming.
- Covering of excavations after completion of construction activities.
- Direct loading excavated soil to hauling vehicles and minimization of soil stockpiling onsite.
- Covering haul trucks and containers with tarps.

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Chemical means for dust and particulate control should not be used without the written approval of the Client.

If, in the opinion of the Client, the paved surfaces of the Site and/or adjacent streets are affected by the transportation of soils from the loading area, the Contractor shall supply, at no additional cost to the Client, mechanized road cleaning equipment to clean the paved surfaces.

2.5 Soil Screening Methods

The soil classifications outlined in Section 2.1 are based on the results of Langan's preliminary characterization program, unless field observations or additional chemical testing indicate the soils to be different from the preliminary classification. Soils may be reclassified prior to or during excavation based on field screening (using a PID), visual and olfactory observations, and results of additional laboratory chemical testing performed. If soils are observed to be stained, exhibit unusual odors or contain other deleterious materials, the Contractor shall notify the Client immediately, and segregate and temporarily stockpile excavated soils, for re-classification by the Client/Langan.

The Contractor shall coordinate with the Client/Langan and arrange for any additional chemical testing required by the Contractor's receiving or temporary offsite stockpiling facilities (if applicable). If additional chemical testing is required to meet proposed receiving facility requirements or to characterize soils deemed not representative of conditions identified by Langan's preliminary characterization data, such sampling will be conducted by Langan. The Contractor shall provide the equipment and labor to obtain the samples at no additional cost to the Client.

2.6 Additional Impacts Contingency Plan

If during construction activities evidence of impacts, including but not limited to free-phase petroleum, visible chemical impacts, staining or vapors/odors, the impacted soil should be segregated from other soils pending proper classification by Langan, under this SMP.

Although not expected at the Site, should the Contractor observe or identify any evidence of impacts or other environmental condition (including but not limited to additional USTs, buried drums or other deleterious material), the Contractor shall notify the Client/Langan immediately and stop all work around the impacted area to prevent worker/public exposure to potential adverse environmental conditions. Appropriate health and safety procedures should also be implemented as required in the Contractor's Health and Safety Plan. The impacted area or environmental condition should only be addressed upon receiving the written authorization of the Client. At the direction of the Client, the Contractor shall segregate and temporarily stockpile potentially impacted soils in accordance with Section 2.7 (i.e., if they are observed to be stained, exhibit unusual odors, contain other deleterious materials, etc.).

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2.7 Stockpiling of Excavated Soils

If onsite stockpiling of excavated soils is conducted, and approved by the Client, separate stockpile areas shall be constructed to avoid co-mingling soils of differing types. Stockpiles will be used only when necessary (and only after approval by the Client) and will be removed as soon as practicable. Stockpile areas will meet the following minimum requirements:

- Stockpile areas shall be bermed (with concrete barriers, hay bales, wattles, or "clean" soil) around the perimeter to prevent runoff and erosion, at locations approved by the Client;
- Soils shall be stockpiled on minimum 8-mil polyethylene sheeting, new stockpile liners, or impermeable surfaces such as asphalt (if approved by Langan);
- Stockpiles shall be segregated by classification in the absence of other specific requirements;
- Any soils not pre-characterized shall be stockpiled by lithology (i.e., fill, natural soils, rock, etc.);
- Stockpiles shall be covered with minimum 6-mil polyethylene sheeting or equivalent at the end of every workday, during adverse weather conditions, and when not in use. Cover shall be weighted or staked; and
- The stockpile areas should be inspected by the Contractor daily, and noted deficiencies promptly addressed.

If additional sampling or screening is deemed necessary, Langan should be provided access to all temporary stockpile locations for the purpose of observing Site activities and collecting environmental samples to document Site conditions, as needed.

2.8 Offsite Soil Disposal

2.8.1 Characterization Soil Sampling

If offsite disposal is necessary, the Contractor's proposed disposal/recycling facility will determine the sampling protocols for soils excavated beyond the existing characterization data limits. If more sampling is needed, the minimum protocols are noted below (unless provided by the proposed disposal facility):

- One sample set per approximately 500 CY of soil.
- Each sample set will consist of one 5-point composite sample and one grab sample, collected from representative areas of soils.
- Although the Site is in Connecticut, typical waste characterization laboratory analyses generally accepted at numerous soil disposal facilities in New York, New Jersey, and Massachusetts as well as in Connecticut should be considered and are as follows:

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Sample Type	Compounds	Frequency
Grab	Volatile Organic Compounds (VOCs)	1/500 CY
Composite	Extractable Total Petroleum Hydrocarbons (ETPH)	1/500 CY
Composite	Semi-Volatile Organic Compounds (SVOCs)	1/500 CY
Composite	Pesticides and Herbicides	1/500 CY
Composite	Polychlorinated Biphenyls (PCBs)	1/500 CY
Composite	Metals (including chromium VI)	1/500 CY
Site-Wide Composite	Full Toxicity Characteristic Leaching Procedure (TCLP), RCRA Characteristics and Paint Filter Test	1/500 CY

CY = Cubic yards

2.8.2 Offsite Recycling/Disposal Facility Approval

If necessary, the proposed recycling and disposal facilities will be provided to Langan and the Client for review and approval prior to offsite recycling and/or disposal.

For all soils leaving the Site, all proposed project sites and recycling/disposal facilities must be reviewed and approved by the Client and Langan prior to offsite transport. For each proposed offsite receiving facility, the Contractor shall provide the Client and Langan with the following information for review and approval:

- Name, address, and location of the facility, including owner's name, address, telephone number, and the facility contact person;
- The EPA Disposal Facility Identification Number (if applicable) and expiration date;
- Total acreage and total daily capacity of the facility permitted to specifically accept the unsuitable soils generated from the Site (i.e., soil volume accepted per day), if applicable;
- Copies of currently valid permits (if any) from any applicable regulatory agencies to specifically accept the soil. Such permits shall indicate that they are presently in effect and shall state the maximum capacity of the facility to accept the soils;
- A listing of the number and types of analytical tests required for initial determinations of the soil for each disposal facility, including the testing requirements and frequency of testing of the soil once the initial characterization has been made, if applicable; and,
- Unless otherwise indicated by the Client, a signed letter from the facility owner granting permission to bring soil to the facility. The letter must be supplied on the facility's letterhead and include the following:
    - A statement that the facility has reviewed the chemical test data and disposal quantity information provided by the Contractor and can legally accept the soil including any contingencies upon which the acceptance is based;
    - A statement that the facility is in compliance with its permit (if applicable) which outlines any restrictions on delivery schedules or other conditions that may cause rejection of transported soils and the accepted daily quantities of soil that may be disposed;

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- Planned use of soils (e.g., reuse, recycle, treatment, disposal);
- Limitations on soils based on material consistency (e.g., granular soil, organic soil, cohesive soil, debris content); and
- If releases have occurred at or adjacent to the site, a statement outlining if they have been reported to CTDEEP, or other applicable agencies, and the status of the release.

Soil characterization sampling results shall be submitted to the proposed recycling and disposal facility for approval prior to initiation of disposal activities.

the Client and Langan will review information submitted by the Contractor and may reject a facility if the submittal is incomplete or if at any time in the submittal process the Client deems the facility unacceptable for any reason that may put the Client at risk or cause delays to the project. Once the submittal requirements outlined above are completed to the satisfaction of the Client, Langan will prepare a letter and data package pursuant to the facility's requirements for acceptance by the facility. This package, once approved, signed and returned to the Client, will constitute approval of the facility.

2.8.3 Loading and Offsite Disposal

Following recycling/disposal facility approval, soil will be loaded into a container, dump truck, or trailer; covered; and transported to the pre-approved state-licensed/-permitted offsite soil recycler or disposal facility. The soil will be handled and transported in accordance with applicable Connecticut Department of Transportation (ConnDOT) regulations and other applicable local, state, and federal regulations. All transport of soils will be performed by licensed haulers with valid permits in accordance with appropriate local, state and federal regulations. Loaded vehicles leaving the Site will be appropriately placarded, lined and securely covered in accordance with applicable federal, state, local and ConnDOT requirements, or other applicable transportation requirements. During redevelopment, and only as needed, Langan and the Contractor will verify the accuracy and existence of and abide by applicable codes, ordinances, and other regulations by obtaining and interpreting state, county, city, or local municipality by-laws for contaminated soil, fill and solid waste removal and disposal.

Unless otherwise indicated by the Client, soil loading and offsite disposal activities will require maintaining records of individual truckload tickets/ waste manifests/soil shipping records for each load of polluted or contaminated soil removed from the Site. At a minimum, each ticket/manifest/record must contain:

- Project Name
- Disposal facility name
- Date of shipment
- Approximate volume/weight (CY/tons)

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- Type/Classification of soil

ABSOLUTELY NO SOILS SHOULD BE REMOVED FROM THE SITE ON A HAZARDOUS WASTE OR UNIFORM HAZARDOUS WASTE MANIFEST WITHOUT WRITTEN AUTHORIZATION FROM THE CLIENT.

2.9 Reuse of Site Soils

According to development plans obtained from the Client, backfill and fill soil will be required to support the proposed redevelopment. Soil composition, site logistics, and stockpiling will determine the feasibility of reusing excavated soils as backfill or fill. Soils designated for onsite reuse should be processed (i.e., screened) as necessary to remove oversize cobbles or boulders and should always be protected from the elements (covered) while stockpiled. Soil that becomes unusable shall be disposed offsite in accordance with Section 2.8. Means by which soil may become unusable include but are not limited to inadequate dewatering, failure to protect prepared surfaces, trafficking over prepared surfaces, failure to cover stockpiles, and comingling.

Excavated soils classified as Group 1-A may be reused across the Site with no restrictions. Excavated soils classified as Group 1-B, that have originated on the Site, can be reused onsite for construction purposes upon approval by the Client provided that the following conditions are met:

- Such soil is not placed below the water table;
- Such soil is not placed in an area subject to erosion, and
- Best efforts are made to place these soils below a minimum of 12-inches of Clean Fill as defined above or an impervious surface (i.e. asphalt, concrete, etc.)

Offsite disposal of Group 2 soil that exceeds RSR criteria is recommended for this project; however, soils that exceed RDEC or GA/GAA PMC due to the presence of asphalt fragments but are below the I/C DEC may be reused onsite below asphalt parking or buildings if proposed by the Contractor and accepted in writing by the Client and Langan

Group 3 soil, if encountered, shall not be reused under any circumstance, and should be disposed offsite at a properly permitted/licensed hazardous waste disposal facility.

Please note that soils may require reclassification prior to or during excavation depending on the results of field screening (using a PID), visual/olfactory observations, and/or results of additional laboratory chemical testing performed.

If soils classified as Group 2 are reused onsite, an as-built drawing must be created and submitted documenting locations and depths (in elevation) where any Group 2 soils have been reused onsite and the depths of the source soil (as applicable).

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Any soils proposed for reuse as backfill should also satisfy geotechnical requirements per the project construction documents.

2.10 Import of Fill Soils

If fill from offsite sources is proposed for import to the Site, this section shall apply. If proposing import of any soils/fill materials to the Site, other than clean virgin quarry stone, the Contractor shall submit the following information to the Client for review at least 48 hours prior to import:

- The name and address of the company(ies)/facility(ies) that shall supply the import soil.
- Any permits associated with the soil or beneficial use of the soil.
- Connecticut-certified laboratory analytical data for samples collected from the proposed import soil by an environmental professional using standard sample collection practice. Samples shall be collected in accordance with the frequencies set forth in CTDEEP RSRs and approved by Langan. Sample results shall be submitted to Langan for review and approval prior to importing soil to the Site. Once sampled, the stockpile must remain isolated and dedicated to import to this project and may not be commingled with any other soil.
- Each borrow fill facility or company shall issue a letter stating that the import fill is native or virgin soil that has not been commingled with any other soil. They shall also state in the letter that the soil was not sourced from or stored at any environmentally impacted/contaminated properties. The letter shall be issued prior to transporting the soil onto the Site. The letter shall reference any characterization data (by sample ID and report number). Maps shall be provided by the Contractor that show the location of the clean fill facility, location of the stockpile at the facility and location of the sample(s) collected from the stockpile.

If soil or fill material requires sampling and laboratory analysis, the frequency of said sampling will be determined by Langan based on the origin of the soil/material. At a minimum, the sample frequency will be one sample per 500 CY of proposed imported soil/material. Samples will be collected in accordance with CTDEEP RSRs to confirm the proposed imported material meets the definition of certified Clean Fill in accordance with the CTDEEP Solid Waste Regulations (RCSA Section 22a-209-1), and be free of contamination in accordance with the CTDEEP RSRs.

Each sample set of proposed imported soil will consist of one 5-point composite sample and one grab sample, collected from representative areas of the proposed imported soil stockpile at the appropriate frequency based on volume. The proposed imported soil sample sets will be analyzed for the following parameters:

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Sample Type	Compounds
Grab	Volatile Organic Compounds (VOCs)
Composite	Extractable Total Petroleum Hydrocarbons (ETPH)
Composite	Semi-Volatile Organic Compounds (SVOCs)
Composite	Pesticides and Herbicides
Composite	Polychlorinated Biphenyls (PCBs)
Composite	CT Metals (including chromium VI)
Stockpile-Wide Composite	Full Toxicity Characteristic Leaching Procedure (TCLP), RCRA Characteristics, and Paint Filter Test

The Contractor shall ensure the facility from which the proposed imported soil is obtained does not and has not added material to the stockpile of soil intended for delivery to the Site after the sampling of the soil has been conducted.

The Client and Langan will review the sampling data, and the Client will provide the Contractor with approval to proceed with the importation or such other directions as may be appropriate based on the sampling data.

2.11 Truck and Equipment Decontamination

All trucks and equipment should be provided to the work site free of contamination and should not be decontaminated onsite if thorough decontamination has not been completed prior to arrival.

Transport vehicles should be inspected prior to leaving the Site to ensure that no soil adheres to the wheels, undercarriage, tailgates, covers, or other areas, and should be cleaned as necessary prior to leaving the Site.

2.12 Employee/ Worker Health and Safety

2.12.1 Potential Exposure Pathways

As identified in Section 1.4, pesticide-impacted soils may be encountered within the proposed development area. Potential exposure pathways associated with the activities outlined in this SMP include dermal absorption, inhalation and ingestion.

Based on current data, Level D Personal Protective Equipment (PPE) should be sufficient to prevent dermal absorption. Those workers whose activities involve direct contact with soils should use PPE deemed appropriate by OSHA and the Contractor's health and safety protocol.

The inhalation risk is to be controlled by implementing dust suppression measures during demolition and excavation activities as outlined in Section 2.4.

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Ingestion risk is to be controlled by restricting eating within the work zones and by providing hand wash stations onsite.

2.12.2 Site Specific Health and Safety Plan

Prior to initiation of construction activities, the Contractor shall develop and implement a Site-Specific Health and Safety Plan (HASP) in accordance with OSHA and other applicable regulations. The Contractor shall be responsible for exercising reasonable precaution to protect the health and safety of all onsite personnel, the public, and the environment during the course of the Work.

3.0 RECORD KEEPING, SITE VISITS, AND REPORTING

3.1 Onsite Record Keeping

Records regarding the approximate volumes of all soils except those classified as Group 1 shall be monitored and maintained onsite and all soil imported to or exported from the Site shall be documented, as specified below:

- Individual truck load-tickets for each load of soil imported and removed from the proposed redevelopment area. Each ticket should contain the date, approximate volume (in CY), and type of soil transported.
- Copies of the final disposal facility load tickets, with incoming load weights clearly identified, will be maintained onsite.

Reuse of excavated soil onsite should be documented as described in Section 2.1.

3.2 Site Visits

Site visits related to this SMP are not anticipated at this time.

DRAFT

Tables

Table 1
Soil Analytical Results Summary (December 2025)
Hillcrest Middle School
Trumbull, Connecticut
Langan Project No. 140325901

Sample ID York ID Sampling Date Presumed soil type	CTDEEP GA PMC	CTDEEP RDEC	SS-01 25H0361-01 8/6/2025 11:10		SS-02 25H0361-02 8/6/2025 10:55:00 AM		SS-03 25H0361-03 8/6/2025 11:40:00 AM		LB-01 25H0361-11 8/6/2025 1:45:00 PM		LB-02 25H0361-12 8/6/2025 2:05:00 PM		LB-03 25H0361-13 8/6/2025 2:50:00 PM		AG-01 25H0361-04 8/6/2025 9:00:00 AM		DUP (AG-01) 25H0361-10 8/6/2025 10:15:00 AM		AG-02 25H0361-05 8/6/2025 8:25:00 AM		AG-03 25H0361-06 8/6/2025 9:15:00 AM	
Compound			Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOCs (mg/kg)																						
Dilution Factor			*1*		*1*		*1*		*1*		*1*		*1*									
1,2-Dibromo-3-chloropropane	0.005	0.09	0.00580	U	0.00640	U	0.00560	U	0.00460	U	0.00520	U	0.00380	U	NT		NT		NT		NT	
SVOCs, Total (mg/kg)																						
Dilution Factor									*1*		*1*		*1*		*2*							
1,2,4,5-Tetrachlorobenzene	0.10	20	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
1-Methylnaphthalene	0.20	21	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
2,4,6-Trichlorophenol	0.20	56	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
2,4-Dinitrotoluene	0.20	0.9	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
2,6-Dinitrotoluene	0.20	0.9	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
3,3-Dichlorobenzidine	0.20	1.4	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
4-Chloroaniline	0.20	3.1	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Aniline	0.20	110	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Carbazole	0.20	31	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Dibenzofuran	0.20	68	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Hexachlorobutadiene	0.20	130	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Nitrobenzene	0.20	4	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
N-nitroso-di-n-propylamine	0.20	0.2	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
N-Nitrosodiphenylamine	0.20	130	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Pentachloronitrobenzene	0.14	68	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Pyridine	0.20	20	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT	
Pesticides (mg/kg)																						
Dilution Factor															5		5		5		5	
4,4'-DDE	NS	NS	NT		NT		NT		NT		NT		NT		0.00446	D	0.00623	D	0.00261	U	0.00262	U
4,4'-DDT	NS	NS	NT		NT		NT		NT		NT		NT		0.00473	D	0.00504	D	0.00261	U	0.00262	U
Total DDT	0.003	1.8	NT		NT		NT		NT		NT		NT		0.00919	D	0.0113	D	0.00261	U	0.00262	U
Aldrin	0.002	0.04	NT		NT		NT		NT		NT		NT		0.00258	U	0.00254	U	0.00261	U	0.00262	U
ETPH (mg/kg)																						
Dilution Factor									*1*		*1*		*1*									
ETPH	500	500	NT		NT		NT		41.8	U	48.3	U	39.7	U	NT		NT		NT		NT	
Metals, Total (mg/kg)																						
Dilution Factor			*1*		*1*		*1*															
Arsenic	NS	10	4.37		4.42		3.97		NT		NT		NT		NT		NT		NT		NT	
Barium	NS	4700	55.7		55.6		42.1		NT		NT		NT		NT		NT		NT		NT	
Beryllium	NS	2	0.443		0.464		0.352		NT		NT		NT		NT		NT		NT		NT	
Cadmium	NS	34	0.497		0.403		0.232	U	NT		NT		NT		NT		NT		NT		NT	
Chromium, Trivalent	NS	4000	20.4		22.0		15.0		NT		NT		NT		NT		NT		NT		NT	
Copper	NS	2500	16.4		21.7		17.6		NT		NT		NT		NT		NT		NT		NT	
Lead	NS	400	21.5		50.1		19.0		NT		NT		NT		NT		NT		NT		NT	
Mercury	NS	20	0.0726		0.107		0.047		NT		NT		NT		NT		NT		NT		NT	
Nickel	NS	1400	12.9		13.0		9.69		NT		NT		NT		NT		NT		NT		NT	
Vanadium	NS	470	30.4		31.4		24.6		NT		NT		NT		NT		NT		NT		NT	
Zinc	NS	20000	61.5		81.4		55.8		NT		NT		NT		NT		NT		NT		NT	

NOTES:

Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

* = This duplicate sample was re-run for total SVOCs only due to suspected asphalt contamination in the original sample.
ND = Not detected
NS = this indicates that no regulatory standard has been established for this analyte
NT = Not tested

CTDEEP PMC = Pollutant Mobility Criteria
CTDEEP RDEC = Residential Direct Exposure Criteria
CTDEEP I/C DEC = Residential Direct Exposure Criteria

VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
ETPH = Extractable Total Petroleum Hydrocarbons
mg/kg = miligram per kilogram

Indicates an exceedance of GA Pollutant Mobility Criteria
Indicates an exceedance of Residential Direct Exposure Criteria
Indicates an exceedance of Ind/Comm. Direct Exposure Criteria

Table 1
Soil Analytical Results Summary (December 2025)
Hillcrest Middle School
Trumbull, Connecticut
Langan Project No. 140325901

Sample ID York ID Sampling Date Presumed soil type	CTDEEP GA PMC	CTDEEP RDEC	AG-04 25H0361-07 8/6/2025 9:55:00 AM		AG-05 25H0361-08 8/6/2025 9:35:00 AM		AG-06 25H0361-09 8/6/2025 10:15:00 AM		AG-07 25H0413-01 8/7/2025 9:00:00 AM		AG-08 25H0413-02 8/7/2025 9:15:00 AM		AG-09 25H0413-03 8/7/2025 8:45:00 AM		AG-10 25H0413-04 8/7/2025 8:20:00 AM		AG-11 25H0413-05 8/7/2025 8:10:00 AM		AG-12 25H0413-06 8/7/2025 8:00:00 AM	
Compound			Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOCs (mg/kg)																				
Dilution Factor																				
1,2-Dibromo-3-chloropropane	0.005	0.09	NT		NT		NT		NT		NT		NT		NT		NT		NT	
SVOCs, Total (mg/kg)																				
Dilution Factor																				
1,2,4,5-Tetrachlorobenzene	0.10	20	NT		NT		NT		NT		NT		NT		NT		NT		NT	
1-Methylnaphthalene	0.20	21	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,4,6-Trichlorophenol	0.20	56	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,4-Dinitrotoluene	0.20	0.9	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,6-Dinitrotoluene	0.20	0.9	NT		NT		NT		NT		NT		NT		NT		NT		NT	
3,3-Dichlorobenzidine	0.20	1.4	NT		NT		NT		NT		NT		NT		NT		NT		NT	
4-Chloroaniline	0.20	3.1	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Aniline	0.20	110	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Carbazole	0.20	31	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Dibenzofuran	0.20	68	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Hexachlorobutadiene	0.20	130	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Nitrobenzene	0.20	4	NT		NT		NT		NT		NT		NT		NT		NT		NT	
N-nitroso-di-n-propylamine	0.20	0.2	NT		NT		NT		NT		NT		NT		NT		NT		NT	
N-Nitrosodiphenylamine	0.20	130	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pentachloronitrobenzene	0.14	68	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pyridine	0.20	20	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pesticides (mg/kg)																				
Dilution Factor			5		5		5		*5*		*5*		*5*		*5*		*5*		*5*	
4,4'-DDE	NS	NS	0.00321	D	0.00267	U	0.00264	U	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	0.00126	
4,4'-DDT	NS	NS	0.00316	D	0.00267	U	0.00264	U	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	0.00146	
Total DDT	0.003	1.8	0.00637	D	0.00267	U	0.00264	U	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	0.00272	
Aldrin	0.002	0.04	0.00254	U	0.00267	U	0.00264	U	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	0.00058	U
ETPH (mg/kg)																				
Dilution Factor																				
ETPH	500	500	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Metals, Total (mg/kg)																				
Dilution Factor																				
Arsenic	NS	10	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Barium	NS	4700	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Beryllium	NS	2	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Cadmium	NS	34	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Chromium, Trivalent	NS	4000	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Copper	NS	2500	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Lead	NS	400	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Mercury	NS	20	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Nickel	NS	1400	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Vanadium	NS	470	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Zinc	NS	20000	NT		NT		NT		NT		NT		NT		NT		NT		NT	

NOTES:

Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is
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B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detect

* = This duplicate sample was re-run for total SVOCs only due to suspected asphalt contamination in the orig
ND = Not detected
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mg/kg = miligram per kilogram

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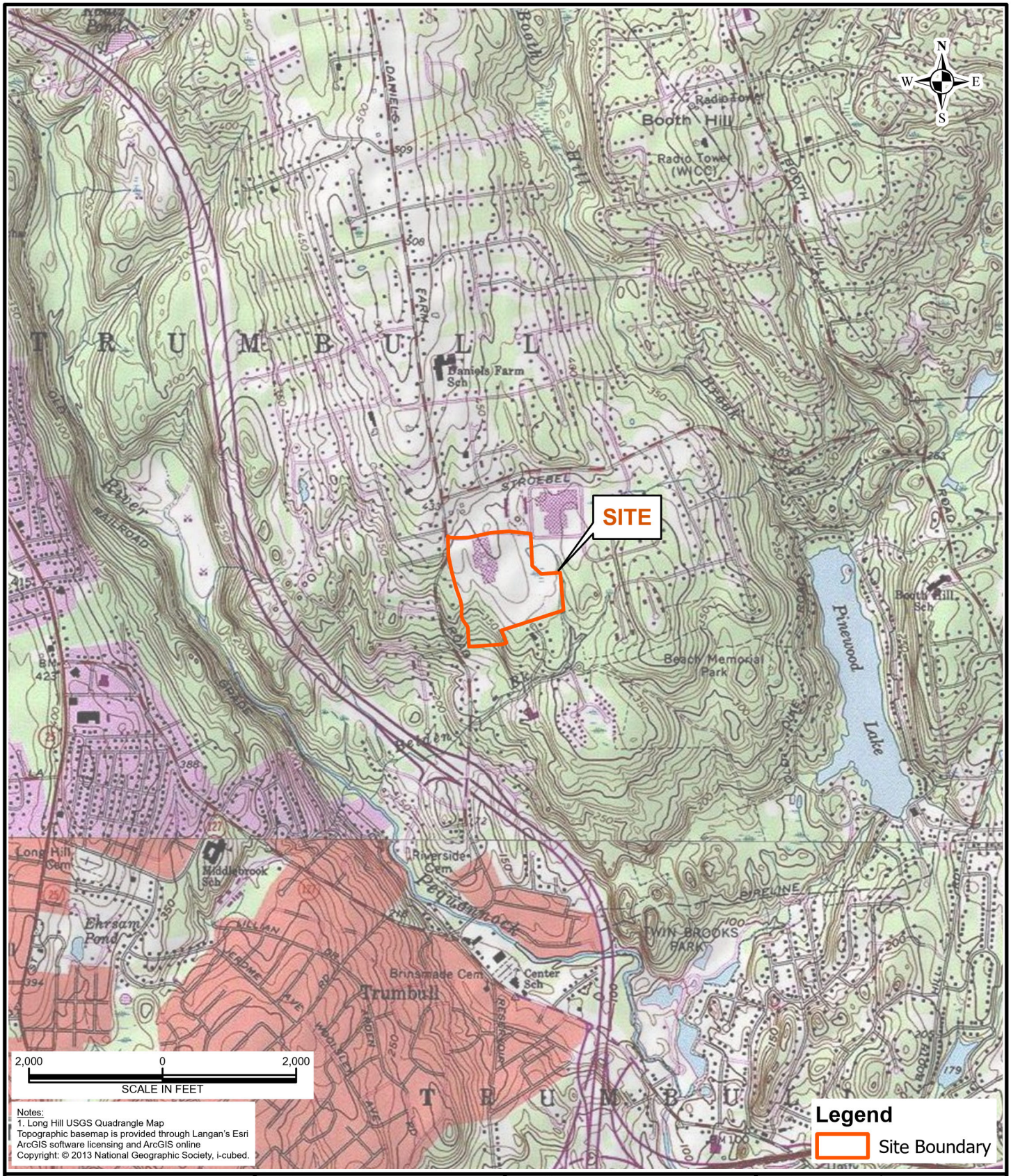
Figures



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Project	Figure Title	Project No.	Figure
HILLCREST MIDDLE SCHOOL TRUMBULL FAIRFIELD OUNTY CT	SITE LOCATION MAP	140325901 Date 8/21/2025 Scale 1" = 2,000 feet Drawn By LDB	1

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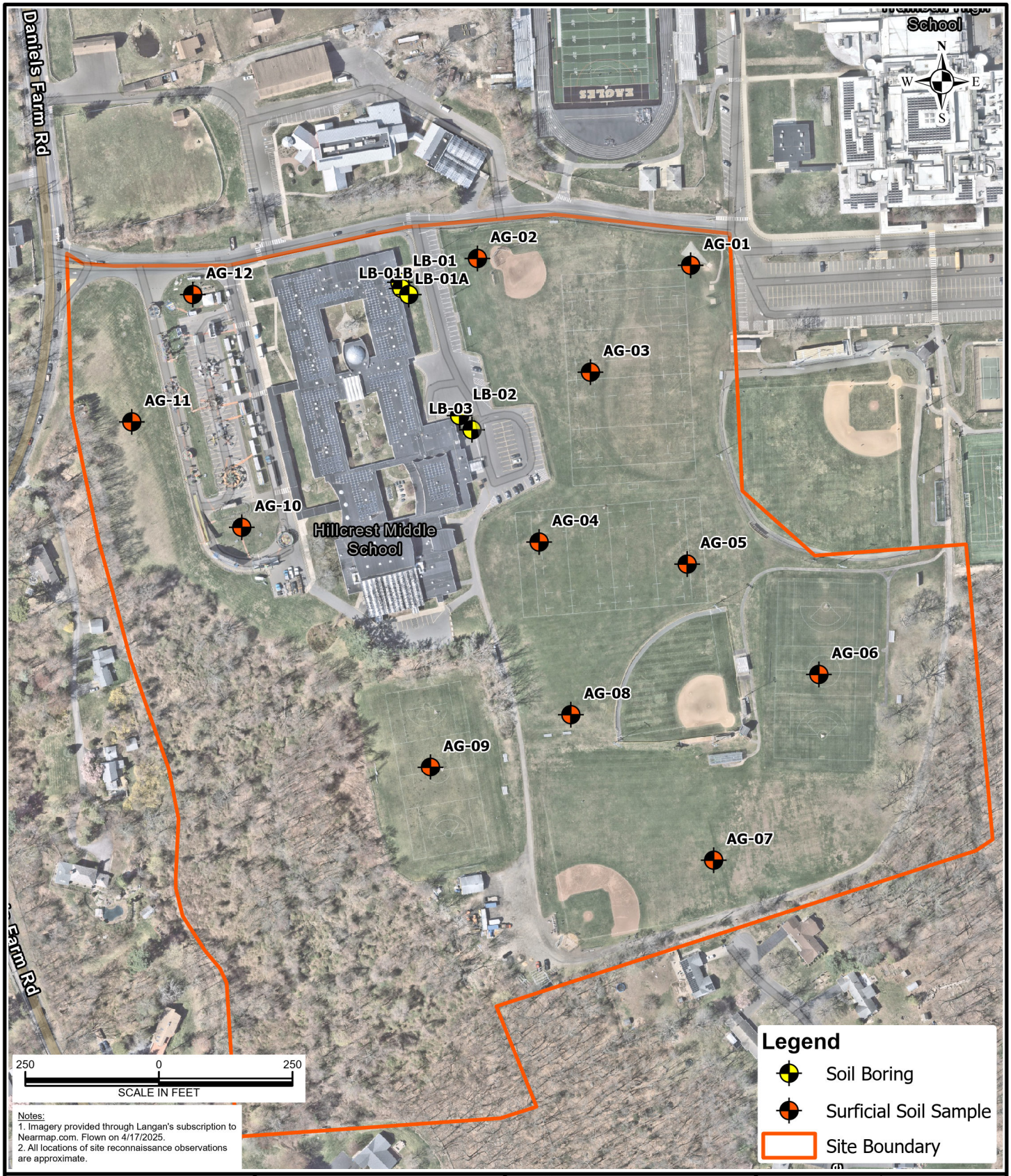

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Project	Figure Title	Project No.	Figure
HILLCREST MIDDLE SCHOOL TRUMBULL FAIRFIELD OUNTY CT	PHASE II INVESTIGATION MAP	140325901 Date 8/21/2025 Scale 1" = 250 feet Drawn By LDB	2

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Appendix A Previous Report

16 December 2025

Michael Scott
TKSP Studio
One Hartford Square West
Building 1-203
Hartford, CT 06106

Re: Draft Limited Phase II Environmental Site Investigation Report
Hillcrest Middle School
530 Daniels Farm Road
Trumbull, Connecticut 06611
Langan Project No. 140325901

Dear Mr. Scott,

Langan CT, Inc. (Langan) prepared this report to document the results of the Limited Phase II Environmental Site Investigation (ESI) completed for the Hillcrest Middle School (HMS) property at 530 Daniels Hill Road in Trumbull, Connecticut (hereafter referred to as the "Subject Property") in connection with Request for Qualifications/Request for Proposals (RFQ/RFP) Bid No. 6546. This report describes the sampling methodology, field observations and analytical results of the subsurface investigation.

BACKGROUND

The Subject Property is part of an approximately 88-acre parcel identified by the Trumbull Tax Assessor as Parcel ID 12708 (530 Daniels Farm Road). The parcel consists of Hillcrest Middle School (the Subject Property) in the southwest and Trumbull High School in the northeast, and surrounding athletic fields and courts. The Subject Property is developed with a 112,342-square foot school building and associated asphalt parking areas, landscaped areas and grass-covered athletic fields. The location of the Subject Property is depicted on Figure 1 (Site Location Map).

Langan's scope of work was conducted in accordance with our approved Proposal for RFQ/RFP Bid No. 6546. Specifically, Langan was retained by Trumbull Public Schools to perform a Phase II Environmental Site Investigation (ESI) for the Subject Property targeting seven areas of concern (AOCs) and Recognized Environmental Concerns (RECs) at the Subject Property identified in a Phase I Environmental Site Assessment (ESA) prepared by Eagle Environmental, Inc. (Eagle) dated June 2024. The AOCs and RECs identified by Eagle during their Phase I ESA consist of the following:

- AOC-1/REC-1: Historical Technical Auto Repair Classroom

- AOC-2/REC-2: 10,000-Gallon Fuel Oil Underground Storage Tanks (USTs)
- AOC-3: Flammable Cabinet and Drum Storage
- AOC-4: Suspected Transformer Room
- AOC-5: Diesel Generator
- AOC-6: Former Paint-Mixing and Spray Booth
- AOC-7: Historical Agricultural Use

The investigation activities described herein were completed in general accordance with the Connecticut Department of Energy and Environmental Protection (CTDEEP) 2007 Site Characterization Guidance Document and Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113. Langan did not complete a full Phase I ESA prior to this Phase II ESI and was not provided with a copy of Eagle's June 2024 Phase I ESA; however, Langan considers assessing potential impacts to the subsurface associated with some of the AOCs listed above to be cause for environmental concern.

Langan's investigation activities were conducted to assess if a release of hazardous/petroleum-related substances had occurred to the subsurface related to AOCs/RECs 1, 2, 6 and 7. Additionally, a visual inspection of AOCs 3 through 5 was conducted to determine whether future subsurface investigation would be needed at one or more of those AOCs.

REGULATORY BACKGROUND

The results from this investigation were compared to the numeric criteria provided in the Connecticut RSRs, sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies (RCSA) dated January 1996, and to numeric criteria in the "Approved Criteria for Additional Polluting Substances" dated 30 April 1999. The RSRs were developed by CTDEEP to define the remediation performance standards for soil and groundwater, specific numeric cleanup criteria, and processes for establishing alternative site-specific standards. The RSRs apply specifically to sites at which remedial actions are required by the CTDEEP under Chapters 445 or 446k of the Connecticut General Statutes such as under an administrative order, subsequent to a transfer of an establishment under CGS Section 22a-134a, and to sites that are enrolled in a Voluntary Remediation Program under CGS Sections 22a-133x or 22a-133y.

Soil Criteria

The RSRs define two criteria that apply to soil: the direct exposure criteria (DEC) and the pollutant mobility criteria (PMC). The DEC defines the maximum level of regulated compounds allowed in soil, to a depth of 15 feet to protect against the effects of contact with or ingestion of contaminants in the soil. The PMC defines the maximum level of regulated compounds allowed in soil without posing a threat to groundwater quality. Each criterion is further divided into two

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categories; the DEC is based on either residential sites or industrial/commercial sites, while the PMC is based on either GA/GAA or GB groundwater classification areas. The Subject Property is in a Class GA-designated area. The RDEC and GA PMC apply to the Subject Property.

PHASE II ESI

The Phase II ESI was conducted to investigate the identified AOCs/RECs (listed above). The investigation was conducted between 6 and 7 August 2025, and included the completion of a geophysical survey, advancement of five soil borings in the vicinity of AOCs 1 and 2, and collection and analysis of 18 grab soil samples and one duplicate soil sample (one associated with AOC-1, two with AOC-2, three with AOC-6 and the remaining 12 with AOC-7). Langan planned to convert one soil borings downgradient of AOC-1/REC-1 (Historical Technical Auto Repair Classroom) into a temporary groundwater well; however, groundwater was not encountered above presumed bedrock refusal at any of the borings. Groundwater, therefore, could not be sampled during this investigation.

Visual Inspection of AOCs

Prior to the commencement of any investigatory activities, a Langan field engineer conducted a visual inspection of the AOCs to determine their locations, appropriate locations for borings/samples and, in the case of AOCs 3 through 5, to visually assess for whether future investigation was warranted. During the visual inspection of the AOCs, Langan field engineer William Adsit was accompanied by Ramon Lopez, the building maintenance supervisor for HMS. Mr. Lopez assisted Mr. Adsit in locating the AOCs, including the historical auto repair classroom (AOC-1), the suspected USTs grave area (AOC-2), the flammable cabinets and drum storage area (AOC-3), the transformer room (AOC-4), the diesel generator (AOC-5) and the former paint/spray booth (AOC-6). A photo log containing select photographs from the visual inspection is attached as Attachment A.

With respect to AOCs 1, 2 and 6, Mr. Adsit was able to select appropriate drilling, hand auger and sampling locations based on the information gleaned during the visual inspection of these areas. Brief descriptions of observations made in relation to AOCs 3 through 5 are provided below.

AOC-3 – Flammable Cabinets and Drum Storage

The flammable cabinets and drum storage area was observed to be a concrete floor room located north-northeast of the boiler room in Section C of the HMS building. This room is accessed via an overhead, roll-up door on the north-northwest side of the building. The room stores lawn-care equipment and tools, five flammable cabinets, eight 55-gallon drums (three steel and five plastic), trash cans and various other maintenance-related equipment. Two of the steel 55-gallon drums

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were labeled as containing non-hazardous waste described as oily rags/speedy dry debris. Mr. Lopez reported the other six drums were empty. He had no knowledge related to the generation of the contents of the two labeled drums. The flammable cabinets were observed to contain gasoline cans (5 gallons or smaller), cans of helium and small quantities of typical maintenance-type substances in manufacturer's packaging. No notable staining or odors were noted in the room, including on the concrete floor, which was observed to be competent and free of obvious cracks or stains. Based on the visual condition of the room, Langan concluded there was no evidence a release occurred in relation to AOC-3. As a result, no future investigation of this AOC is warranted.

AOC-4 – Transformer Room

A transformer room is located east and south of the boiler room area of the school. It contains multiple transformers. Langan originally planned to visually assess the transformer room and collect two concrete samples from the floor if evidence of release of extractable total petroleum hydrocarbons (ETPH) and polychlorinated biphenyls (PCBs) was identified. However, Langan determined these samples were not necessary based on the conditions noted below.

When Langan initially attempted to access the transformer room during this event on 6-7 August 2025, the transformer room was locked and inaccessible by school or town faculty. According to Mr. Lopez, the transformer room was only accessible by United Illuminated (UI) (the electric provider) personnel. Subsequent communications with a UI representative indicated access to the transformer room could not be provided during this event but would have to occur on a later date.

On 15 August 2025, Langan field staff remobilized to the Subject Property when UI personnel was scheduled to access the room. The room could not be accessed during the return visit because the UI representative could not access the room. School staff was subsequently provided access to the transformer room in September 2025. Although Langan was not able to access the transformer room during UI's second visit, school staff collected photographs of the transformer room and provided them to Langan.

The photographs depict multiple (between three and five), corrugated panel-style electrical power transformers. The transformers are labeled as having had the dielectric oil tested to determine its PCBs content as less than 1 parts per million (ppm) PCBs. Dielectric oil with PCBs of less than 1 ppm is considered non-PCBs containing. The photos show the transformers are generally in good condition, and no obvious staining from potential leaks are visible on the concrete floor beneath or around the transformers. Based on the transformers' labels and visible condition, Langan concluded that the transformer room is unlikely to have experienced a release and therefore requires no further investigation.

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AOC-5 – Diesel Generator

A Cummins diesel-powered electrical generator is located on the west side of the HMS building in a grass island adjacent to the boiler room. The generator is fueled via an aboveground, belly-style storage tank with a volume estimated to be approximately 100 gallons. The generator is bolted to a concrete pad. Langan observed no staining to the concrete or soil under or around the generator, no stressed vegetation in the area and no other indications of a potential release from the generator or its tank. Based on the visual condition of the generator and its surroundings, Langan concluded there was no evidence a release has occurred in relation to AOC-5. As a result, no future investigation of this AOC is warranted.

Geophysical Survey

A geophysical survey was completed by New England Subsurface Imaging, LLC (NESI) of Newtown, Connecticut under the observation of a Langan field engineer on 6 August 2025. The survey included ground penetrating radar (GPR) to locate and identify current and former utility lines, anomalies, USTs and subsurface structures, and to clear proposed boring locations.

Soil Investigation of AOCs 1 and 2

Five soil borings (LB-01, LB-01A, LB-01B, LB-02 and LB-03) were advanced by Lakewood Environmental Services Corp. (Lakewood), LLC of Smithtown, New York under the supervision of a Langan field engineer on 6 August 2025. Boring locations were selected to evaluate the subsurface conditions around AOC-1/REC-1 (Historical Technical Auto Repair Classroom) and AOC-2/REC-2 (historical USTs) (see Figure 2). Borings LB-01, LB-01A and LB-01B were advanced to assess AOC-1/REC-1 and to attempt to install an overburden groundwater monitoring well. Soil borings LB-01A and LB-01B were offsets of LB-01 advanced in attempt to find overburden groundwater. Soil borings LB-02 and LB-03 were advanced in the area of the historical USTs (AOC-2/REC-2).

The five soil borings were completed using a Geoprobe direct-push drill rig. Soil samples were collected from each environmental boring using a 5-foot macrocore sample barrel with dedicated acetate liners. Soil samples retrieved from each boring were visually classified for soil type, grain size and texture. Each soil sample was screened for total organic vapors using a PID equipped with a 10.6-electron volt (-eV) lamp. Soil samples were also evaluated for visual and olfactory indications of environmental impact. Refusal was encountered between 4.5 and 11 feet below ground surface at all five borings. Groundwater was not encountered in any of the boreholes. Soil boring logs are provided as Attachment B.

To assess AOC-2/REC-2, one discrete (grab) soil sample (composed of 2 x 8 oz. lab-supplied jars and one Terracore set) were collected from each of the two borings in the area of the former

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USTs (LB-02 and LB-03) at depths of approximately 6.5 to 8 feet below ground surface (bgs) based on anticipated potential release depth and tank bottom depths. To assess AOC-1/REC-1, a grab soil sample was collected from LB-01 at a depth of approximately 2.5 to 4.5 feet bgs, and to correspond to the maximum depth of overburden soils before refusal was encountered. Samples were submitted to York Analytical Laboratory (York), a Connecticut-certified for the following analysis:

- Volatile organic compounds (VOCs) (EPA method 8260C) (Samples LB-01 through LB-03)
- Semi-volatile organic compounds (SVOCs) (EPA method 8270D) (Sample LB-01)
- Polycyclic aromatic hydrocarbons (PAHs) (EPA method 8270D) (Samples LB-02 and LB-03)
- ETPH (CT ETPH method(Samples LB-01 through LB-03)

Samples were collected and analyzed in accordance with Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113. Quality assurance and quality control (QA/QC) samples included the collection of one duplicate soil sample and one trip blank.

A summary of soil analytical data is presented in Table 1. Analytical reports and chain-of-custody documentation are provided in Attachment C.

Soil Investigation of AOCs 6 and 7

Fifteen shallow soil samples (SS-01 through SS-03, and AG-01 through AG-12) were collected from shallow soil boring advanced by Lakewood using a hand auger to 2 feet bgs. The shallow soil borings were advanced under the supervision of a Langan field engineer on 6 and 7 August 2025. Soil samples were collected by Langan field staff.

The hand auger locations for soil samples SS-01 through SS-03 were selected to evaluate the shallow subsurface conditions associated with AOC-6 (former paint-mixing and spray booth). These locations consisted of the soil immediately beneath a suspected former exhaust penetration on the north side of the building (SS-01), a location of suspected surficial ground disturbance from the dumping of classroom or other wastewater (SS-02) and beneath the downspout of the roof leader associated with rooftop stormwater drainage in the area of AOC-6 (SS-03).

The hand auger locations for soil samples AG-01 through AG-12 were selected to evaluate the surrounding grass-field areas of the Subject Property for potential residual impacts from pesticides associated with the Subject Property's reported historical use as agricultural land (AOC-7). The AOC-7 sample locations were spread throughout the grassy areas of the Subject Property to provide sufficient coverage for this purpose.

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Shallow soil samples were collected from each hand auger boring. The shallow borings were installed using a steel hand auger that was decontaminated between each use. Each soil sample was screened for total organic vapors using a PID equipped with a 10.6-electron volt (-eV) lamp. Soil samples were also evaluated for visual and olfactory indications of environmental impact. The shallow soil boring logs are provided as Attachment B.

One discrete (grab) soil sample (composed of 2x 8-oz. lab-supplied jars and one Terracore set) were collected from each of the shallow borings. Shallow soil samples were submitted to York Analytical Laboratory (York), a Connecticut-certified for one or more of the following analyses, as noted:

- VOCs (EPA method 8260C) (Samples SS-01 through SS-03)
- SVOCs (Sample LB-01)
- ETPH (CT ETPH method) (Samples SS-01 through SS-03)
- Pesticides (EPA method 8081B) (Samples AG-01 through AG-12)
- Total metals (Samples SS-01 through SS-03)

Quality assurance and quality control (QA/QC) samples included the collection of one duplicate soil sample and one trip blank. Additionally, samples LB-02 and LB-03 were collected and analyzed in accordance with Underground Storage Tank Regulations, Regulations of Connecticut State Agencies, Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113, and the CTDEEP Site Characterization Guidance Document (SCGD).

A summary of soil analytical data is presented in Table 2. Analytical reports and chain-of-custody documentation are provided in Attachment C.

Groundwater Investigation

Langan's 2025 Phase II ESI proposal included installation of one temporary well downgradient to the former automotive classroom (AOC-1/REC-1) and the collection of one groundwater sample. LB-01 was advanced for this purpose. However, refusal was encountered in LB-01 at approximately 4.5 feet bgs, and groundwater was not observed in overburden soils. Two offset borings were advanced to attempt to reach overburden groundwater: soil boring LB-01A was advanced approximately 7 feet south-southwest of LB-01 boring, and LB-01B was advanced approximately 20 feet south-southeast. Refusal was encountered in both offset boring locations at a similar depth with no detection of groundwater. Given the lack of groundwater at LB-01, Langan could not successfully install and sample a temporary well.

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OBSERVATIONS AND RESULTS

Geophysical Survey

As stated above, a geophysical survey was conducted to locate and identify current and former utility lines, anomalies, USTs, subsurface structures, and to clear proposed boring locations. As Langan was not provided with Eagle's Phase I ESA, the precise locations of the former USTs were unknown. Mr. Lopez identified the likely former location, which the GPR survey confirmed was the likely location of the former USTs. This area is located immediately north of the diesel generator in the asphalt lot. The GPR survey identified a suspected area where bedrock was excavated to accommodate the former USTs. This area was observed to be covered by an obvious asphalt patch. Subsequent investigation in this area through soil boing LB-02 identified peastone/gravel fill and a thin layer of concrete consistent with a former tank pad and surrounding fill. Additionally, deeper drilling refusal (11 feet bgs) was observed in this area compared to the surrounding area (4.5 feet bgs to 7 feet bgs). However, no USTs or anomalies were detected, suggesting the former USTs have been removed.

Subsurface Observations

The stratigraphy underlying the Subject Property consists of approximately 6 to 12 inches of topsoil consisting of brown silt or silty fine sand with some gravel and roots. Soils below 6 to 12 inches generally consisted of light reddish brown to brown silt or silty fine sand with varying amounts of gravel, light brown fine- to medium-sands with some orange streaks and crushed rock at varying intervals. These materials are believed to be native. Refusal was encountered from 4.5 to 11 feet bgs, and groundwater was not encountered in overburden soils. Suspected perched water was observed in LB-02, which was advanced in the middle of the suspected UST grave. The UST grave was suspected to be within a concave area carved into the bedrock to hold the USTs underground. Petroleum impacts (e.g., staining, odors, elevated PID readings, etc) were not identified in any boring. Soil boring logs are provided in Attachment B.

Soil Sample Analytical Results

Eighteen soil samples and one duplicate soil sample were submitted for the laboratory analyses identified in the previous section. Analytical results were compared to CTDEEP GA/GAA PMC and residential DEC (RDEC). The results are discussed below in relation to the corresponding AOC/REC. A summary of soil analyses is provided in Table 1, and laboratory reports are included as Attachment C.

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AOC-1/REC-1

VOCs, SVOCs and ETPH were not detected at concentrations exceeding the laboratory reporting limits in soil sample LB-01.

AOC-2/REC-2

VOCs, PAHs and ETPH were not detected at concentrations exceeding the laboratory reporting limits in soil sample LB-02 or LB-03.

AOC-6

VOCs were not detected at concentrations exceeding laboratory reporting limits in soil sample SS-01, SS-02 or SS-03. Total metals, including arsenic, barium, beryllium, cadmium, lead, mercury and vanadium, were detected in one of more of samples SS-01, SS-02 and/or SS-03 at concentrations exceeding laboratory reporting limits but below applicable CTDEEP RSRs soil criteria.

AOC-7

The pesticide total DDT was identified at concentrations exceeding the GA PMC in soil samples AG-01, its duplicate (DUP) and AG-04. Total DDT was detected in AG-12 at a concentration exceeding the laboratory reporting limit but below applicable CTDEEP RSRs soil criteria. No other pesticides were detected at concentrations above the laboratory reporting limits.

CONCLUSIONS AND RECOMMENDATIONS

Based on the observations and results of this investigation, Langan concludes the following:

- Overburden groundwater was not identified and bedrock groundwater is likely deeper than 11 feet bgs.
- No evidence of petroleum or releases (staining, odors and/or elevated PID readings) associated with AOCs 1, 2, 4 or 6 was identified during this investigation.
- Total DDT was detected in samples AG-01, its duplicate (DUP) and AG-04 at concentrations exceeding the GA PMC, and in AG-12 at a concentration exceeding the laboratory reporting limit. The relatively low-level detections of total DDT are attributable to historical application of pesticides when the Subject Property was used for agricultural purposes.

Based on our findings, Langan does not recommend additional environmental investigation at the Subject Property at this time. However, as part of redevelopment activities at the Subject Property, Langan recommends the preparation and implementation of a site-specific soil

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management plan (SMP) to provide guidance and procedures for documenting and managing the excavation and export of soils, import of soil for backfill, construction of stockpiles and re-use of on-site soil during the redevelopment project.

LIMITATIONS

This Phase II ESI report was prepared expressly for TKSP Studio for the Hillcrest Middle School portion of the parcel at 530 Daniels Farm Road in Trumbull, Connecticut (identified in Figure 2) and for the objectives defined herein. Langan cannot assume responsibility for the use of this report for any property other than the specific site addressed in this report, or by any third party without specific written authorization from Langan. The conclusions and opinions provided in this report are based on subsurface conditions ascertained from the analysis of a limited number of samples and from environmental reports prepared by other professionals. Actual conditions encountered during redevelopment may differ from those presented herein and if evidence of a release is identified, it should be brought to our attention to determine how such impacts may affect our conclusions.

Sincerely,
Langan CT, Inc.

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David V. Granucci
Senior Project Engineer

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Jamie P. Barr, L.E.P.
Principal/Vice President

Enclosures: Table 1 – Soil Analytical Results Summary
Figure 1 – Site Location Map
Figure 2 – Phase II Investigation Map
Attachment A – Photographic Log
Attachment B – Soil Boring Logs
Attachment C – Laboratory Analytical Reports

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TABLES

Table 1
Laboratory Analytical Summary Table - Fill and Native Soil Samples
Hillcrest Middle School Phase 2 - Soil Characterization Analytical Results
Trumbull, Connecticut
Langan Project No. 140325901

Sample ID York ID Sampling Date Presumed soil type	CTDEEP GA PMC	CTDEEP RDEC	CTDEEP I/C DEC	SS-01 25H0361-01 8/6/2025 11:10		SS-02 25H0361-02 8/6/2025 10:55:00 AM		SS-03 25H0361-03 8/6/2025 11:40:00 AM		LB-01 25H0361-11 8/6/2025 1:45:00 PM		LB-02 25H0361-12 8/6/2025 2:05:00 PM		LB-03 25H0361-13 8/6/2025 2:50:00 PM		AG-01 25H0361-04 8/6/2025 9:00:00 AM		DUP (AG-01) 25H0361-10 8/6/2025 10:15:00 AM		AG-02 25H0361-05 8/6/2025 8:25:00 AM		AG-03 25H0361-06 8/6/2025 9:15:00 AM		AG-04 25H0361-07 8/6/2025 9:55:00 AM		AG-05 25H0361-08 8/6/2025 9:35:00 AM		AG-06 25H0361-09 8/6/2025 10:15:00 AM	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOCs (mg/kg)																													
Dilution Factor				*1*		*1*		*1*		*1*		*1*		*1*															
1,2-Dibromo-3-chloropropane	0.005	0.09	0.82	0.00580	U	0.00640	U	0.00560	U	0.00460	U	0.00520	U	0.00380	U	NT		NT		NT		NT		NT		NT		NT	
SVOCs, Total (mg/kg)																													
Dilution Factor										*1*		*1*		*1*		*2*													
1,2,4,5-Tetrachlorobenzene	0.10	20	610	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
1-Methylnaphthalene	0.20	21	200	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,4,6-Trichlorophenol	0.20	56	520	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,4-Dinitrotoluene	0.20	0.9	8.4	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
2,6-Dinitrotoluene	0.20	0.9	8.4	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
3,3-Dichlorobenzidine	0.20	1.4	13	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
4-Chloroaniline	0.20	3.1	29	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Aniline	0.20	110	1000	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Carbazole	0.20	31	290	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Dibenzofuran	0.20	68	1000	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Hexachlorobutadiene	0.20	130	1200	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Nitrobenzene	0.20	4	41	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
N-nitroso-di-n-propylamine	0.20	0.2	0.82	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
N-Nitrosodiphenylamine	0.20	130	1200	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pentachloronitrobenzene	0.14	68	2000	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pyridine	0.20	20	610	NT		NT		NT		0.264	U	NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pesticides (mg/kg)																													
Dilution Factor																5		5		5		5		5		5		5	
4,4'-DDE	NS	NS	NS	NT		NT		NT		NT		NT		NT		0.00446	D	0.00623	D	0.00261	U	0.00262	U	**0.00321**	D	0.00267	U	0.00264	U
4,4'-DDT	NS	NS	NS	NT		NT		NT		NT		NT		NT		0.00473	D	0.00504	D	0.00261	U	0.00262	U	**0.00316**	D	0.00267	U	0.00264	U
Total DDT	0.003	1.8	17	NT		NT		NT		NT		NT		NT		0.00919	D	0.0113	D	0.00261	U	0.00262	U	**0.00637**	D	0.00267	U	0.00264	U
Aldrin	0.002	0.04	0.34	NT		NT		NT		NT		NT		NT		0.00258	U	0.00254	U	0.00261	U	0.00262	U	0.00254	U	0.00267	U	0.00264	U
ETPH (mg/kg)																													
Dilution Factor										*1*		*1*		*1*															
ETPH	500	500	2,500	NT		NT		NT		41.8	U	48.3	U	39.7	U	NT		NT		NT		NT		NT		NT		NT	
Metals, Total (mg/kg)																													
Dilution Factor				*1*		*1*		*1*																					
Arsenic	NS	10	10	4.37		4.42		3.97		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Barium	NS	4700	140000	55.7		55.6		42.1		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Beryllium	NS	2	2	0.443		0.464		0.352		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Cadmium	NS	34	1000	0.497		0.403		0.232	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Chromium, Trivalent	NS	4000	51100	20.4		22.0		15.0		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Copper	NS	2500	76000	16.4		21.7		17.6		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Lead	NS	400	1000	21.5		50.1		19.0		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Mercury	NS	20	610	0.0726		0.107		0.047		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Nickel	NS	1400	7500	12.9		13.0		9.69		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Vanadium	NS	470	14000	30.4		31.4		24.6		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Zinc	NS	20000	610000	61.5		81.4		55.8		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	

NOTES:

Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

* = This duplicate sample was re-run for total SVOCs only due to suspected asphalt contamination in the original sample.
ND = Not detected
NS = this indicates that no regulatory standard has been established for this analyte
NT = Not tested

CTDEEP PMC = Pollutant Mobility Criteria
CTDEEP RDEC = Residential Direct Exposure Criteria
CTDEEP I/C DEC = Residential Direct Exposure Criteria

VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
ETPH = Extractable Total Petroleum Hydrocarbons
mg/kg = miligram per kilogram

Indicates an exceedance of GA Pollutant Mobility Criteria
Indicates an exceedance of Residential Direct Exposure Criteria
Indicates an exceedance of Ind/Comm. Direct Exposure Criteria

Table 1
Laboratory Analytical Summary Table - Fill and Native Soil Samples
Hillcrest Middle School Phase 2 - Soil Characterization Analytical Results
Trumbull, Connecticut
Langan Project No. 140325901

Sample ID York ID Sampling Date Presumed soil type	CTDEEP GA PMC	CTDEEP RDEC	CTDEEP I/C DEC	AG-07 25H0413-01 8/7/2025 9:00:00 AM		AG-08 25H0413-02 8/7/2025 9:15:00 AM		AG-09 25H0413-03 8/7/2025 8:45:00 AM		AG-10 25H0413-04 8/7/2025 8:20:00 AM		AG-11 25H0413-05 8/7/2025 8:10:00 AM		AG-12 25H0413-06 8/7/2025 8:00:00 AM	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOCs (mg/kg)															
Dilution Factor															
1,2-Dibromo-3-chloropropane	0.005	0.09	0.82	NT		NT		NT		NT		NT		NT	
SVOCs, Total (mg/kg)															
Dilution Factor															
1,2,4,5-Tetrachlorobenzene	0.10	20	610	NT		NT		NT		NT		NT		NT	
1-Methylnaphthalene	0.20	21	200	NT		NT		NT		NT		NT		NT	
2,4,6-Trichlorophenol	0.20	56	520	NT		NT		NT		NT		NT		NT	
2,4-Dinitrotoluene	0.20	0.9	8.4	NT		NT		NT		NT		NT		NT	
2,6-Dinitrotoluene	0.20	0.9	8.4	NT		NT		NT		NT		NT		NT	
3,3-Dichlorobenzidine	0.20	1.4	13	NT		NT		NT		NT		NT		NT	
4-Chloroaniline	0.20	3.1	29	NT		NT		NT		NT		NT		NT	
Aniline	0.20	110	1000	NT		NT		NT		NT		NT		NT	
Carbazole	0.20	31	290	NT		NT		NT		NT		NT		NT	
Dibenzofuran	0.20	68	1000	NT		NT		NT		NT		NT		NT	
Hexachlorobutadiene	0.20	130	1200	NT		NT		NT		NT		NT		NT	
Nitrobenzene	0.20	4	41	NT		NT		NT		NT		NT		NT	
N-nitroso-di-n-propylamine	0.20	0.2	0.82	NT		NT		NT		NT		NT		NT	
N-Nitrosodiphenylamine	0.20	130	1200	NT		NT		NT		NT		NT		NT	
Pentachloronitrobenzene	0.14	68	2000	NT		NT		NT		NT		NT		NT	
Pyridine	0.20	20	610	NT		NT		NT		NT		NT		NT	
Pesticides (mg/kg)															
Dilution Factor				*5*		*5*		*5*		*5*		*5*		*5*	
4,4'-DDE	NS	NS	NS	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	**0.00126**	
4,4'-DDT	NS	NS	NS	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	**0.00146**	
Total DDT	0.003	1.8	17	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	**0.00272**	
Aldrin	0.002	0.04	0.34	0.00254	U	0.00281	U	0.00054	U	0.00055	U	0.00275	U	0.00058	U
ETPH (mg/kg)															
Dilution Factor															
ETPH	500	500	2,500	NT		NT		NT		NT		NT		NT	
Metals, Total (mg/kg)															
Dilution Factor															
Arsenic	NS	10	10	NT		NT		NT		NT		NT		NT	
Barium	NS	4700	140000	NT		NT		NT		NT		NT		NT	
Beryllium	NS	2	2	NT		NT		NT		NT		NT		NT	
Cadmium	NS	34	1000	NT		NT		NT		NT		NT		NT	
Chromium, Trivalent	NS	4000	51100	NT		NT		NT		NT		NT		NT	
Copper	NS	2500	76000	NT		NT		NT		NT		NT		NT	
Lead	NS	400	1000	NT		NT		NT		NT		NT		NT	
Mercury	NS	20	610	NT		NT		NT		NT		NT		NT	
Nickel	NS	1400	7500	NT		NT		NT		NT		NT		NT	
Vanadium	NS	470	14000	NT		NT		NT		NT		NT		NT	
Zinc	NS	20000	610000	NT		NT		NT		NT		NT		NT	

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P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations th

* = This duplicate sample was re-run for total SVOCs only due to suspected asphalt contamination in the original sample.
ND = Not detected
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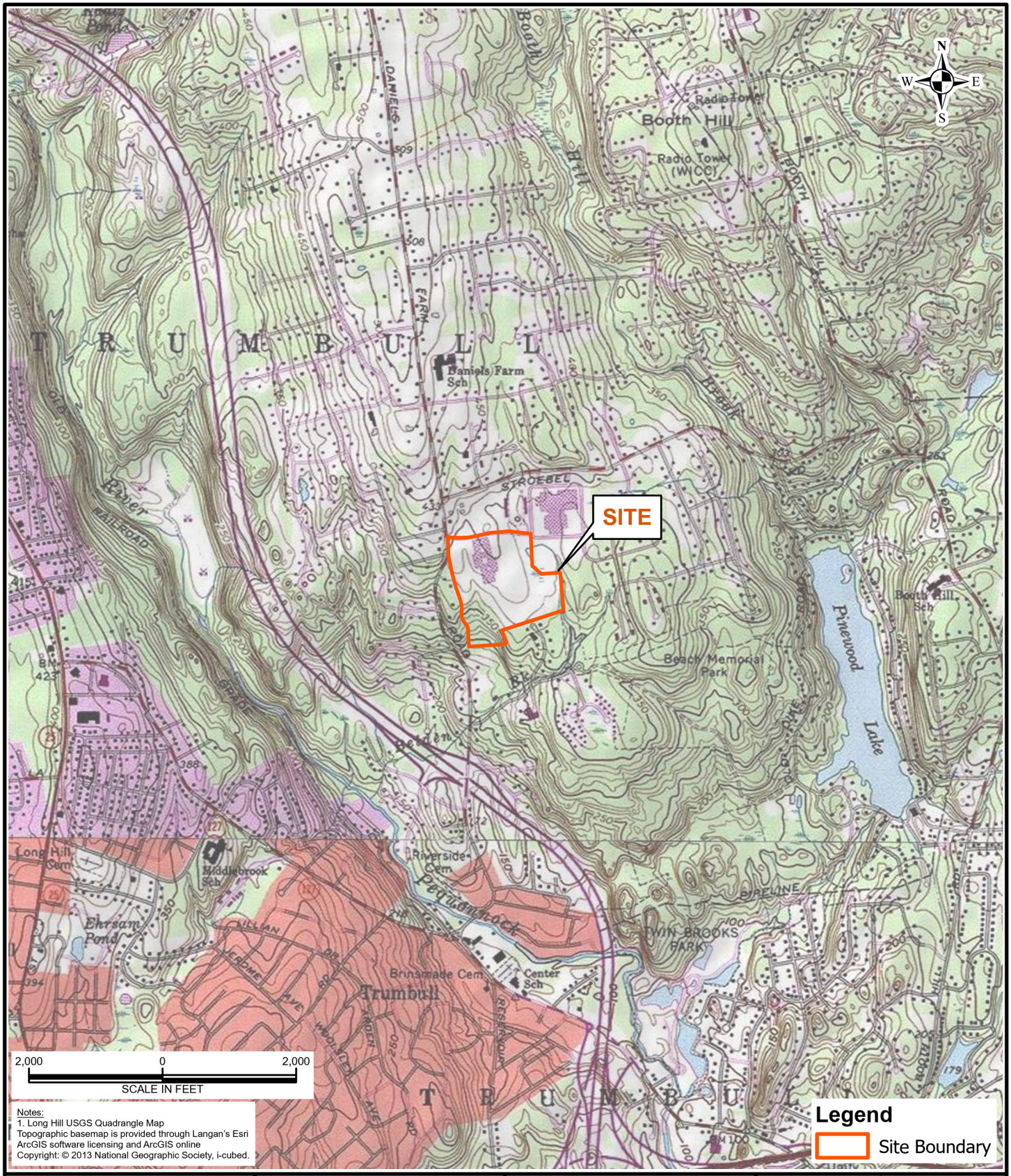
CTDEEP I/C DEC = Residential Direct Exposure Criteria

VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
ETPH = Extractable Total Petroleum Hydrocarbons
mg/kg = miligram per kilogram

Indicates an exceedance of GA Pollutant Mobility Criteria
Indicates an exceedance of Residential Direct Exposure Criteria
Indicates an exceedance of Ind/Comm. Direct Exposure Criteria

FIGURES



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Project	Figure Title	Project No.	Figure
HILLCREST MIDDLE SCHOOL TRUMBULL FAIRFIELD OUNTY CT	SITE LOCATION MAP	140325901 Date 8/21/2025 Scale 1" = 2,000 feet Drawn By LDB	1

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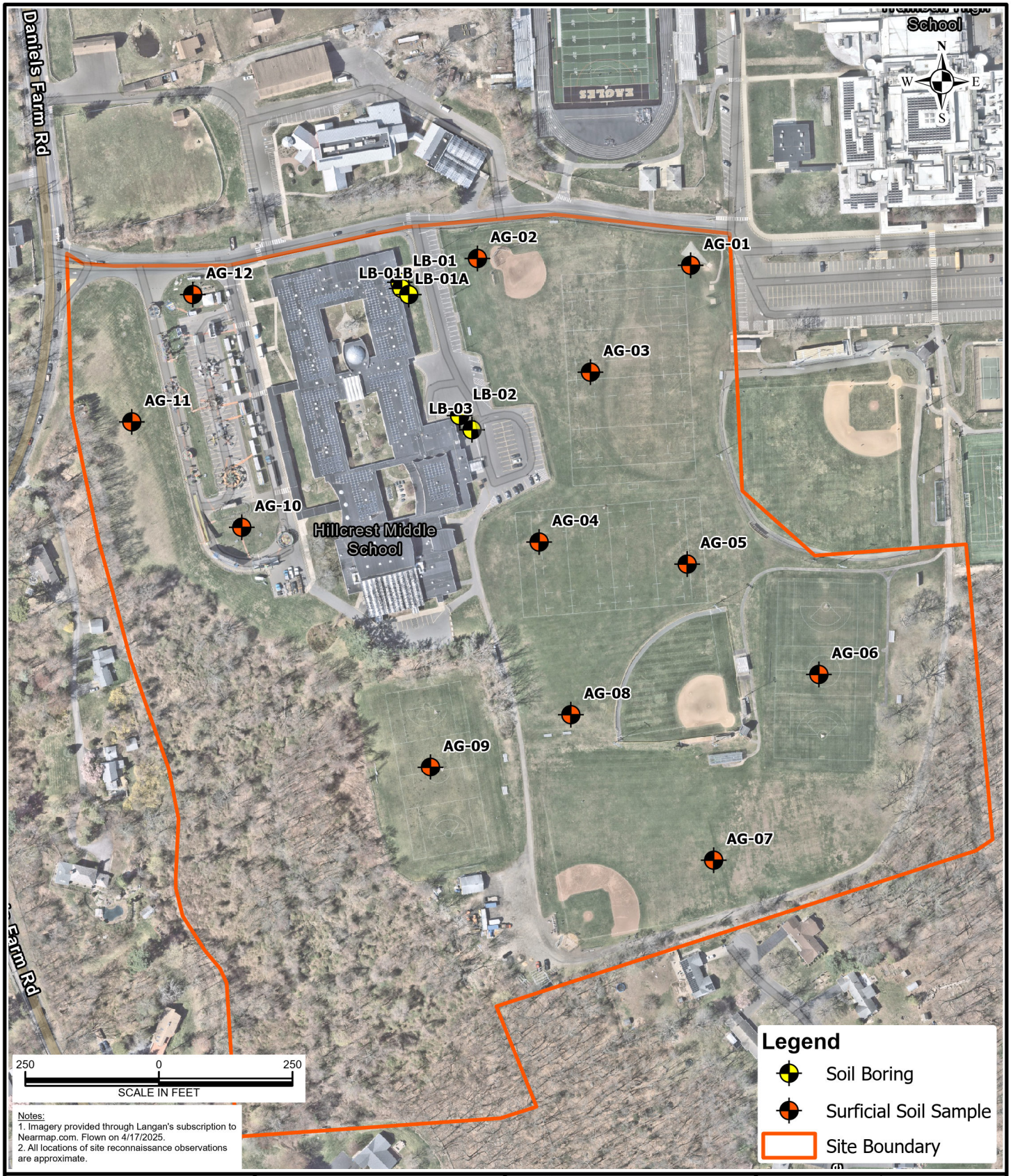
Path: \\langan.com\data\NHV\data9\140325901\Project Data\ArcGIS\APRX\140325901\140325901.aprx



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Project	Figure Title	Project No.	Figure
HILLCREST MIDDLE SCHOOL TRUMBULL FAIRFIELD OUNTY CT	PHASE II INVESTIGATION MAP	140325901 Date 8/21/2025 Scale 1" = 250 feet Drawn By LDB	2

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Appendix A Photographic Log

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Site Photographs

Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
08/06/2025	1

Direction Photo Taken:

Southwest

Description:

AOC-1 – Historical Technical Auto Repair Classroom area.



Date	Photo No.
08/06/2025	2

Direction Photo Taken:

Southwest

Description:

AOC-1 – Historical Technical Auto Repair Classroom area.



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Site Photographs

Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
08/06/2025	3

Direction Photo Taken:

East

Description:

AOC-2 – 10,000-Gallon Fuel Oil UST area (presume tank grave outlined in blue).



Date	Photo No.
08/06/2025	4

Direction Photo Taken:

South

Description:

AOC-3 – Flammable Cabinet and Drum Storage.



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Site Photographs

Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
08/06/2025	5

Direction Photo Taken:

South

Description:

AOC-4 – Transformer room entrance.



Date	Photo No.
Unknown	6

Direction Photo Taken:

Unknown

Description:

AOC-4 – Transformer room (photo of interior provided by school staff). This photo was not taken by Langan.



Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
Unknown	7

Direction Photo Taken:

Unknown

Description:

AOC-4 – Transformer room (photo of interior provided by school staff). This photo was not taken by Langan.



Date	Photo No.
08/06/2025	8

Direction Photo Taken:

Northwest

Description:

AOC-5 – Diesel Generator.



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Site Photographs

Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
08/06/2025	9

Direction Photo Taken:

South

Description:

AOC-6 – Former Paint-Mixing and Spray Booth (exterior).



Date	Photo No.
08/06/2025	10

Direction Photo Taken:

North

Description:

AOC-6 – Former Paint-Mixing and Spray Booth (interior).



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Site Photographs

Client Name:	Subject Property Location:	Project No.
TKSP Studio	Hillcrest MS - 530 Daniels Farm Rd, Trumbull, CT	140325901

Date	Photo No.
08/06/2025	11

Direction Photo Taken:

West

Description:

AOC-6 – Former Paint-Mixing and Spray Booth (interior).



Date	Photo No.
08/06/2025	12

Direction Photo Taken:

North

Description:

AOC-6 – Former Paint-Mixing and Spray Booth (interior).



Appendix B Soil Boring Logs

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Log of Boring **AG-01** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, some root, some fibrous vegetation, trace subangular gravel, some clay, trace fine sand (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0	09:00 - Collect grab sample AG-01 from 0 to 0.5 ft bgs. Start Drilling: 0 ft, 8:00 AM
	N/A	Light reddish brown SILT, some clay, trace subangular gravel (dry) [FILL]	1	M-1B				0.0	
	N/A	End of Boring at 2.0ft.	2					0.0	Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
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			4						
			5						
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			7						
			8						
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			14						
			15						
			16						

LANGAN

Log of Boring **AG-02** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.2 0.0	Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0 0.2	08:25 - Collect grab sample AG-02 from 1.5 to 2.0 ft bgs. Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
	N/A	End of Boring at 2.0ft.	2						
			3						
			4						
			5						
			6						
			7						
			8						
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			11						
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			13						
			14						
			15						
			16						

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Log of Boring **AG-03** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0	Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0	09:15 - Collect grab sample AG-03 from 0.5 to 1.0 ft bgs.
	N/A	End of Boring at 2.0ft.	2					0.0	Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
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			4						
			5						
			6						
			7						
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			11						
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			13						
			14						
			15						
			16						

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Log of Boring **AG-04** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0 0.1	Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.1 0.0	09:55 - Collect grab sample AG-04 from 1.0 to 1.5 ft bgs.
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
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			4						
			5						
			6						
			7						
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			16						

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Log of Boring **AG-05** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0 0.0	09:35 - Collect grab sample AG-05 from 0 to 0.5 ft bgs. Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0 0.0	
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
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			11						
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			14						
			15						
			16						

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Log of Boring **AG-06** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0	Start Drilling: 0 ft, 10:40 AM
	N/A							0.0	10:15 - Collect grab sample AG-06 from 0.5 to 1.0 ft bgs.
		Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0	
	N/A							0.0	
		End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
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			7						
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			9						
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			11						
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			16						

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Log of Boring **AG-07** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.2 0.0	Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0 0.2	09:00 - Collect grab sample AG-07 from 1.5 to 2.0 ft bgs. Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
	N/A	End of Boring at 2.0ft.	2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
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			13						
			14						
			15						
			16						

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Log of Boring **AG-08** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.2 0.0	09:15 - Collect grab sample AG-08 from 0 to 0.5 ft bgs. Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0 0.2	
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
			6						
			7						
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			9						
			10						
			11						
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			14						
			15						
			16						

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Log of Boring **AG-09** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Dark brown SILT, trace fine sand, trace clay, trace fine gravel (moist) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.0 0.0	Start Drilling: 0 ft, 8:50 AM
	N/A	Dark brown to orangish brown Silty fine SAND, trace fine gravel (moist) [FILL]	1	M-1B				0.0 0.0	08:45 - Collect grab sample AG-09 from 1 to 1.5 ft bgs.
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with drill cuttings and filter sand to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **AG-10** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, some clay, trace fine sand, trace subangular gravel, root, fibrous vegetation (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24			Start Drilling: 0 ft, 8:00 AM 08:20 - Collect grab sample AG-10 from 0.5 to 1.0 ft bgs.
	N/A	Brown SILT, some clay, trace fine sand, trace gravel (dry) [FILL]	1	M-1B					
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
			6						
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			15						
			16						

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Log of Boring **AG-11** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, some clay, trace fine sand, trace subangular gravel, root, fibrous vegetation (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24			Start Drilling: 0 ft, 8:00 AM
	N/A	Brown SILT, some clay, trace fine sand, trace gravel (dry) [FILL]	1	M-1B					08:10 - Collect grab sample AG-11 from 1 to 1.5 ft bgs.
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **AG-12** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/7/2025 — Date Finished: 8/7/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, some clay, trace fine sand, trace subangular gravel, root, fibrous vegetation (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24			Start Drilling: 0 ft, 8:00 AM
	N/A	Brown SILT, some clay, trace fine sand, trace gravel (dry) [FILL]	1	M-1B					08:00 - Collect grab sample AG-12 from 1.5 to 2.0 ft bgs.
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with auger cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **LB-01** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Direct Push	Completion Depth: 4.5 ft — Rock Depth:
Size and Type of Bit: N/A	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A — Completion ▼ N/A — 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler: Macrocore	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description
	N/A	Light brown SILT, some clay (dry) [TOPSOIL]
	N/A	Brown SILT, trace fine subrounded gravel, trace fine sand, some clay (dry) [FILL]
	N/A	Light gray SCHIST, weathered bedrock (dry) [WEATHERED ROCK]

Depth Scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Sample Data

Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)
M-1A				0.0
				0.0
				0.0
				0.0
				0.0
M-1B	Macrocore	41/48		0.0
				0.0
				0.0
M-1C				0.0
				0.0

Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)

Start Drilling: 0 ft, 12:20 PM

13:45 - Collect grab sample LB-01 from 2.5 to 4.5 ft bgs.

Refusal encountered at 4.5 ft. Borehole backfilled with drill cuttings to grade.

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Log of Boring **LB-01A** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Direct Push	Completion Depth: 4.5 ft — Rock Depth:
Size and Type of Bit: N/A	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A — Completion ▼ N/A — 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler: Macrocore	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Light brown SILT, some clay (dry) [TOPSOIL]	0	M-1A				0.0	Start Drilling: 0 ft, 12:20 PM
	N/A	Brown SILT, trace fine subrounded gravel, trace fine sand, some clay (dry) [FILL]	1					0.0	
			2	M-1B	Macrocore	41/48		0.0	
			3					0.0	
	N/A	Light gray SCHIST, weathered bedrock (dry) [WEATHERED ROCK]	4	M-1C				0.0	Refusal encountered at 4.5 ft. Borehole backfilled with drill cuttings to grade.
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **LB-01B** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Direct Push	Completion Depth: 4.5 ft — Rock Depth:
Size and Type of Bit: N/A	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First N/A — Completion N/A — 24 HR. N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler: Macrocore	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Light brown SILT, some clay (dry) [TOPSOIL]	0	M-1A	Macrocore	41/48		0.0	Start Drilling: 0 ft, 12:20 PM
			0.5					0.0	
	N/A	Brown SILT, trace fine subrounded gravel, trace fine sand, some clay (dry) [FILL]	1					0.0	
			1.5					0.0	
			2	M-1B				0.0	
			2.5					0.0	
			3					0.0	
	N/A		3.5					0.0	
		Light gray SCHIST, weathered bedrock (dry) [WEATHERED ROCK]	4	M-1C				0.0	
			4.5						Refusal encountered at 4.5 ft. Borehole backfilled with drill cuttings to grade.
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **LB-02** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Direct Push	Completion Depth: 11.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: Not Applicable	Number of Samples: Disturbed 3 — Undisturbed 0 — Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A — Completion ▼ N/A — 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler: Macrocore	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A								
	N/A	Black ASPHALT (dry) [ASPHALT]	0	M-1A				0.0	Start Drilling: 0 ft, 1:57 PM
		Dark brown fine SAND, some silt, trace fine subrounded gravel (dry) [FILL]	1					0.0	
				M-1B	Macrocore	37/48		0.0	
			2					0.0	
								0.0	
			3					0.0	
								0.0	
		Dark brown fine SAND, some silt, trace fine gravel (dry) [FILL]	4					0.0	
				M-2A				0.0	
		Brown to brownish gray Gravelly fine SAND, trace silt (moist) [FILL]	5					0.0	
								0.0	
			6	M-2B	Macrocore	34/48		0.0	
								0.0	
			7					0.0	14:05 - Collect grab sample LB-02 from 7 to 8 ft bgs.
	N/A							0.0	
	N/A	Gray CONCRETE (moist) [CONCRETE]		M-2C					
		Brown to dark brown subangular GRAVEL, trace fine sand (wet) [FILL]	8					0.0	
								0.0	
			9	M-3	Macrocore	22/36		0.0	
								0.0	
			10					0.0	
								0.0	
	N/A		11						Refusal encountered at 11 ft. Borehole backfilled with drill cuttings to grade.
		End of Boring at 11.0ft.	12						
			13						
			14						
			15						
			16						

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Log of Boring **LB-03** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Direct Push	Completion Depth: 7.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: Not Applicable	Number of Samples: Disturbed 2, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler: Macrocore	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description
	N/A	Dark brown SILT, trace fine gravel (dry) [TOPSOIL]
	N/A	Light brown to reddish brown Silty fine SAND, trace gravel (dry) [FILL]
	N/A	White to light gray SCHIST (dry) [WEATHERED ROCK]
	N/A	End of Boring at 7.0ft.

Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)
0	M-1A	Macrocore	35/48		0.0
1					0.0
2	M-1B				0.0
3					0.0
4	M-2A	Macrocore	32/36		0.0
5					0.0
6	M-2B				0.0
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)

Start Drilling: 0 ft, 2:40 PM

14:50 - Collect grab sample LB-03 from 5.5 to 6.5 ft bgs.

Refusal encountered at 7 ft. Borehole backfilled with drill cuttings to grade.

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Log of Boring **SS-01** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0					0.0	Start Drilling: 0 ft, 10:40 AM
	N/A			M-1A	Macrocore	24/24		0.1	11:10 - Collect grab sample SS-01 from 0.5 to 1.0 ft bgs.
		Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.2	
	N/A							0.0	
		End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with drill cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **SS-02** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.2 0.1	10:55 - Collect grab sample SS-02 from 0 to 0.5 ft bgs. Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.3 0.3	
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with drill cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

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Log of Boring **SS-03** Sheet 1 of 1

Project: Hillcrest MS	Project No.: 140325901
Location: 530 DANIELS FARM RD, Trumbull, CT	Elevation and Datum: N/A
Drilling Company: Lakewood	Date Started: 8/6/2025 — Date Finished: 8/6/2025
Drilling Equipment: Hand Auger	Completion Depth: 2.0 ft — Rock Depth: Not Encountered
Size and Type of Bit: N/A	Number of Samples: Disturbed 1, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ⧩ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Adam
Sampler:	Field Engineer: William Adsit
Sampler Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	N/A	Brown SILT, fibrous vegetation, rootlets, trace coarse gravel, trace clay (dry) [TOPSOIL]	0	M-1A	Macrocore	24/24		0.1 0.0	11:40 - Collect grab sample SS-03 from 0 to 0.5 ft bgs. Start Drilling: 0 ft, 10:40 AM
	N/A	Light reddish brown SILT, trace fine to coarse gravel (dry) [FILL]	1	M-1B				0.0 0.0	
	N/A	End of Boring at 2.0ft.	2						Hand auger to 2.00 ft. Borehole backfilled with drill cuttings to grade.
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

Appendix C Laboratory Analytical Reports

Technical Report

prepared for:

Langan Engineering & Environmental Services (CT)
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511-6107
Attention: William Adsit

Report Date: 08/13/2025
Client Project ID: 140325901
York Project (SDG) No.: 25H0361

Report Date: 08/13/2025
Client Project ID: 140325901
York Project (SDG) No.: 25H0361

Langan Engineering & Environmental Services (CT)
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511-6107
Attention: William Adsit

Purpose and Results

This report contains the analytical data for the sample(s) identified on the attached chain-of-custody received in our laboratory on August 06, 2025 and listed below. The project was identified as your project: **140325901**.

The analyses were conducted utilizing appropriate EPA, Standard Methods, and ASTM methods as detailed in the data summary tables.

All samples were received in proper condition meeting the customary acceptance requirements for environmental samples except those indicated under the Sample and Analysis Qualifiers section of this report.

All analyses met the method and laboratory standard operating procedure requirements except as indicated by any data flags, the meaning of which are explained in the Sample and Data Qualifiers Relating to This Work Order section of this report and case narrative if applicable.

The results of the analyses, which are all reported on dry weight basis (soils) unless otherwise noted, are detailed in the following pages.

Please contact Client Services at 203.325.1371 with any questions regarding this report.

York Sample ID	Client Sample ID	Matrix	Date Collected	Date Received
25H0361-01	SS-01	Soil	08/06/2025	08/06/2025
25H0361-02	SS-02	Soil	08/06/2025	08/06/2025
25H0361-03	SS-03	Soil	08/06/2025	08/06/2025
25H0361-04	AG-01	Soil	08/06/2025	08/06/2025
25H0361-05	AG-02	Soil	08/06/2025	08/06/2025
25H0361-06	AG-03	Soil	08/06/2025	08/06/2025
25H0361-07	AG-04	Soil	08/06/2025	08/06/2025
25H0361-08	AG-05	Soil	08/06/2025	08/06/2025
25H0361-09	AG-06	Soil	08/06/2025	08/06/2025
25H0361-10	DUP	Soil	08/06/2025	08/06/2025
25H0361-11	LB-01	Soil	08/06/2025	08/06/2025
25H0361-12	LB-02	Soil	08/06/2025	08/06/2025
25H0361-13	LB-03	Soil	08/06/2025	08/06/2025
25H0361-14	Trip Blanks	Water	08/06/2025	08/06/2025

General Notes for York Project (SDG) No.: 25H0361

1. The RLs and MDLs (Reporting Limit and Method Detection Limit respectively) reported are adjusted for any dilution necessary due to the levels of target and/or non-target analytes and matrix interference. The RL(REPORTING LIMIT) is based upon the lowest standard utilized for the calibration where applicable.
2. Samples are retained for a period of thirty days after submittal of report, unless other arrangements are made.
3. York's liability for the above data is limited to the dollar value paid to York for the referenced project.
4. This report shall not be reproduced without the written approval of York Analytical Laboratories, Inc.
5. All analyses conducted met method or Laboratory SOP requirements. See the Sample and Data Qualifiers Section for further information.
6. It is noted that no analyses reported herein were subcontracted to another laboratory, unless noted in the report.
7. This report reflects results that relate only to the samples submitted on the attached chain-of-custody form(s) received by York.
8. Analyses conducted at York Analytical Laboratories, Inc. Stratford, CT are indicated by NY Cert. No. 10854; those conducted at York Analytical Laboratories, Inc., Richmond Hill, NY are indicated by NY Cert. No. 12058.

Approved By  **Date:** 08/13/2025

Cassie L. Mosher
Laboratory Manager

Sample Information

Client Sample ID: SS-01 **York Sample ID:** 25H0361-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:10 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-01 **York Sample ID:** 25H0361-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:10 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	12	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-01 **York Sample ID:** 25H0361-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:10 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	QL-02, CCVE, ICVE20	ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	12	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	12	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	12	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND	ICVE20	ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	12	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-01 **York Sample ID:** 25H0361-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:10 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	5.8	1	EPA 8260D	08/12/2025 07:17	08/12/2025 11:14	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*99.9 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*104 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*100 %*	*70-130*

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-36-0	Antimony	ND		mg/kg dry	1.99	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-38-2	**Arsenic**	**4.37**		mg/kg dry	1.19	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-39-3	**Barium**	**55.7**		mg/kg dry	1.99	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-41-7	**Beryllium**	**0.443**		mg/kg dry	0.040	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-43-9	**Cadmium**	**0.497**		mg/kg dry	0.239	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-47-3	**Chromium**	**20.4**		mg/kg dry	0.398	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-50-8	**Copper**	**16.4**		mg/kg dry	1.59	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7439-92-1	**Lead**	**21.5**		mg/kg dry	0.398	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-02-0	**Nickel**	**12.9**		mg/kg dry	0.793	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7782-49-2	Selenium	ND		mg/kg dry	1.99	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-01 **York Sample ID:** 25H0361-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:10 am	08/06/2025

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-22-4	Silver	ND	M-CCV 1	mg/kg dry	0.401	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-28-0	Thallium	ND		mg/kg dry	1.99	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-62-2	**Vanadium**	**30.4**		mg/kg dry	0.793	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-66-6	**Zinc**	**61.5**		mg/kg dry	1.98	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:23	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Mercury by 7473

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.0726**		mg/kg dry	0.0344	1	EPA 7473	08/07/2025 08:35	08/07/2025 13:06	DBT
							Certifications:	CTDOH-PH-0723,NJDEP-CT005,NELAC-NY10854,PADEP-68-044		

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**87.2**		%	0.100	1	SM 2540G	08/08/2025 08:55	08/08/2025 09:19	BF
							Certifications:	CTDOH-PH-0723		

Sample Information

Client Sample ID: SS-02 **York Sample ID:** 25H0361-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:55 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-02 **York Sample ID:** 25H0361-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:55 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	13	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND	QL-02, ICVE20	ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-02 **York Sample ID:** 25H0361-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:55 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	QL-02, ICVE	ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	13	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	13	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	13	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	13	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-02 **York Sample ID:** 25H0361-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:55 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	6.4	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:01	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*110 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*103 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*112 %*	*70-130*

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-36-0	Antimony	ND		mg/kg dry	2.05	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-38-2	**Arsenic**	**4.42**		mg/kg dry	1.23	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-39-3	**Barium**	**55.6**		mg/kg dry	2.04	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-41-7	**Beryllium**	**0.464**		mg/kg dry	0.041	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-43-9	**Cadmium**	**0.403**		mg/kg dry	0.245	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-47-3	**Chromium**	**22.0**		mg/kg dry	0.409	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-50-8	**Copper**	**21.7**		mg/kg dry	1.64	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7439-92-1	**Lead**	**50.1**		mg/kg dry	0.409	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-02-0	**Nickel**	**13.0**		mg/kg dry	0.815	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7782-49-2	Selenium	ND		mg/kg dry	2.05	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-22-4	Silver	ND	M-CCV 1	mg/kg dry	0.412	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-02 **York Sample ID:** 25H0361-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:55 am	08/06/2025

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-28-0	Thallium	ND		mg/kg dry	2.05	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-62-2	**Vanadium**	**31.4**		mg/kg dry	0.815	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-66-6	**Zinc**	**81.4**		mg/kg dry	2.04	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:33	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Mercury by 7473

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.107**		mg/kg dry	0.0353	1	EPA 7473	08/07/2025 08:35	08/07/2025 13:06	DBT
							Certifications:	CTDOH-PH-0723,NJDEP-CT005,NELAC-NY10854,PADEP-68-044		

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**84.9**		%	0.100	1	SM 2540G	08/08/2025 08:55	08/08/2025 09:19	BF
							Certifications:	CTDOH-PH-0723		

Sample Information

Client Sample ID: SS-03 **York Sample ID:** 25H0361-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:40 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-03 **York Sample ID:** 25H0361-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:40 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	11	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND	ICVE20, QL-02	ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-03 **York Sample ID:** 25H0361-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:40 am	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	ICVE, QL-02	ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	11	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	11	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	11	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	11	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-03 **York Sample ID:** 25H0361-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:40 am	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	5.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:29	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*112 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*103 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*112 %*	*70-130*

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-36-0	Antimony	ND		mg/kg dry	1.93	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-38-2	**Arsenic**	**3.97**		mg/kg dry	1.16	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-39-3	**Barium**	**42.1**		mg/kg dry	1.93	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-41-7	**Beryllium**	**0.352**		mg/kg dry	0.039	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-43-9	Cadmium	ND		mg/kg dry	0.232	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-47-3	**Chromium**	**15.0**		mg/kg dry	0.386	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-50-8	**Copper**	**17.6**		mg/kg dry	1.54	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7439-92-1	**Lead**	**19.0**		mg/kg dry	0.386	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-02-0	**Nickel**	**9.69**		mg/kg dry	0.769	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7782-49-2	Selenium	ND		mg/kg dry	1.93	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-22-4	Silver	ND	M-CCV 1	mg/kg dry	0.389	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: SS-03 **York Sample ID:** 25H0361-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 11:40 am	08/06/2025

Metals, CTDEP RCP

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3050B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7440-28-0	Thallium	ND		mg/kg dry	1.93	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-62-2	**Vanadium**	**24.6**		mg/kg dry	0.769	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7440-66-6	**Zinc**	**55.8**		mg/kg dry	1.92	1	EPA 6010D	08/11/2025 14:35	08/12/2025 10:35	AGNR
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Mercury by 7473

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 7473 soil

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
7439-97-6	**Mercury**	**0.0471**		mg/kg dry	0.0333	1	EPA 7473	08/07/2025 08:35	08/07/2025 13:06	DBT
							Certifications:	CTDOH-PH-0723,NJDEP-CT005,NELAC-NY10854,PADEP-68-044		

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**90.0**		%	0.100	1	SM 2540G	08/08/2025 08:55	08/08/2025 09:19	BF
							Certifications:	CTDOH-PH-0723		

Sample Information

Client Sample ID: AG-01 **York Sample ID:** 25H0361-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:00 am	08/06/2025

Pesticides, CT RCP Target List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	**4,4'-DDE**	**0.00446**		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	**4,4'-DDT**	**0.00473**		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0344	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00258	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0129	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.130	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:38	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-01 **York Sample ID:** 25H0361-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:00 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*34.7 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*36.1 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**94.0**		%	0.100	1	SM 2540G	08/08/2025 12:41	08/08/2025 12:58	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: AG-02 **York Sample ID:** 25H0361-05

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 8:25 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0348	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00261	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0130	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.132	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:00	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-02 **York Sample ID:** 25H0361-05

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 8:25 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*47.9 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*32.4 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**93.0**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: AG-03 **York Sample ID:** 25H0361-06

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:15 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0349	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00262	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0131	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.132	5	EPA 8081B	08/08/2025 10:03	08/10/2025 21:16	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-03 **York Sample ID:** 25H0361-06

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:15 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*49.7 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*38.7 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**92.7**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: AG-04 **York Sample ID:** 25H0361-07

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:55 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	**4,4'-DDE**	**0.00321**		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	**4,4'-DDT**	**0.00316**		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0338	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0127	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.128	5	EPA 8081B	08/08/2025 10:03	08/13/2025 07:03	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-04 **York Sample ID:** 25H0361-07

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:55 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*140 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*154 %*	S-08, S-GC	*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**95.7**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: AG-05 **York Sample ID:** 25H0361-08

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:35 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0357	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00267	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0134	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.135	5	EPA 8081B	08/08/2025 10:03	08/13/2025 05:55	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-05 **York Sample ID:** 25H0361-08

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 9:35 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**			**Acceptance Range**					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*27.4 %*	S-08, S-GC		*30-150*					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*30.3 %*			*30-150*					

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**90.8**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: AG-06 **York Sample ID:** 25H0361-09

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:15 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0351	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00264	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0132	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.133	5	EPA 8081B	08/08/2025 10:03	08/10/2025 22:02	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: AG-06 **York Sample ID:** 25H0361-09

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:15 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**			**Acceptance Range**					
2051-24-3	*Surrogate: Decachlorobiphenyl*	*35.6 %*			*30-150*					
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*27.2 %*	S-08, S-GC		*30-150*					

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**92.0**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: **DUP** **York Sample ID:** **25H0361-10**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:15 am	08/06/2025

Pesticides, CT RCP Target List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-55-9	**4,4'-DDE**	**0.00623**		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-29-3	**4,4'-DDT**	**0.00504**		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
15972-60-8	Alachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723		
309-00-2	Aldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
319-85-7	beta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0339	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
60-57-1	Dieldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-20-8	Endrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-44-8	Heptachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00254	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0127	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
8001-35-2	Toxaphene	ND		mg/kg dry	0.129	5	EPA 8081B	08/08/2025 10:03	08/13/2025 06:12	RJ
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: DUP

York Sample ID: 25H0361-10

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 10:15 am	08/06/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PPCB

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*39.9 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*50.6 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**95.4**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	9.3	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND	ICVE20, QL-02	ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	ICVE, QL-02	ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	9.3	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	9.3	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	9.3	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	9.3	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	4.6	1	EPA 8260D	08/07/2025 17:26	08/10/2025 20:56	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*110 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*102 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*106 %*	*70-130*

Semi-Volatiles, CT RCP BNA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-94-3	1,2,4,5-Tetrachlorobenzene	ND	ICVE20	ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
90-12-0	1-Methylnaphthalene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723		
95-95-4	2,4,5-Trichlorophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
88-06-2	2,4,6-Trichlorophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
120-83-2	2,4-Dichlorophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
105-67-9	2,4-Dimethylphenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
51-28-5	2,4-Dinitrophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
121-14-2	2,4-Dinitrotoluene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
606-20-2	2,6-Dinitrotoluene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-58-7	2-Chloronaphthalene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Semi-Volatiles, CT RCP BNA List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
95-57-8	2-Chlorophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-57-6	2-Methylnaphthalene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
95-48-7	2-Methylphenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
88-74-4	2-Nitroaniline	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
88-75-5	2-Nitrophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
65794-96-9	3- & 4-Methylphenols	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
91-94-1	3,3-Dichlorobenzidine	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
99-09-2	3-Nitroaniline	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
534-52-1	4,6-Dinitro-2-methylphenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
101-55-3	4-Bromophenyl phenyl ether	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
59-50-7	4-Chloro-3-methylphenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-47-8	4-Chloroaniline	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
7005-72-3	4-Chlorophenyl phenyl ether	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-01-6	4-Nitroaniline	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-02-7	4-Nitrophenol	ND	CCVE	ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
83-32-9	Acenaphthene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
208-96-8	Acenaphthylene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
62-53-3	Aniline	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
120-12-7	Anthracene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-55-3	Benzo(a)anthracene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-32-8	Benzo(a)pyrene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
205-99-2	Benzo(b)fluoranthene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Semi-Volatiles, CT RCP BNA List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
191-24-2	Benzo(g,h,i)perylene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
207-08-9	Benzo(k)fluoranthene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
85-68-7	Benzyl butyl phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
111-91-1	Bis(2-chloroethoxy)methane	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
111-44-4	Bis(2-chloroethyl)ether	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-60-1	Bis(2-chloroisopropyl)ether	ND	CCVE	ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
117-81-7	Bis(2-ethylhexyl)phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
86-74-8	Carbazole	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
218-01-9	Chrysene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53-70-3	Dibenzo(a,h)anthracene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
132-64-9	Dibenzofuran	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
84-66-2	Diethyl phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
131-11-3	Dimethyl phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
84-74-2	Di-n-butyl phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
117-84-0	Di-n-octyl phthalate	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
206-44-0	Fluoranthene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
86-73-7	Fluorene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
118-74-1	Hexachlorobenzene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
77-47-4	Hexachlorocyclopentadiene	ND	CCVE	ug/kg dry	528	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-72-1	Hexachloroethane	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
193-39-5	Indeno(1,2,3-cd)pyrene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-01 **York Sample ID:** 25H0361-11

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Semi-Volatiles, CT RCP BNA List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
78-59-1	Isophorone	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
98-95-3	Nitrobenzene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
621-64-7	N-nitroso-di-n-propylamine	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
86-30-6	N-Nitrosodiphenylamine	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
82-68-8	Pentachloronitrobenzene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723		
87-86-5	Pentachlorophenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
85-01-8	Phenanthrene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-95-2	Phenol	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
129-00-0	Pyrene	ND		ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-86-1	Pyridine	ND	CCVE	ug/kg dry	264	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:08	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
367-12-4	*Surrogate: SURR: 2-Fluorophenol*	*72.5 %*	*30-130*
13127-88-3	*Surrogate: SURR: Phenol-d6*	*67.7 %*	*30-130*
4165-60-0	*Surrogate: SURR: Nitrobenzene-d5*	*37.7 %*	*30-130*
321-60-8	*Surrogate: SURR: 2-Fluorobiphenyl*	*62.0 %*	*30-130*
118-79-6	*Surrogate: SURR: 2,4,6-Tribromophenol*	*105 %*	*30-130*
1718-51-0	*Surrogate: SURR: Terphenyl-d14*	*79.2 %*	*30-130*

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 ETPH

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	ETPH (Extractable Total Petroleum Hydrocarbons)	ND		mg/kg dry	41.8	1	CT DEP ETPH	08/10/2025 07:00	08/10/2025 15:55	GXB
							Certifications:	CTDOH-PH-0723		

	Surrogate Recoveries	Result	Acceptance Range
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*96.7 %*	*50-150*

Total Solids

Log-in Notes:

Sample Notes:

Sample Information

Client Sample ID: **LB-01** **York Sample ID:** **25H0361-11**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 1:45 pm	08/06/2025

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**93.8**		%	0.100	1	SM 2540G	08/11/2025 08:32	08/11/2025 12:07	BF
							Certifications: CTDOH-PH-0723			

Sample Information

Client Sample ID: **LB-02** **York Sample ID:** **25H0361-12**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:05 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-02 **York Sample ID:** 25H0361-12

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:05 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	10	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND	ICVE20, QL-02	ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-02 **York Sample ID:** 25H0361-12

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:05 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	ICVE, QL-02	ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	10	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	10	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	10	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	10	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-02 **York Sample ID:** 25H0361-12

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:05 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	5.2	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:23	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*106 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*103 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*107 %*	*70-130*

Semi-volatiles, CT RCP PAH List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
91-57-6	2-Methylnaphthalene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
83-32-9	Acenaphthene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
208-96-8	Acenaphthylene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
120-12-7	Anthracene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-55-3	Benzo(a)anthracene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-32-8	Benzo(a)pyrene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
205-99-2	Benzo(b)fluoranthene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
191-24-2	Benzo(g,h,i)perylene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
207-08-9	Benzo(k)fluoranthene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
218-01-9	Chrysene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53-70-3	Dibenzo(a,h)anthracene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-02 **York Sample ID:** 25H0361-12

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:05 pm	08/06/2025

Semi-volatiles, CT RCP PAH List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
206-44-0	Fluoranthene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
86-73-7	Fluorene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
193-39-5	Indeno(1,2,3-cd)pyrene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
85-01-8	Phenanthrene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
129-00-0	Pyrene	ND		mg/kg dry	0.320	1	EPA 8270D	08/11/2025 10:13	08/13/2025 05:39	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
4165-60-0	*Surrogate: SURR: Nitrobenzene-d5*	*58.5 %*	*30-130*
321-60-8	*Surrogate: SURR: 2-Fluorobiphenyl*	*75.2 %*	*30-130*
1718-51-0	*Surrogate: SURR: Terphenyl-d14*	*91.0 %*	*30-130*

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 ETPH

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	ETPH (Extractable Total Petroleum Hydrocarbons)	ND		mg/kg dry	48.3	1	CT DEP ETPH	08/10/2025 07:00	08/10/2025 16:33	GXB
							Certifications:	CTDOH-PH-0723		

	Surrogate Recoveries	Result	Acceptance Range
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*88.7 %*	*50-150*

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**77.3**		%	0.100	1	SM 2540G	08/08/2025 08:55	08/08/2025 09:19	BF
							Certifications:	CTDOH-PH-0723		

Sample Information

Client Sample ID: LB-03 **York Sample ID:** 25H0361-13

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:50 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-55-6	1,1,1-Trichloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
79-00-5	1,1,2-Trichloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-34-3	1,1-Dichloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-35-4	1,1-Dichloroethylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
563-58-6	1,1-Dichloropropylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
96-18-4	1,2,3-Trichloropropane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-93-4	1,2-Dibromoethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-50-1	1,2-Dichlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-06-2	1,2-Dichloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
78-87-5	1,2-Dichloropropane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
541-73-1	1,3-Dichlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
142-28-9	1,3-Dichloropropane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
106-46-7	1,4-Dichlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-03 **York Sample ID:** 25H0361-13

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:50 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
78-93-3	2-Butanone	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-49-8	2-Chlorotoluene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
591-78-6	2-Hexanone	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
106-43-4	4-Chlorotoluene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-10-1	4-Methyl-2-pentanone	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-64-1	Acetone	ND		ug/kg dry	7.7	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
107-13-1	Acrylonitrile	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
71-43-2	Benzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-86-1	Bromobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-97-5	Bromochloromethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-27-4	Bromodichloromethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-25-2	Bromoform	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-83-9	Bromomethane	ND	ICVE20, QL-02	ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-15-0	Carbon disulfide	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-23-5	Carbon tetrachloride	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
108-90-7	Chlorobenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-00-3	Chloroethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
67-66-3	Chloroform	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
74-87-3	Chloromethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-03 **York Sample ID:** 25H0361-13

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:50 pm	08/06/2025

Volatiles, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
74-95-3	Dibromomethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
75-71-8	Dichlorodifluoromethane	ND	ICVE, QL-02	ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
100-41-4	Ethyl Benzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
87-68-3	Hexachlorobutadiene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
98-82-8	Isopropylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
80-62-6	Methyl Methacrylate	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-09-2	Methylene chloride	ND		ug/kg dry	7.7	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		ug/kg dry	7.7	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	NELAC-NY10854,NJDEP-CT005,PADEP-68-04440		
104-51-8	n-Butylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
103-65-1	n-Propylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
95-47-6	o-Xylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
179601-23-1	p- & m- Xylenes	ND		ug/kg dry	7.7	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,PADEP-68-04440		
99-87-6	p-Isopropyltoluene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
135-98-8	sec-Butylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
100-42-5	Styrene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
98-06-6	tert-Butylbenzene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
127-18-4	Tetrachloroethylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
109-99-9	Tetrahydrofuran	ND		ug/kg dry	7.7	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:			
108-88-3	Toluene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-03 **York Sample ID:** 25H0361-13

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:50 pm	08/06/2025

Volatiles, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5035A

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:			
79-01-6	Trichloroethylene	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-69-4	Trichlorofluoromethane	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
75-01-4	Vinyl Chloride	ND		ug/kg dry	3.8	1	EPA 8260D	08/07/2025 17:26	08/10/2025 21:50	PRS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*107 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*102 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*106 %*	*70-130*

Semi-volatiles, CT RCP PAH List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
91-57-6	2-Methylnaphthalene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
83-32-9	Acenaphthene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
208-96-8	Acenaphthylene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
120-12-7	Anthracene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
56-55-3	Benzo(a)anthracene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
50-32-8	Benzo(a)pyrene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
205-99-2	Benzo(b)fluoranthene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
191-24-2	Benzo(g,h,i)perylene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
207-08-9	Benzo(k)fluoranthene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
218-01-9	Chrysene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
53-70-3	Dibenzo(a,h)anthracene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

Sample Information

Client Sample ID: LB-03 **York Sample ID:** 25H0361-13

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Soil	August 6, 2025 2:50 pm	08/06/2025

Semi-volatiles, CT RCP PAH List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546- SVOA RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
206-44-0	Fluoranthene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
86-73-7	Fluorene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
193-39-5	Indeno(1,2,3-cd)pyrene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
91-20-3	Naphthalene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005		
85-01-8	Phenanthrene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		
129-00-0	Pyrene	ND		mg/kg dry	0.254	1	EPA 8270D	08/11/2025 10:13	08/13/2025 06:10	SS
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NJDEP-CT005,PADEP-68-044		

	Surrogate Recoveries	Result	Acceptance Range
4165-60-0	*Surrogate: SURR: Nitrobenzene-d5*	*43.4 %*	*30-130*
321-60-8	*Surrogate: SURR: 2-Fluorobiphenyl*	*69.6 %*	*30-130*
1718-51-0	*Surrogate: SURR: Terphenyl-d14*	*81.9 %*	*30-130*

Extractable Total Petroleum Hydrocarbons (ETPH)

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 ETPH

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
CT ETPH	ETPH (Extractable Total Petroleum Hydrocarbons)	ND		mg/kg dry	39.7	1	CT DEP ETPH	08/10/2025 07:00	08/10/2025 17:11	GXB
							Certifications:	CTDOH-PH-0723		

	Surrogate Recoveries	Result	Acceptance Range
3386-33-2	*Surrogate: 1-Chlorooctadecane*	*78.1 %*	*50-150*

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**96.8**		%	0.100	1	SM 2540G	08/08/2025 08:55	08/08/2025 09:19	BF
							Certifications:	CTDOH-PH-0723		

Sample Information

Client Sample ID: **Trip Blanks** **York Sample ID:** **25H0361-14**

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Water	August 6, 2025 3:00 pm	08/06/2025

Volatile Organics, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5030B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
630-20-6	1,1,1,2-Tetrachloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
71-55-6	1,1,1-Trichloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
79-34-5	1,1,2,2-Tetrachloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
79-00-5	1,1,2-Trichloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-34-3	1,1-Dichloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-35-4	1,1-Dichloroethylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
563-58-6	1,1-Dichloropropylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005		
87-61-6	1,2,3-Trichlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
96-18-4	1,2,3-Trichloropropane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
120-82-1	1,2,4-Trichlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
95-63-6	1,2,4-Trimethylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
96-12-8	1,2-Dibromo-3-chloropropane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
106-93-4	1,2-Dibromoethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
95-50-1	1,2-Dichlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
107-06-2	1,2-Dichloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
78-87-5	1,2-Dichloropropane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
108-67-8	1,3,5-Trimethylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
541-73-1	1,3-Dichlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
142-28-9	1,3-Dichloropropane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
106-46-7	1,4-Dichlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		

Sample Information

Client Sample ID: Trip Blanks **York Sample ID:** 25H0361-14

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Water	August 6, 2025 3:00 pm	08/06/2025

Volatile Organics, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5030B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
594-20-7	2,2-Dichloropropane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
78-93-3	2-Butanone	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
95-49-8	2-Chlorotoluene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
591-78-6	2-Hexanone	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
106-43-4	4-Chlorotoluene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
108-10-1	4-Methyl-2-pentanone	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
67-64-1	Acetone	ND		ug/L	2.00	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
107-13-1	Acrylonitrile	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
71-43-2	Benzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
108-86-1	Bromobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
74-97-5	Bromochloromethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
75-27-4	Bromodichloromethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-25-2	Bromoform	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
74-83-9	Bromomethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-15-0	Carbon disulfide	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
56-23-5	Carbon tetrachloride	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
108-90-7	Chlorobenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-00-3	Chloroethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
67-66-3	Chloroform	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
74-87-3	Chloromethane	ND	QL-02	ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
156-59-2	cis-1,2-Dichloroethylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
10061-01-5	cis-1,3-Dichloropropylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		

Sample Information

Client Sample ID: Trip Blanks

York Sample ID: 25H0361-14

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Water	August 6, 2025 3:00 pm	08/06/2025

Volatile Organics, 8260 CT RCP List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 5030B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
124-48-1	Dibromochloromethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
74-95-3	Dibromomethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
75-71-8	Dichlorodifluoromethane	ND	QL-02	ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
100-41-4	Ethyl Benzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
87-68-3	Hexachlorobutadiene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
98-82-8	Isopropylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
80-62-6	Methyl Methacrylate	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005		
1634-04-4	Methyl tert-butyl ether (MTBE)	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-09-2	Methylene chloride	ND		ug/L	2.00	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
91-20-3	Naphthalene	ND		ug/L	2.00	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
104-51-8	n-Butylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
103-65-1	n-Propylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
95-47-6	o-Xylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,PADEP-68		
179601-23-1	p- & m- Xylenes	ND		ug/L	1.00	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,PADEP-68		
99-87-6	p-Isopropyltoluene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
135-98-8	sec-Butylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
100-42-5	Styrene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
98-06-6	tert-Butylbenzene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
127-18-4	Tetrachloroethylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
109-99-9	Tetrahydrofuran	ND		ug/L	4.00	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:			
108-88-3	Toluene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
156-60-5	trans-1,2-Dichloroethylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		

Sample Information

Client Sample ID: Trip Blanks **York Sample ID:** 25H0361-14

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0361	140325901	Water	August 6, 2025 3:00 pm	08/06/2025

Volatile Organics, 8260 CT RCP List **Log-in Notes:** **Sample Notes:**

Sample Prepared by Method: EPA 5030B

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
10061-02-6	trans-1,3-Dichloropropylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
110-57-6	trans-1,4-dichloro-2-butene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	NELAC-NY10854,NELAC-NY12058,NJDEP-CT005,PADEP-68-04		
79-01-6	Trichloroethylene	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-69-4	Trichlorofluoromethane	ND		ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		
75-01-4	Vinyl Chloride	ND	QL-02	ug/L	0.500	1	EPA 8260D	08/11/2025 10:00	08/11/2025 15:38	PMB
							Certifications:	CTDOH-PH-0723,NELAC-NY10854,NELAC-NY12058,NJDEP-CT		

	Surrogate Recoveries	Result	Acceptance Range
17060-07-0	*Surrogate: SURR: 1,2-Dichloroethane-d4*	*100 %*	*70-130*
2037-26-5	*Surrogate: SURR: Toluene-d8*	*102 %*	*70-130*
460-00-4	*Surrogate: SURR: p-Bromofluorobenzene*	*101 %*	*70-130*

Analytical Batch Summary

Batch ID: BH50507 **Preparation Method:** EPA 7473 soil **Prepared By:** JWT

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-01	SS-01	08/07/25
25H0361-02	SS-02	08/07/25
25H0361-03	SS-03	08/07/25
BH50507-BLK1	Blank	08/07/25
BH50507-DUP1	Duplicate	08/07/25
BH50507-MS1	Matrix Spike	08/07/25
BH50507-SRM1	Reference	08/07/25

Batch ID: BH50593 **Preparation Method:** EPA 5035A **Prepared By:** PMB

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-02	SS-02	08/07/25
25H0361-03	SS-03	08/07/25
25H0361-11	LB-01	08/07/25
25H0361-12	LB-02	08/07/25
25H0361-13	LB-03	08/07/25
BH50593-BLK1	Blank	08/07/25
BH50593-BS1	LCS	08/07/25
BH50593-BSD1	LCS Dup	08/07/25

Batch ID: BH50636 **Preparation Method:** % Solids Prep **Prepared By:** BNF

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-01	SS-01	08/08/25
25H0361-02	SS-02	08/08/25
25H0361-03	SS-03	08/08/25
25H0361-12	LB-02	08/08/25
25H0361-13	LB-03	08/08/25
BH50636-DUP1	Duplicate	08/08/25

Batch ID: BH50645 **Preparation Method:** EPA 3546 PPCB **Prepared By:** FA

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-05	AG-02	08/08/25
25H0361-06	AG-03	08/08/25
25H0361-07	AG-04	08/08/25
25H0361-09	AG-06	08/08/25
BH50645-BLK1	Blank	08/08/25
BH50645-BS1	LCS	08/08/25

Batch ID: BH50658 **Preparation Method:** % Solids Prep **Prepared By:** BNF

YORK Sample ID	Client Sample ID	Preparation Date

25H0361-04	AG-01	08/08/25
BH50658-DUP1	Duplicate	08/08/25

Batch ID: BH50710 **Preparation Method:** EPA 3546 ETPH **Prepared By:** AJF

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-11	LB-01	08/10/25
25H0361-12	LB-02	08/10/25
25H0361-13	LB-03	08/10/25
BH50710-BLK1	Blank	08/10/25
BH50710-BS1	LCS	08/10/25
BH50710-MS1	Matrix Spike	08/10/25
BH50710-MSD1	Matrix Spike Dup	08/10/25

Batch ID: BH50741 **Preparation Method:** % Solids Prep **Prepared By:** BNF

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-05	AG-02	08/11/25
25H0361-06	AG-03	08/11/25
25H0361-07	AG-04	08/11/25
25H0361-08	AG-05	08/11/25
25H0361-09	AG-06	08/11/25
25H0361-10	DUP	08/11/25
25H0361-11	LB-01	08/11/25
BH50741-DUP1	Duplicate	08/11/25

Batch ID: BH50780 **Preparation Method:** EPA 3546- SVOA RCP **Prepared By:** JAA

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-11	LB-01	08/11/25
25H0361-12	LB-02	08/11/25
25H0361-13	LB-03	08/11/25

Batch ID: BH50793 **Preparation Method:** EPA 3050B **Prepared By:** KMQ

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-01	SS-01	08/11/25
25H0361-02	SS-02	08/11/25
25H0361-03	SS-03	08/11/25
BH50793-BLK1	Blank	08/11/25
BH50793-DUP1	Duplicate	08/11/25
BH50793-MS1	Matrix Spike	08/11/25
BH50793-PS1	Post Spike	08/11/25
BH50793-SRM1	Reference	08/11/25

Batch ID: BH50823 **Preparation Method:** EPA 5030B **Prepared By:** SKF

YORK Sample ID	Client Sample ID	Preparation Date

25H0361-14	Trip Blanks	08/11/25
BH50823-BLK1	Blank	08/11/25
BH50823-BS1	LCS	08/11/25
BH50823-BSD1	LCS Dup	08/11/25

Batch ID: BH50871 **Preparation Method:** EPA 3546 PPCB **Prepared By:** AJF

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-04	AG-01	08/08/25
25H0361-08	AG-05	08/08/25
25H0361-10	DUP	08/08/25
BH50871-BLK1	Blank	08/12/25
BH50871-BS1	LCS	08/12/25
BH50871-MS1	Matrix Spike	08/12/25
BH50871-MSD1	Matrix Spike Dup	08/12/25

Batch ID: BH50889 **Preparation Method:** EPA 5035A **Prepared By:** PRS

YORK Sample ID	Client Sample ID	Preparation Date
25H0361-01	SS-01	08/12/25
BH50889-BLK1	Blank	08/12/25
BH50889-BS1	LCS	08/12/25
BH50889-BSD1	LCS Dup	08/12/25
BH50889-MS1	Matrix Spike	08/12/25
BH50889-MSD1	Matrix Spike Dup	08/12/25

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50593 - EPA 5035A											
Blank (BH50593-BLK1) Blank										Prepared: 08/07/2025 Analyzed: 08/10/2025	
1,1,1,2-Tetrachloroethane	ND	5.0	ug/kg wet								
1,1,1-Trichloroethane	ND	5.0	"								
1,1,2,2-Tetrachloroethane	ND	5.0	"								
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	5.0	"								
1,1,2-Trichloroethane	ND	5.0	"								
1,1-Dichloroethane	ND	5.0	"								
1,1-Dichloroethylene	ND	5.0	"								
1,1-Dichloropropylene	ND	5.0	"								
1,2,3-Trichlorobenzene	ND	5.0	"								
1,2,3-Trichloropropane	ND	5.0	"								
1,2,4-Trichlorobenzene	ND	5.0	"								
1,2,4-Trimethylbenzene	ND	5.0	"								
1,2-Dibromo-3-chloropropane	ND	5.0	"								
1,2-Dibromoethane	ND	5.0	"								
1,2-Dichlorobenzene	ND	5.0	"								
1,2-Dichloroethane	ND	5.0	"								
1,2-Dichloropropane	ND	5.0	"								
1,3,5-Trimethylbenzene	ND	5.0	"								
1,3-Dichlorobenzene	ND	5.0	"								
1,3-Dichloropropane	ND	5.0	"								
1,4-Dichlorobenzene	ND	5.0	"								
2,2-Dichloropropane	ND	5.0	"								
2-Butanone	ND	5.0	"								
2-Chlorotoluene	ND	5.0	"								
2-Hexanone	ND	5.0	"								
4-Chlorotoluene	ND	5.0	"								
4-Methyl-2-pentanone	ND	5.0	"								
Acetone	ND	10	"								
Acrylonitrile	ND	5.0	"								
Benzene	ND	5.0	"								
Bromobenzene	ND	5.0	"								
Bromochloromethane	ND	5.0	"								
Bromodichloromethane	ND	5.0	"								
Bromoform	ND	5.0	"								
Bromomethane	ND	5.0	"								
Carbon disulfide	ND	5.0	"								
Carbon tetrachloride	ND	5.0	"								
Chlorobenzene	ND	5.0	"								
Chloroethane	ND	5.0	"								
Chloroform	ND	5.0	"								
Chloromethane	ND	5.0	"								
cis-1,2-Dichloroethylene	ND	5.0	"								
cis-1,3-Dichloropropylene	ND	5.0	"								
Dibromochloromethane	ND	5.0	"								
Dibromomethane	ND	5.0	"								
Dichlorodifluoromethane	ND	5.0	"								
Ethyl Benzene	ND	5.0	"								
Hexachlorobutadiene	ND	5.0	"								
Isopropylbenzene	ND	5.0	"								
Methyl Methacrylate	ND	5.0	"								

Volatile Organic Compounds by GC/MS - Quality Control Data

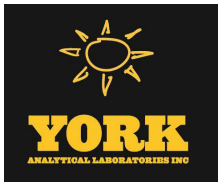
York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50593 - EPA 5035A											
Blank (BH50593-BLK1) Blank									Prepared: 08/07/2025 Analyzed: 08/10/2025		
Methyl tert-butyl ether (MTBE)	ND	5.0	ug/kg wet								
Methylene chloride	ND	10	"								
Naphthalene	ND	10	"								
n-Butylbenzene	ND	5.0	"								
n-Propylbenzene	ND	5.0	"								
o-Xylene	ND	5.0	"								
p- & m- Xylenes	ND	10	"								
p-Isopropyltoluene	ND	5.0	"								
sec-Butylbenzene	ND	5.0	"								
Styrene	ND	5.0	"								
tert-Butylbenzene	ND	5.0	"								
Tetrachloroethylene	ND	5.0	"								
Tetrahydrofuran	ND	10	"								
Toluene	ND	5.0	"								
trans-1,2-Dichloroethylene	ND	5.0	"								
trans-1,3-Dichloropropylene	ND	5.0	"								
trans-1,4-dichloro-2-butene	ND	5.0	"								
Trichloroethylene	ND	5.0	"								
Trichlorofluoromethane	ND	5.0	"								
Vinyl Chloride	ND	5.0	"								
Surrogate: SURR: 1,2-Dichloroethane-d4	*50.1*		*ug/L*	*50.0*		*100*	*70-130*				
Surrogate: SURR: Toluene-d8	*51.0*		*"*	*50.0*		*102*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*54.5*		*"*	*50.0*		*109*	*70-130*				
LCS (BH50593-BS1) LCS									Prepared: 08/07/2025 Analyzed: 08/10/2025		
1,1,1,2-Tetrachloroethane	44.4		ug/L	50.0		88.9	70-130				
1,1,1-Trichloroethane	45.8		"	50.0		91.7	70-130				
1,1,2,2-Tetrachloroethane	53.7		"	50.0		107	70-130				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	47.4		"	50.0		94.9	70-130				
1,1,2-Trichloroethane	50.8		"	50.0		102	70-130				
1,1-Dichloroethane	50.4		"	50.0		101	70-130				
1,1-Dichloroethylene	46.2		"	50.0		92.4	70-130				
1,1-Dichloropropylene	45.0		"	50.0		90.1	70-130				
1,2,3-Trichlorobenzene	49.4		"	50.0		98.9	70-130				
1,2,3-Trichloropropane	52.2		"	50.0		104	70-130				
1,2,4-Trichlorobenzene	52.0		"	50.0		104	70-130				
1,2,4-Trimethylbenzene	51.5		"	50.0		103	70-130				
1,2-Dibromo-3-chloropropane	44.8		"	50.0		89.5	70-130				
1,2-Dibromoethane	53.6		"	50.0		107	70-130				
1,2-Dichlorobenzene	48.6		"	50.0		97.3	70-130				
1,2-Dichloroethane	47.8		"	50.0		95.6	70-130				
1,2-Dichloropropane	49.1		"	50.0		98.2	70-130				
1,3,5-Trimethylbenzene	51.1		"	50.0		102	70-130				
1,3-Dichlorobenzene	49.0		"	50.0		98.0	70-130				
1,3-Dichloropropane	50.6		"	50.0		101	70-130				
1,4-Dichlorobenzene	50.4		"	50.0		101	70-130				
2,2-Dichloropropane	46.2		"	50.0		92.3	70-130				
2-Butanone	61.8		"	50.0		124	70-130				
2-Chlorotoluene	49.7		"	50.0		99.5	70-130				
2-Hexanone	56.5		"	50.0		113	70-130				
4-Chlorotoluene	51.4		"	50.0		103	70-130				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50593 - EPA 5035A											
LCS (BH50593-BS1) LCS								Prepared: 08/07/2025 Analyzed: 08/10/2025			
4-Methyl-2-pentanone	51.3		ug/L	50.0		103	70-130				
Acetone	74.0		"	50.0		148	70-130	High Bias			
Acrylonitrile	77.0		"	50.0		154	70-130	High Bias			
Benzene	49.2		"	50.0		98.5	70-130				
Bromobenzene	49.0		"	50.0		98.0	70-130				
Bromochloromethane	52.2		"	50.0		104	70-130				
Bromodichloromethane	44.7		"	50.0		89.3	70-130				
Bromoform	47.2		"	50.0		94.4	70-130				
Bromomethane	25.8		"	50.0		51.6	70-130	Low Bias			
Carbon disulfide	47.6		"	50.0		95.2	70-130				
Carbon tetrachloride	43.4		"	50.0		86.9	70-130				
Chlorobenzene	49.0		"	50.0		97.9	70-130				
Chloroethane	44.9		"	50.0		89.8	70-130				
Chloroform	47.1		"	50.0		94.3	70-130				
Chloromethane	38.7		"	50.0		77.4	70-130				
cis-1,2-Dichloroethylene	50.5		"	50.0		101	70-130				
cis-1,3-Dichloropropylene	46.0		"	50.0		92.1	70-130				
Dibromochloromethane	45.0		"	50.0		90.0	70-130				
Dibromomethane	49.7		"	50.0		99.4	70-130				
Dichlorodifluoromethane	28.8		"	50.0		57.7	70-130	Low Bias			
Ethyl Benzene	50.4		"	50.0		101	70-130				
Hexachlorobutadiene	49.8		"	50.0		99.5	70-130				
Isopropylbenzene	45.9		"	50.0		91.9	70-130				
Methyl Methacrylate	51.2		"	50.0		102	70-130				
Methyl tert-butyl ether (MTBE)	52.4		"	50.0		105	70-130				
Methylene chloride	45.7		"	50.0		91.4	70-130				
Naphthalene	49.6		"	50.0		99.2	70-130				
n-Butylbenzene	50.9		"	50.0		102	70-130				
n-Propylbenzene	50.4		"	50.0		101	70-130				
o-Xylene	47.4		"	50.0		94.7	70-130				
p- & m- Xylenes	99.8		"	100		99.8	70-130				
p-Isopropyltoluene	49.9		"	50.0		99.7	70-130				
sec-Butylbenzene	51.0		"	50.0		102	70-130				
Styrene	45.7		"	50.0		91.3	70-130				
tert-Butylbenzene	45.6		"	50.0		91.3	70-130				
Tetrachloroethylene	40.1		"	50.0		80.2	70-130				
Tetrahydrofuran	60.6		"	50.0		121	70-130				
Toluene	48.7		"	50.0		97.5	70-130				
trans-1,2-Dichloroethylene	55.0		"	50.0		110	70-130				
trans-1,3-Dichloropropylene	45.7		"	50.0		91.4	70-130				
trans-1,4-dichloro-2-butene	54.5		"	50.0		109	70-130				
Trichloroethylene	46.2		"	50.0		92.5	70-130				
Trichlorofluoromethane	45.8		"	50.0		91.6	70-130				
Vinyl Chloride	42.6		"	50.0		85.2	70-130				
Surrogate: SURR: 1,2-Dichloroethane-d4	*50.6*		*"*	*50.0*		*101*	*70-130*				
Surrogate: SURR: Toluene-d8	*50.6*		*"*	*50.0*		*101*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*51.1*		*"*	*50.0*		*102*	*70-130*				



Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50593 - EPA 5035A											
LCS Dup (BH50593-BSD1) LCS Dup									Prepared: 08/07/2025 Analyzed: 08/10/2025		
1,1,1,2-Tetrachloroethane	44.3		ug/L	50.0		88.6	70-130		0.361	30	
1,1,1-Trichloroethane	46.0		"	50.0		91.9	70-130		0.283	30	
1,1,2,2-Tetrachloroethane	51.5		"	50.0		103	70-130		4.16	30	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	45.7		"	50.0		91.5	70-130		3.63	30	
1,1,2-Trichloroethane	50.6		"	50.0		101	70-130		0.414	30	
1,1-Dichloroethane	50.4		"	50.0		101	70-130		0.0992	30	
1,1-Dichloroethylene	45.7		"	50.0		91.3	70-130		1.18	30	
1,1-Dichloropropylene	45.3		"	50.0		90.6	70-130		0.554	30	
1,2,3-Trichlorobenzene	48.7		"	50.0		97.4	70-130		1.55	30	
1,2,3-Trichloropropane	50.2		"	50.0		100	70-130		3.98	30	
1,2,4-Trichlorobenzene	51.3		"	50.0		103	70-130		1.37	30	
1,2,4-Trimethylbenzene	51.9		"	50.0		104	70-130		0.813	30	
1,2-Dibromo-3-chloropropane	42.5		"	50.0		85.1	70-130		5.13	30	
1,2-Dibromoethane	52.4		"	50.0		105	70-130		2.32	30	
1,2-Dichlorobenzene	48.5		"	50.0		97.0	70-130		0.309	30	
1,2-Dichloroethane	46.9		"	50.0		93.8	70-130		1.92	30	
1,2-Dichloropropane	49.5		"	50.0		99.0	70-130		0.811	30	
1,3,5-Trimethylbenzene	52.1		"	50.0		104	70-130		2.05	30	
1,3-Dichlorobenzene	49.4		"	50.0		98.7	70-130		0.752	30	
1,3-Dichloropropane	49.9		"	50.0		99.8	70-130		1.45	30	
1,4-Dichlorobenzene	50.7		"	50.0		101	70-130		0.653	30	
2,2-Dichloropropane	45.7		"	50.0		91.4	70-130		1.07	30	
2-Butanone	58.1		"	50.0		116	70-130		6.10	30	
2-Chlorotoluene	50.6		"	50.0		101	70-130		1.75	30	
2-Hexanone	53.8		"	50.0		108	70-130		4.84	30	
4-Chlorotoluene	51.6		"	50.0		103	70-130		0.272	30	
4-Methyl-2-pentanone	49.2		"	50.0		98.5	70-130		4.16	30	
Acetone	66.8		"	50.0		134	70-130	High Bias	10.2	30	
Acrylonitrile	70.1		"	50.0		140	70-130	High Bias	9.30	30	
Benzene	49.2		"	50.0		98.4	70-130		0.142	30	
Bromobenzene	49.8		"	50.0		99.5	70-130		1.52	30	
Bromochloromethane	51.2		"	50.0		102	70-130		1.86	30	
Bromodichloromethane	45.0		"	50.0		90.0	70-130		0.714	30	
Bromoform	44.8		"	50.0		89.7	70-130		5.15	30	
Bromomethane	35.0		"	50.0		69.9	70-130	Low Bias	30.2	30	Non-dir.
Carbon disulfide	43.9		"	50.0		87.7	70-130		8.20	30	
Carbon tetrachloride	43.8		"	50.0		87.5	70-130		0.780	30	
Chlorobenzene	49.5		"	50.0		99.0	70-130		1.14	30	
Chloroethane	44.1		"	50.0		88.2	70-130		1.82	30	
Chloroform	47.2		"	50.0		94.3	70-130		0.0636	30	
Chloromethane	38.9		"	50.0		77.8	70-130		0.541	30	
cis-1,2-Dichloroethylene	50.4		"	50.0		101	70-130		0.0595	30	
cis-1,3-Dichloropropylene	46.1		"	50.0		92.3	70-130		0.195	30	
Dibromochloromethane	44.8		"	50.0		89.5	70-130		0.557	30	
Dibromomethane	49.4		"	50.0		98.9	70-130		0.545	30	
Dichlorodifluoromethane	45.3		"	50.0		90.6	70-130		44.3	30	Non-dir.
Ethyl Benzene	51.6		"	50.0		103	70-130		2.37	30	
Hexachlorobutadiene	48.5		"	50.0		97.1	70-130		2.46	30	
Isopropylbenzene	47.1		"	50.0		94.3	70-130		2.56	30	
Methyl Methacrylate	49.2		"	50.0		98.3	70-130		3.95	30	
Methyl tert-butyl ether (MTBE)	49.7		"	50.0		99.4	70-130		5.25	30	

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50593 - EPA 5035A											
LCS Dup (BH50593-BSD1) LCS Dup									Prepared: 08/07/2025 Analyzed: 08/10/2025		
Methylene chloride	44.0		ug/L	50.0		88.1	70-130		3.70	30	
Naphthalene	47.7		"	50.0		95.4	70-130		3.89	30	
n-Butylbenzene	51.0		"	50.0		102	70-130		0.177	30	
n-Propylbenzene	51.4		"	50.0		103	70-130		1.99	30	
o-Xylene	48.2		"	50.0		96.5	70-130		1.86	30	
p- & m- Xylenes	102		"	100		102	70-130		1.96	30	
p-Isopropyltoluene	50.7		"	50.0		101	70-130		1.61	30	
sec-Butylbenzene	52.2		"	50.0		104	70-130		2.21	30	
Styrene	46.0		"	50.0		92.0	70-130		0.720	30	
tert-Butylbenzene	46.8		"	50.0		93.7	70-130		2.60	30	
Tetrachloroethylene	41.0		"	50.0		82.1	70-130		2.34	30	
Tetrahydrofuran	54.1		"	50.0		108	70-130		11.4	30	
Toluene	50.0		"	50.0		99.9	70-130		2.45	30	
trans-1,2-Dichloroethylene	55.0		"	50.0		110	70-130		0.145	30	
trans-1,3-Dichloropropylene	45.1		"	50.0		90.2	70-130		1.32	30	
trans-1,4-dichloro-2-butene	52.8		"	50.0		106	70-130		3.28	30	
Trichloroethylene	47.4		"	50.0		94.8	70-130		2.50	30	
Trichlorofluoromethane	44.5		"	50.0		89.0	70-130		2.86	30	
Vinyl Chloride	42.4		"	50.0		84.9	70-130		0.353	30	
Surrogate: SURR: 1,2-Dichloroethane-d4	*49.8*		*"*	*50.0*		*99.7*	*70-130*				
Surrogate: SURR: Toluene-d8	*51.2*		*"*	*50.0*		*102*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*51.6*		*"*	*50.0*		*103*	*70-130*				
Batch BH50823 - EPA 5030B											
Blank (BH50823-BLK1) Blank									Prepared & Analyzed: 08/11/2025		
1,1,1,2-Tetrachloroethane	ND	0.500	ug/L								
1,1,1-Trichloroethane	ND	0.500	"								
1,1,2,2-Tetrachloroethane	ND	0.500	"								
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.500	"								
1,1,2-Trichloroethane	ND	0.500	"								
1,1-Dichloroethane	ND	0.500	"								
1,1-Dichloroethylene	ND	0.500	"								
1,1-Dichloropropylene	ND	0.500	"								
1,2,3-Trichlorobenzene	ND	0.500	"								
1,2,3-Trichloropropane	ND	0.500	"								
1,2,4-Trichlorobenzene	ND	0.500	"								
1,2,4-Trimethylbenzene	ND	0.500	"								
1,2-Dibromo-3-chloropropane	ND	0.500	"								
1,2-Dibromoethane	ND	0.500	"								
1,2-Dichlorobenzene	ND	0.500	"								
1,2-Dichloroethane	ND	0.500	"								
1,2-Dichloropropane	ND	0.500	"								
1,3,5-Trimethylbenzene	ND	0.500	"								
1,3-Dichlorobenzene	ND	0.500	"								
1,3-Dichloropropane	ND	0.500	"								
1,4-Dichlorobenzene	ND	0.500	"								
2,2-Dichloropropane	ND	0.500	"								
2-Butanone	ND	0.500	"								
2-Chlorotoluene	ND	0.500	"								
2-Hexanone	ND	0.500	"								

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50823 - EPA 5030B											
Blank (BH50823-BLK1) Blank									Prepared & Analyzed: 08/11/2025		
4-Chlorotoluene	ND	0.500	ug/L								
4-Methyl-2-pentanone	ND	0.500	"								
Acetone	ND	2.00	"								
Acrylonitrile	ND	0.500	"								
Benzene	ND	0.500	"								
Bromobenzene	ND	0.500	"								
Bromochloromethane	ND	0.500	"								
Bromodichloromethane	ND	0.500	"								
Bromoform	ND	0.500	"								
Bromomethane	ND	0.500	"								
Carbon disulfide	ND	0.500	"								
Carbon tetrachloride	ND	0.500	"								
Chlorobenzene	ND	0.500	"								
Chloroethane	ND	0.500	"								
Chloroform	ND	0.500	"								
Chloromethane	ND	0.500	"								
cis-1,2-Dichloroethylene	ND	0.500	"								
cis-1,3-Dichloropropylene	ND	0.500	"								
Dibromochloromethane	ND	0.500	"								
Dibromomethane	ND	0.500	"								
Dichlorodifluoromethane	ND	0.500	"								
Ethyl Benzene	ND	0.500	"								
Hexachlorobutadiene	ND	0.500	"								
Isopropylbenzene	ND	0.500	"								
Methyl Methacrylate	ND	0.500	"								
Methyl tert-butyl ether (MTBE)	ND	0.500	"								
Methylene chloride	ND	2.00	"								
Naphthalene	ND	2.00	"								
n-Butylbenzene	ND	0.500	"								
n-Propylbenzene	ND	0.500	"								
o-Xylene	ND	0.500	"								
p- & m- Xylenes	ND	1.00	"								
p-Isopropyltoluene	ND	0.500	"								
sec-Butylbenzene	ND	0.500	"								
Styrene	ND	0.500	"								
tert-Butylbenzene	ND	0.500	"								
Tetrachloroethylene	ND	0.500	"								
Tetrahydrofuran	ND	4.00	"								
Toluene	ND	0.500	"								
trans-1,2-Dichloroethylene	ND	0.500	"								
trans-1,3-Dichloropropylene	ND	0.500	"								
trans-1,4-dichloro-2-butene	ND	0.500	"								
Trichloroethylene	ND	0.500	"								
Trichlorofluoromethane	ND	0.500	"								
Vinyl Chloride	ND	0.500	"								
Surrogate: SURR: 1,2-Dichloroethane-d4	*10.4*		*"*	*10.0*		*104*	*70-130*				
Surrogate: SURR: Toluene-d8	*10.2*		*"*	*10.0*		*102*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*10.0*		*"*	*10.0*		*100*	*70-130*				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50823 - EPA 5030B											
LCS (BH50823-BS1) LCS								Prepared & Analyzed: 08/11/2025			
1,1,1,2-Tetrachloroethane	10.2		ug/L	10.0		102	70-130				
1,1,1-Trichloroethane	9.51		"	10.0		95.1	70-130				
1,1,2,2-Tetrachloroethane	10.6		"	10.0		106	70-130				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	9.20		"	10.0		92.0	70-130				
1,1,2-Trichloroethane	10.9		"	10.0		109	70-130				
1,1-Dichloroethane	9.50		"	10.0		95.0	70-130				
1,1-Dichloroethylene	9.52		"	10.0		95.2	70-130				
1,1-Dichloropropylene	8.71		"	10.0		87.1	70-130				
1,2,3-Trichlorobenzene	11.4		"	10.0		114	70-130				
1,2,3-Trichloropropane	10.6		"	10.0		106	70-130				
1,2,4-Trichlorobenzene	11.4		"	10.0		114	70-130				
1,2,4-Trimethylbenzene	10.7		"	10.0		107	70-130				
1,2-Dibromo-3-chloropropane	11.0		"	10.0		110	70-130				
1,2-Dibromoethane	11.1		"	10.0		111	70-130				
1,2-Dichlorobenzene	10.4		"	10.0		104	70-130				
1,2-Dichloroethane	9.80		"	10.0		98.0	70-130				
1,2-Dichloropropane	10.1		"	10.0		101	70-130				
1,3,5-Trimethylbenzene	10.5		"	10.0		105	70-130				
1,3-Dichlorobenzene	10.2		"	10.0		102	70-130				
1,3-Dichloropropane	10.5		"	10.0		105	70-130				
1,4-Dichlorobenzene	10.3		"	10.0		103	70-130				
2,2-Dichloropropane	10.2		"	10.0		102	70-130				
2-Butanone	10.3		"	10.0		103	70-130				
2-Chlorotoluene	9.73		"	10.0		97.3	70-130				
2-Hexanone	10.8		"	10.0		108	70-130				
4-Chlorotoluene	10.2		"	10.0		102	70-130				
4-Methyl-2-pentanone	10.9		"	10.0		109	70-130				
Acetone	9.82		"	10.0		98.2	70-130				
Acrylonitrile	9.34		"	10.0		93.4	70-130				
Benzene	10.0		"	10.0		100	70-130				
Bromobenzene	9.74		"	10.0		97.4	70-130				
Bromochloromethane	10.1		"	10.0		101	70-130				
Bromodichloromethane	10.2		"	10.0		102	70-130				
Bromoform	11.2		"	10.0		112	70-130				
Bromomethane	9.89		"	10.0		98.9	70-130				
Carbon disulfide	8.66		"	10.0		86.6	70-130				
Carbon tetrachloride	9.46		"	10.0		94.6	70-130				
Chlorobenzene	10.4		"	10.0		104	70-130				
Chloroethane	9.48		"	10.0		94.8	70-130				
Chloroform	9.68		"	10.0		96.8	70-130				
Chloromethane	8.29		"	10.0		82.9	70-130				
cis-1,2-Dichloroethylene	10.2		"	10.0		102	70-130				
cis-1,3-Dichloropropylene	11.0		"	10.0		110	70-130				
Dibromochloromethane	10.8		"	10.0		108	70-130				
Dibromomethane	10.4		"	10.0		104	70-130				
Dichlorodifluoromethane	7.64		"	10.0		76.4	70-130				
Ethyl Benzene	10.4		"	10.0		104	70-130				
Hexachlorobutadiene	9.90		"	10.0		99.0	70-130				
Isopropylbenzene	9.86		"	10.0		98.6	70-130				
Methyl Methacrylate	11.3		"	10.0		113	70-130				
Methyl tert-butyl ether (MTBE)	10.0		"	10.0		100	70-130				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50823 - EPA 5030B											
LCS (BH50823-BS1) LCS								Prepared & Analyzed: 08/11/2025			
Methylene chloride	8.80		ug/L	10.0		88.0	70-130				
Naphthalene	12.1		"	10.0		121	70-130				
n-Butylbenzene	9.93		"	10.0		99.3	70-130				
n-Propylbenzene	9.85		"	10.0		98.5	70-130				
o-Xylene	10.9		"	10.0		109	70-130				
p- & m- Xylenes	21.3		"	20.0		106	70-130				
p-Isopropyltoluene	10.1		"	10.0		101	70-130				
sec-Butylbenzene	9.88		"	10.0		98.8	70-130				
Styrene	10.4		"	10.0		104	70-130				
tert-Butylbenzene	9.87		"	10.0		98.7	70-130				
Tetrachloroethylene	8.95		"	10.0		89.5	70-130				
Tetrahydrofuran	10.1		"	10.0		101	70-130				
Toluene	10.6		"	10.0		106	70-130				
trans-1,2-Dichloroethylene	9.42		"	10.0		94.2	70-130				
trans-1,3-Dichloropropylene	10.9		"	10.0		109	70-130				
trans-1,4-dichloro-2-butene	10.3		"	10.0		103	70-130				
Trichloroethylene	9.53		"	10.0		95.3	70-130				
Trichlorofluoromethane	8.61		"	10.0		86.1	70-130				
Vinyl Chloride	8.43		"	10.0		84.3	70-130				
Surrogate: SURR: 1,2-Dichloroethane-d4	*10.2*		*"*	*10.0*		*102*	*70-130*				
Surrogate: SURR: Toluene-d8	*10.2*		*"*	*10.0*		*102*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*9.69*		*"*	*10.0*		*96.9*	*70-130*				
LCS Dup (BH50823-BSD1) LCS Dup								Prepared & Analyzed: 08/11/2025			
1,1,1,2-Tetrachloroethane	9.59		ug/L	10.0		95.9	70-130		6.26	30	
1,1,1-Trichloroethane	8.67		"	10.0		86.7	70-130		9.24	30	
1,1,2,2-Tetrachloroethane	9.99		"	10.0		99.9	70-130		5.64	30	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	7.72		"	10.0		77.2	70-130		17.5	30	
1,1,2-Trichloroethane	10.2		"	10.0		102	70-130		7.12	30	
1,1-Dichloroethane	8.43		"	10.0		84.3	70-130		11.9	30	
1,1-Dichloroethylene	7.70		"	10.0		77.0	70-130		21.1	30	
1,1-Dichloropropylene	7.72		"	10.0		77.2	70-130		12.1	30	
1,2,3-Trichlorobenzene	11.2		"	10.0		112	70-130		1.51	30	
1,2,3-Trichloropropane	10.2		"	10.0		102	70-130		4.52	30	
1,2,4-Trichlorobenzene	10.8		"	10.0		108	70-130		5.95	30	
1,2,4-Trimethylbenzene	9.79		"	10.0		97.9	70-130		9.16	30	
1,2-Dibromo-3-chloropropane	10.4		"	10.0		104	70-130		6.35	30	
1,2-Dibromoethane	10.2		"	10.0		102	70-130		8.44	30	
1,2-Dichlorobenzene	9.92		"	10.0		99.2	70-130		5.11	30	
1,2-Dichloroethane	8.79		"	10.0		87.9	70-130		10.9	30	
1,2-Dichloropropane	9.45		"	10.0		94.5	70-130		6.85	30	
1,3,5-Trimethylbenzene	9.82		"	10.0		98.2	70-130		6.79	30	
1,3-Dichlorobenzene	9.73		"	10.0		97.3	70-130		5.21	30	
1,3-Dichloropropane	9.71		"	10.0		97.1	70-130		7.63	30	
1,4-Dichlorobenzene	9.73		"	10.0		97.3	70-130		5.98	30	
2,2-Dichloropropane	9.21		"	10.0		92.1	70-130		9.91	30	
2-Butanone	9.12		"	10.0		91.2	70-130		12.3	30	
2-Chlorotoluene	9.23		"	10.0		92.3	70-130		5.27	30	
2-Hexanone	9.83		"	10.0		98.3	70-130		9.31	30	
4-Chlorotoluene	9.61		"	10.0		96.1	70-130		6.25	30	
4-Methyl-2-pentanone	10.0		"	10.0		100	70-130		8.59	30	

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50823 - EPA 5030B											
LCS Dup (BH50823-BSD1) LCS Dup								Prepared & Analyzed: 08/11/2025			
Acetone	8.54		ug/L	10.0		85.4	70-130		13.9	30	
Acrylonitrile	8.35		"	10.0		83.5	70-130		11.2	30	
Benzene	8.95		"	10.0		89.5	70-130		11.5	30	
Bromobenzene	9.19		"	10.0		91.9	70-130		5.81	30	
Bromochloromethane	9.09		"	10.0		90.9	70-130		10.6	30	
Bromodichloromethane	9.51		"	10.0		95.1	70-130		6.71	30	
Bromoform	10.4		"	10.0		104	70-130		6.77	30	
Bromomethane	8.39		"	10.0		83.9	70-130		16.4	30	
Carbon disulfide	7.02		"	10.0		70.2	70-130		20.9	30	
Carbon tetrachloride	8.41		"	10.0		84.1	70-130		11.8	30	
Chlorobenzene	9.69		"	10.0		96.9	70-130		7.36	30	
Chloroethane	7.90		"	10.0		79.0	70-130		18.2	30	
Chloroform	8.74		"	10.0		87.4	70-130		10.2	30	
Chloromethane	5.83		"	10.0		58.3	70-130	Low Bias	34.8	30	Non-dir.
cis-1,2-Dichloroethylene	9.05		"	10.0		90.5	70-130		11.9	30	
cis-1,3-Dichloropropylene	10.2		"	10.0		102	70-130		7.56	30	
Dibromochloromethane	10.3		"	10.0		103	70-130		4.56	30	
Dibromomethane	9.44		"	10.0		94.4	70-130		9.58	30	
Dichlorodifluoromethane	3.73		"	10.0		37.3	70-130	Low Bias	68.8	30	Non-dir.
Ethyl Benzene	9.53		"	10.0		95.3	70-130		8.73	30	
Hexachlorobutadiene	9.05		"	10.0		90.5	70-130		8.97	30	
Isopropylbenzene	9.30		"	10.0		93.0	70-130		5.85	30	
Methyl Methacrylate	10.3		"	10.0		103	70-130		8.61	30	
Methyl tert-butyl ether (MTBE)	9.08		"	10.0		90.8	70-130		9.94	30	
Methylene chloride	8.18		"	10.0		81.8	70-130		7.30	30	
Naphthalene	11.6		"	10.0		116	70-130		3.96	30	
n-Butylbenzene	9.29		"	10.0		92.9	70-130		6.66	30	
n-Propylbenzene	9.17		"	10.0		91.7	70-130		7.15	30	
o-Xylene	9.88		"	10.0		98.8	70-130		9.63	30	
p- & m- Xylenes	19.3		"	20.0		96.3	70-130		10.1	30	
p-Isopropyltoluene	9.42		"	10.0		94.2	70-130		6.97	30	
sec-Butylbenzene	9.18		"	10.0		91.8	70-130		7.35	30	
Styrene	9.68		"	10.0		96.8	70-130		7.46	30	
tert-Butylbenzene	9.24		"	10.0		92.4	70-130		6.59	30	
Tetrachloroethylene	8.18		"	10.0		81.8	70-130		8.99	30	
Tetrahydrofuran	9.57		"	10.0		95.7	70-130		5.59	30	
Toluene	9.41		"	10.0		94.1	70-130		11.9	30	
trans-1,2-Dichloroethylene	8.32		"	10.0		83.2	70-130		12.4	30	
trans-1,3-Dichloropropylene	10.2		"	10.0		102	70-130		7.20	30	
trans-1,4-dichloro-2-butene	9.67		"	10.0		96.7	70-130		6.60	30	
Trichloroethylene	8.93		"	10.0		89.3	70-130		6.50	30	
Trichlorofluoromethane	7.34		"	10.0		73.4	70-130		15.9	30	
Vinyl Chloride	6.46		"	10.0		64.6	70-130	Low Bias	26.5	30	
Surrogate: SURR: 1,2-Dichloroethane-d4	*9.77*		*"*	*10.0*		*97.7*	*70-130*				
Surrogate: SURR: Toluene-d8	*10.4*		*"*	*10.0*		*104*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*9.90*		*"*	*10.0*		*99.0*	*70-130*				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
Blank (BH50889-BLK1) Blank									Prepared & Analyzed: 08/12/2025		
1,1,1,2-Tetrachloroethane	ND	5.0	ug/kg wet								
1,1,1-Trichloroethane	ND	5.0	"								
1,1,2,2-Tetrachloroethane	ND	5.0	"								
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	5.0	"								
1,1,2-Trichloroethane	ND	5.0	"								
1,1-Dichloroethane	ND	5.0	"								
1,1-Dichloroethylene	ND	5.0	"								
1,1-Dichloropropylene	ND	5.0	"								
1,2,3-Trichlorobenzene	ND	5.0	"								
1,2,3-Trichloropropane	ND	5.0	"								
1,2,4-Trichlorobenzene	ND	5.0	"								
1,2,4-Trimethylbenzene	ND	5.0	"								
1,2-Dibromo-3-chloropropane	ND	5.0	"								
1,2-Dibromoethane	ND	5.0	"								
1,2-Dichlorobenzene	ND	5.0	"								
1,2-Dichloroethane	ND	5.0	"								
1,2-Dichloropropane	ND	5.0	"								
1,3,5-Trimethylbenzene	ND	5.0	"								
1,3-Dichlorobenzene	ND	5.0	"								
1,3-Dichloropropane	ND	5.0	"								
1,4-Dichlorobenzene	ND	5.0	"								
2,2-Dichloropropane	ND	5.0	"								
2-Butanone	ND	5.0	"								
2-Chlorotoluene	ND	5.0	"								
2-Hexanone	ND	5.0	"								
4-Chlorotoluene	ND	5.0	"								
4-Methyl-2-pentanone	ND	5.0	"								
Acetone	ND	10	"								
Acrylonitrile	ND	5.0	"								
Benzene	ND	5.0	"								
Bromobenzene	ND	5.0	"								
Bromochloromethane	ND	5.0	"								
Bromodichloromethane	ND	5.0	"								
Bromoform	ND	5.0	"								
Bromomethane	ND	5.0	"								
Carbon disulfide	ND	5.0	"								
Carbon tetrachloride	ND	5.0	"								
Chlorobenzene	ND	5.0	"								
Chloroethane	ND	5.0	"								
Chloroform	ND	5.0	"								
Chloromethane	ND	5.0	"								
cis-1,2-Dichloroethylene	ND	5.0	"								
cis-1,3-Dichloropropylene	ND	5.0	"								
Dibromochloromethane	ND	5.0	"								
Dibromomethane	ND	5.0	"								
Dichlorodifluoromethane	ND	5.0	"								
Ethyl Benzene	ND	5.0	"								
Hexachlorobutadiene	ND	5.0	"								
Isopropylbenzene	ND	5.0	"								
Methyl Methacrylate	ND	5.0	"								
Methyl tert-butyl ether (MTBE)	ND	5.0	"								

Volatile Organic Compounds by GC/MS - Quality Control Data

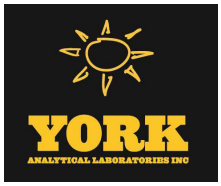
York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
Blank (BH50889-BLK1) Blank								Prepared & Analyzed: 08/12/2025			
Methylene chloride	ND	10	ug/kg wet								
Naphthalene	ND	10	"								
n-Butylbenzene	ND	5.0	"								
n-Propylbenzene	ND	5.0	"								
o-Xylene	ND	5.0	"								
p- & m- Xylenes	ND	10	"								
p-Isopropyltoluene	ND	5.0	"								
sec-Butylbenzene	ND	5.0	"								
Styrene	ND	5.0	"								
tert-Butylbenzene	ND	5.0	"								
Tetrachloroethylene	ND	5.0	"								
Tetrahydrofuran	ND	10	"								
Toluene	ND	5.0	"								
trans-1,2-Dichloroethylene	ND	5.0	"								
trans-1,3-Dichloropropylene	ND	5.0	"								
trans-1,4-dichloro-2-butene	ND	5.0	"								
Trichloroethylene	ND	5.0	"								
Trichlorofluoromethane	ND	5.0	"								
Vinyl Chloride	ND	5.0	"								
Surrogate: SURR: 1,2-Dichloroethane-d4	*49.9*		*ug/L*	*50.0*		*99.9*	*70-130*				
Surrogate: SURR: Toluene-d8	*52.1*		*"*	*50.0*		*104*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*50.2*		*"*	*50.0*		*100*	*70-130*				
LCS (BH50889-BS1) LCS								Prepared & Analyzed: 08/12/2025			
1,1,1,2-Tetrachloroethane	36.1		ug/L	50.0		72.3	70-130				
1,1,1-Trichloroethane	44.1		"	50.0		88.3	70-130				
1,1,2,2-Tetrachloroethane	40.8		"	50.0		81.6	70-130				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	54.1		"	50.0		108	70-130				
1,1,2-Trichloroethane	44.7		"	50.0		89.3	70-130				
1,1-Dichloroethane	48.3		"	50.0		96.6	70-130				
1,1-Dichloroethylene	47.3		"	50.0		94.6	70-130				
1,1-Dichloropropylene	41.9		"	50.0		83.8	70-130				
1,2,3-Trichlorobenzene	46.5		"	50.0		93.1	70-130				
1,2,3-Trichloropropane	41.3		"	50.0		82.6	70-130				
1,2,4-Trichlorobenzene	48.8		"	50.0		97.7	70-130				
1,2,4-Trimethylbenzene	44.9		"	50.0		89.9	70-130				
1,2-Dibromo-3-chloropropane	35.7		"	50.0		71.5	70-130				
1,2-Dibromoethane	45.8		"	50.0		91.5	70-130				
1,2-Dichlorobenzene	45.9		"	50.0		91.8	70-130				
1,2-Dichloroethane	41.5		"	50.0		82.9	70-130				
1,2-Dichloropropane	41.3		"	50.0		82.6	70-130				
1,3,5-Trimethylbenzene	46.0		"	50.0		92.0	70-130				
1,3-Dichlorobenzene	46.8		"	50.0		93.6	70-130				
1,3-Dichloropropane	42.8		"	50.0		85.5	70-130				
1,4-Dichlorobenzene	46.4		"	50.0		92.8	70-130				
2,2-Dichloropropane	40.1		"	50.0		80.3	70-130				
2-Butanone	49.6		"	50.0		99.2	70-130				
2-Chlorotoluene	43.8		"	50.0		87.7	70-130				
2-Hexanone	46.4		"	50.0		92.8	70-130				
4-Chlorotoluene	44.0		"	50.0		88.0	70-130				
4-Methyl-2-pentanone	42.9		"	50.0		85.7	70-130				

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
LCS (BH50889-BS1) LCS							Prepared & Analyzed: 08/12/2025				
Acetone	55.6		ug/L	50.0		111	70-130				
Acrylonitrile	49.5		"	50.0		99.0	70-130				
Benzene	45.7		"	50.0		91.4	70-130				
Bromobenzene	40.4		"	50.0		80.9	70-130				
Bromochloromethane	43.6		"	50.0		87.2	70-130				
Bromodichloromethane	41.0		"	50.0		82.1	70-130				
Bromoform	40.6		"	50.0		81.2	70-130				
Bromomethane	40.5		"	50.0		81.0	70-130				
Carbon disulfide	46.0		"	50.0		92.0	70-130				
Carbon tetrachloride	42.5		"	50.0		85.0	70-130				
Chlorobenzene	45.8		"	50.0		91.5	70-130				
Chloroethane	44.9		"	50.0		89.9	70-130				
Chloroform	42.8		"	50.0		85.6	70-130				
Chloromethane	42.1		"	50.0		84.1	70-130				
cis-1,2-Dichloroethylene	45.1		"	50.0		90.2	70-130				
cis-1,3-Dichloropropylene	39.6		"	50.0		79.3	70-130				
Dibromochloromethane	41.0		"	50.0		82.0	70-130				
Dibromomethane	43.3		"	50.0		86.7	70-130				
Dichlorodifluoromethane	29.8		"	50.0		59.6	70-130	Low Bias			
Ethyl Benzene	46.8		"	50.0		93.5	70-130				
Hexachlorobutadiene	46.1		"	50.0		92.2	70-130				
Isopropylbenzene	45.3		"	50.0		90.6	70-130				
Methyl Methacrylate	43.7		"	50.0		87.4	70-130				
Methyl tert-butyl ether (MTBE)	40.2		"	50.0		80.3	70-130				
Methylene chloride	53.1		"	50.0		106	70-130				
Naphthalene	46.7		"	50.0		93.4	70-130				
n-Butylbenzene	46.0		"	50.0		92.0	70-130				
n-Propylbenzene	44.7		"	50.0		89.4	70-130				
o-Xylene	46.2		"	50.0		92.5	70-130				
p- & m- Xylenes	95.0		"	100		95.0	70-130				
p-Isopropyltoluene	46.0		"	50.0		92.0	70-130				
sec-Butylbenzene	46.2		"	50.0		92.5	70-130				
Styrene	37.9		"	50.0		75.8	70-130				
tert-Butylbenzene	44.8		"	50.0		89.5	70-130				
Tetrachloroethylene	38.0		"	50.0		76.0	70-130				
Tetrahydrofuran	40.5		"	50.0		80.9	70-130				
Toluene	46.0		"	50.0		92.0	70-130				
trans-1,2-Dichloroethylene	48.3		"	50.0		96.7	70-130				
trans-1,3-Dichloropropylene	36.8		"	50.0		73.6	70-130				
trans-1,4-dichloro-2-butene	40.6		"	50.0		81.2	70-130				
Trichloroethylene	42.6		"	50.0		85.1	70-130				
Trichlorofluoromethane	47.8		"	50.0		95.5	70-130				
Vinyl Chloride	46.4		"	50.0		92.9	70-130				
Surrogate: SURR: 1,2-Dichloroethane-d4	*48.5*		*"*	*50.0*		*97.0*	*70-130*				
Surrogate: SURR: Toluene-d8	*51.8*		*"*	*50.0*		*104*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*45.7*		*"*	*50.0*		*91.5*	*70-130*				



Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
LCS Dup (BH50889-BSD1) LCS Dup								Prepared & Analyzed: 08/12/2025			
1,1,1,2-Tetrachloroethane	37.3		ug/L	50.0		74.7	70-130		3.27	30	
1,1,1-Trichloroethane	44.7		"	50.0		89.5	70-130		1.33	30	
1,1,2,2-Tetrachloroethane	41.8		"	50.0		83.5	70-130		2.33	30	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	54.2		"	50.0		108	70-130		0.166	30	
1,1,2-Trichloroethane	45.8		"	50.0		91.6	70-130		2.50	30	
1,1-Dichloroethane	48.8		"	50.0		97.6	70-130		1.05	30	
1,1-Dichloroethylene	47.7		"	50.0		95.4	70-130		0.800	30	
1,1-Dichloropropylene	42.4		"	50.0		84.8	70-130		1.19	30	
1,2,3-Trichlorobenzene	48.4		"	50.0		96.8	70-130		3.90	30	
1,2,3-Trichloropropane	43.0		"	50.0		86.0	70-130		3.99	30	
1,2,4-Trichlorobenzene	50.0		"	50.0		100	70-130		2.43	30	
1,2,4-Trimethylbenzene	45.5		"	50.0		91.1	70-130		1.30	30	
1,2-Dibromo-3-chloropropane	36.4		"	50.0		72.7	70-130		1.75	30	
1,2-Dibromoethane	47.3		"	50.0		94.5	70-130		3.20	30	
1,2-Dichlorobenzene	46.9		"	50.0		93.9	70-130		2.22	30	
1,2-Dichloroethane	42.7		"	50.0		85.4	70-130		2.95	30	
1,2-Dichloropropane	42.6		"	50.0		85.2	70-130		3.10	30	
1,3,5-Trimethylbenzene	46.6		"	50.0		93.3	70-130		1.40	30	
1,3-Dichlorobenzene	47.5		"	50.0		95.0	70-130		1.49	30	
1,3-Dichloropropane	44.1		"	50.0		88.2	70-130		3.06	30	
1,4-Dichlorobenzene	47.4		"	50.0		94.8	70-130		2.15	30	
2,2-Dichloropropane	59.1		"	50.0		118	70-130		38.2	30	Non-dir.
2-Butanone	64.9		"	50.0		130	70-130		26.7	30	
2-Chlorotoluene	44.5		"	50.0		89.0	70-130		1.47	30	
2-Hexanone	47.7		"	50.0		95.5	70-130		2.85	30	
4-Chlorotoluene	44.6		"	50.0		89.2	70-130		1.33	30	
4-Methyl-2-pentanone	44.0		"	50.0		88.1	70-130		2.67	30	
Acetone	57.4		"	50.0		115	70-130		3.11	30	
Acrylonitrile	51.6		"	50.0		103	70-130		4.17	30	
Benzene	46.8		"	50.0		93.5	70-130		2.27	30	
Bromobenzene	40.8		"	50.0		81.6	70-130		0.862	30	
Bromochloromethane	44.6		"	50.0		89.1	70-130		2.18	30	
Bromodichloromethane	42.2		"	50.0		84.5	70-130		2.91	30	
Bromoform	42.0		"	50.0		83.9	70-130		3.27	30	
Bromomethane	39.1		"	50.0		78.2	70-130		3.52	30	
Carbon disulfide	47.9		"	50.0		95.7	70-130		3.99	30	
Carbon tetrachloride	43.2		"	50.0		86.4	70-130		1.68	30	
Chlorobenzene	46.6		"	50.0		93.3	70-130		1.95	30	
Chloroethane	44.8		"	50.0		89.7	70-130		0.201	30	
Chloroform	43.5		"	50.0		87.1	70-130		1.71	30	
Chloromethane	41.5		"	50.0		83.1	70-130		1.27	30	
cis-1,2-Dichloroethylene	53.3		"	50.0		107	70-130		16.7	30	
cis-1,3-Dichloropropylene	41.0		"	50.0		81.9	70-130		3.27	30	
Dibromochloromethane	42.4		"	50.0		84.8	70-130		3.33	30	
Dibromomethane	44.5		"	50.0		88.9	70-130		2.55	30	
Dichlorodifluoromethane	27.4		"	50.0		54.7	70-130	Low Bias	8.64	30	
Ethyl Benzene	47.4		"	50.0		94.7	70-130		1.27	30	
Hexachlorobutadiene	47.1		"	50.0		94.2	70-130		2.17	30	
Isopropylbenzene	46.0		"	50.0		91.9	70-130		1.40	30	
Methyl Methacrylate	45.8		"	50.0		91.6	70-130		4.78	30	
Methyl tert-butyl ether (MTBE)	42.3		"	50.0		84.7	70-130		5.29	30	

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
LCS Dup (BH50889-BSD1) LCS Dup								Prepared & Analyzed: 08/12/2025			
Methylene chloride	56.7		ug/L	50.0		113	70-130		6.61	30	
Naphthalene	48.9		"	50.0		97.9	70-130		4.64	30	
n-Butylbenzene	46.3		"	50.0		92.6	70-130		0.715	30	
n-Propylbenzene	45.2		"	50.0		90.5	70-130		1.16	30	
o-Xylene	47.2		"	50.0		94.4	70-130		2.01	30	
p- & m- Xylenes	96.2		"	100		96.2	70-130		1.21	30	
p-Isopropyltoluene	46.8		"	50.0		93.7	70-130		1.87	30	
sec-Butylbenzene	46.7		"	50.0		93.5	70-130		1.08	30	
Styrene	38.8		"	50.0		77.5	70-130		2.32	30	
tert-Butylbenzene	45.6		"	50.0		91.2	70-130		1.88	30	
Tetrachloroethylene	38.6		"	50.0		77.3	70-130		1.67	30	
Tetrahydrofuran	41.1		"	50.0		82.3	70-130		1.67	30	
Toluene	46.9		"	50.0		93.7	70-130		1.87	30	
trans-1,2-Dichloroethylene	49.9		"	50.0		99.8	70-130		3.18	30	
trans-1,3-Dichloropropylene	38.5		"	50.0		77.1	70-130		4.62	30	
trans-1,4-dichloro-2-butene	41.7		"	50.0		83.3	70-130		2.53	30	
Trichloroethylene	43.3		"	50.0		86.6	70-130		1.79	30	
Trichlorofluoromethane	48.2		"	50.0		96.3	70-130		0.813	30	
Vinyl Chloride	46.3		"	50.0		92.6	70-130		0.302	30	
Surrogate: SURR: 1,2-Dichloroethane-d4	*48.0*		*"*	*50.0*		*95.9*	*70-130*				
Surrogate: SURR: Toluene-d8	*51.5*		*"*	*50.0*		*103*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*45.6*		*"*	*50.0*		*91.2*	*70-130*				
Matrix Spike (BH50889-MS1) Matrix Spike *Source sample: 25H0361-01 (SS-01)								Prepared & Analyzed: 08/12/2025			
1,1,1,2-Tetrachloroethane	22.2		ug/L	50.0	0.00	44.4	70-130	Low Bias			
1,1,1-Trichloroethane	28.6		"	50.0	0.00	57.2	70-130	Low Bias			
1,1,2,2-Tetrachloroethane	29.8		"	50.0	0.00	59.5	70-130	Low Bias			
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	31.5		"	50.0	0.00	63.0	70-130	Low Bias			
1,1,2-Trichloroethane	32.7		"	50.0	0.00	65.4	70-130	Low Bias			
1,1-Dichloroethane	32.3		"	50.0	0.00	64.7	70-130	Low Bias			
1,1-Dichloroethylene	29.6		"	50.0	0.00	59.1	70-130	Low Bias			
1,1-Dichloropropylene	25.7		"	50.0	0.00	51.5	70-130	Low Bias			
1,2,3-Trichlorobenzene	13.1		"	50.0	0.00	26.1	70-130	Low Bias			
1,2,3-Trichloropropane	31.8		"	50.0	0.00	63.6	70-130	Low Bias			
1,2,4-Trichlorobenzene	13.1		"	50.0	0.00	26.2	70-130	Low Bias			
1,2,4-Trimethylbenzene	22.2		"	50.0	0.00	44.3	70-130	Low Bias			
1,2-Dibromo-3-chloropropane	23.2		"	50.0	0.00	46.5	70-130	Low Bias			
1,2-Dibromoethane	32.4		"	50.0	0.00	64.8	70-130	Low Bias			
1,2-Dichlorobenzene	20.9		"	50.0	0.00	41.9	70-130	Low Bias			
1,2-Dichloroethane	30.2		"	50.0	0.00	60.4	70-130	Low Bias			
1,2-Dichloropropane	34.7		"	50.0	0.00	69.3	70-130	Low Bias			
1,3,5-Trimethylbenzene	22.8		"	50.0	0.00	45.6	70-130	Low Bias			
1,3-Dichlorobenzene	20.3		"	50.0	0.00	40.6	70-130	Low Bias			
1,3-Dichloropropane	31.2		"	50.0	0.00	62.5	70-130	Low Bias			
1,4-Dichlorobenzene	21.1		"	50.0	0.00	42.2	70-130	Low Bias			
2,2-Dichloropropane	25.3		"	50.0	0.00	50.6	70-130	Low Bias			
2-Butanone	36.5		"	50.0	0.00	72.9	70-130				
2-Chlorotoluene	21.2		"	50.0	0.00	42.3	70-130	Low Bias			
2-Hexanone	31.0		"	50.0	0.00	62.0	70-130	Low Bias			
4-Chlorotoluene	21.6		"	50.0	0.00	43.3	70-130	Low Bias			
4-Methyl-2-pentanone	36.1		"	50.0	0.00	72.1	70-130				

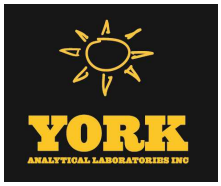
Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Batch BH50889 - EPA 5035A

Matrix Spike (BH50889-MS1) Matrix Spike *Source sample: 25H0361-01 (SS-01) Prepared & Analyzed: 08/12/2025

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Acetone	35.5		ug/L	50.0	1.81	67.4	70-130	Low Bias			
Acrylonitrile	37.0		"	50.0	0.00	73.9	70-130				
Benzene	31.9		"	50.0	0.00	63.7	70-130	Low Bias			
Bromobenzene	22.1		"	50.0	0.00	44.2	70-130	Low Bias			
Bromochloromethane	33.2		"	50.0	0.00	66.3	70-130	Low Bias			
Bromodichloromethane	32.0		"	50.0	0.00	64.0	70-130	Low Bias			
Bromoform	25.8		"	50.0	0.00	51.6	70-130	Low Bias			
Bromomethane	27.2		"	50.0	0.00	54.4	70-130	Low Bias			
Carbon disulfide	27.6		"	50.0	0.00	55.2	70-130	Low Bias			
Carbon tetrachloride	26.0		"	50.0	0.00	52.1	70-130	Low Bias			
Chlorobenzene	26.7		"	50.0	0.00	53.5	70-130	Low Bias			
Chloroethane	29.2		"	50.0	0.00	58.4	70-130	Low Bias			
Chloroform	30.2		"	50.0	0.00	60.4	70-130	Low Bias			
Chloromethane	26.4		"	50.0	0.00	52.9	70-130	Low Bias			
cis-1,2-Dichloroethylene	31.3		"	50.0	0.00	62.7	70-130	Low Bias			
cis-1,3-Dichloropropylene	29.5		"	50.0	0.00	59.0	70-130	Low Bias			
Dibromochloromethane	27.4		"	50.0	0.00	54.8	70-130	Low Bias			
Dibromomethane	36.8		"	50.0	0.00	73.7	70-130				
Dichlorodifluoromethane	14.6		"	50.0	0.00	29.3	70-130	Low Bias			
Ethyl Benzene	26.0		"	50.0	0.00	52.0	70-130	Low Bias			
Hexachlorobutadiene	11.1		"	50.0	0.00	22.2	70-130	Low Bias			
Isopropylbenzene	23.1		"	50.0	0.00	46.3	70-130	Low Bias			
Methyl Methacrylate	46.1		"	50.0	0.00	92.2	70-130				
Methyl tert-butyl ether (MTBE)	27.8		"	50.0	0.00	55.5	70-130	Low Bias			
Methylene chloride	35.4		"	50.0	2.26	66.3	70-130	Low Bias			
Naphthalene	16.0		"	50.0	0.00	31.9	70-130	Low Bias			
n-Butylbenzene	16.7		"	50.0	0.00	33.4	70-130	Low Bias			
n-Propylbenzene	22.1		"	50.0	0.00	44.1	70-130	Low Bias			
o-Xylene	25.4		"	50.0	0.00	50.8	70-130	Low Bias			
p- & m- Xylenes	51.5		"	100	0.00	51.5	70-130	Low Bias			
p-Isopropyltoluene	19.4		"	50.0	0.00	38.7	70-130	Low Bias			
sec-Butylbenzene	19.2		"	50.0	0.00	38.4	70-130	Low Bias			
Styrene	20.0		"	50.0	0.00	40.0	70-130	Low Bias			
tert-Butylbenzene	20.6		"	50.0	0.00	41.3	70-130	Low Bias			
Tetrachloroethylene	20.4		"	50.0	0.00	40.9	70-130	Low Bias			
Tetrahydrofuran	31.9		"	50.0	0.00	63.8	70-130	Low Bias			
Toluene	29.4		"	50.0	0.00	58.8	70-130	Low Bias			
trans-1,2-Dichloroethylene	30.8		"	50.0	0.00	61.5	70-130	Low Bias			
trans-1,3-Dichloropropylene	23.9		"	50.0	0.00	47.8	70-130	Low Bias			
trans-1,4-dichloro-2-butene	29.1		"	50.0	0.00	58.1	70-130	Low Bias			
Trichloroethylene	30.0		"	50.0	0.00	60.0	70-130	Low Bias			
Trichlorofluoromethane	30.0		"	50.0	0.00	60.0	70-130	Low Bias			
Vinyl Chloride	30.6		"	50.0	0.00	61.1	70-130	Low Bias			
Surrogate: SURR: 1,2-Dichloroethane-d4	*48.8*		*"*	*50.0*		*97.6*	*70-130*				
Surrogate: SURR: Toluene-d8	*56.5*		*"*	*50.0*		*113*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*47.6*		*"*	*50.0*		*95.1*	*70-130*				



Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
Matrix Spike Dup (BH50889-! Matrix Spike Dup	*Source sample: 25H0361-01 (SS-01)								Prepared & Analyzed: 08/12/2025		
1,1,1,2-Tetrachloroethane	21.9		ug/L	50.0	0.00	43.7	70-130	Low Bias	1.50	30	
1,1,1-Trichloroethane	28.6		"	50.0	0.00	57.1	70-130	Low Bias	0.0350	30	
1,1,2,2-Tetrachloroethane	28.3		"	50.0	0.00	56.6	70-130	Low Bias	5.03	30	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	35.5		"	50.0	0.00	70.9	70-130		11.8	30	
1,1,2-Trichloroethane	31.3		"	50.0	0.00	62.7	70-130	Low Bias	4.28	30	
1,1-Dichloroethane	32.7		"	50.0	0.00	65.4	70-130	Low Bias	1.08	30	
1,1-Dichloroethylene	32.7		"	50.0	0.00	65.4	70-130	Low Bias	10.0	30	
1,1-Dichloropropylene	25.8		"	50.0	0.00	51.6	70-130	Low Bias	0.310	30	
1,2,3-Trichlorobenzene	15.0		"	50.0	0.00	29.9	70-130	Low Bias	13.6	30	
1,2,3-Trichloropropane	30.1		"	50.0	0.00	60.2	70-130	Low Bias	5.36	30	
1,2,4-Trichlorobenzene	15.0		"	50.0	0.00	30.0	70-130	Low Bias	13.7	30	
1,2,4-Trimethylbenzene	23.6		"	50.0	0.00	47.3	70-130	Low Bias	6.42	30	
1,2-Dibromo-3-chloropropane	22.6		"	50.0	0.00	45.2	70-130	Low Bias	2.71	30	
1,2-Dibromoethane	31.0		"	50.0	0.00	62.1	70-130	Low Bias	4.32	30	
1,2-Dichlorobenzene	22.4		"	50.0	0.00	44.8	70-130	Low Bias	6.74	30	
1,2-Dichloroethane	30.1		"	50.0	0.00	60.3	70-130	Low Bias	0.166	30	
1,2-Dichloropropane	28.5		"	50.0	0.00	57.1	70-130	Low Bias	19.4	30	
1,3,5-Trimethylbenzene	24.6		"	50.0	0.00	49.1	70-130	Low Bias	7.48	30	
1,3-Dichlorobenzene	22.0		"	50.0	0.00	44.0	70-130	Low Bias	8.05	30	
1,3-Dichloropropane	29.8		"	50.0	0.00	59.6	70-130	Low Bias	4.62	30	
1,4-Dichlorobenzene	22.6		"	50.0	0.00	45.1	70-130	Low Bias	6.74	30	
2,2-Dichloropropane	24.6		"	50.0	0.00	49.2	70-130	Low Bias	2.68	30	
2-Butanone	32.1		"	50.0	0.00	64.2	70-130	Low Bias	12.7	30	
2-Chlorotoluene	22.8		"	50.0	0.00	45.6	70-130	Low Bias	7.46	30	
2-Hexanone	27.4		"	50.0	0.00	54.9	70-130	Low Bias	12.1	30	
4-Chlorotoluene	23.0		"	50.0	0.00	46.0	70-130	Low Bias	5.96	30	
4-Methyl-2-pentanone	29.5		"	50.0	0.00	59.1	70-130	Low Bias	19.9	30	
Acetone	33.7		"	50.0	1.91	63.5	70-130	Low Bias	5.35	30	
Acrylonitrile	35.0		"	50.0	0.00	70.0	70-130		5.45	30	
Benzene	30.4		"	50.0	0.00	60.9	70-130	Low Bias	4.62	30	
Bromobenzene	22.8		"	50.0	0.00	45.5	70-130	Low Bias	2.99	30	
Bromochloromethane	31.7		"	50.0	0.00	63.5	70-130	Low Bias	4.38	30	
Bromodichloromethane	27.3		"	50.0	0.00	54.6	70-130	Low Bias	15.8	30	
Bromoform	24.5		"	50.0	0.00	49.0	70-130	Low Bias	5.25	30	
Bromomethane	30.5		"	50.0	0.00	61.0	70-130	Low Bias	11.4	30	
Carbon disulfide	29.6		"	50.0	0.00	59.1	70-130	Low Bias	6.89	30	
Carbon tetrachloride	26.4		"	50.0	0.00	52.7	70-130	Low Bias	1.18	30	
Chlorobenzene	26.6		"	50.0	0.00	53.2	70-130	Low Bias	0.450	30	
Chloroethane	31.9		"	50.0	0.00	63.8	70-130	Low Bias	8.90	30	
Chloroform	29.5		"	50.0	0.00	58.9	70-130	Low Bias	2.45	30	
Chloromethane	29.6		"	50.0	0.00	59.2	70-130	Low Bias	11.3	30	
cis-1,2-Dichloroethylene	29.8		"	50.0	0.00	59.7	70-130	Low Bias	4.87	30	
cis-1,3-Dichloropropylene	24.9		"	50.0	0.00	49.7	70-130	Low Bias	17.1	30	
Dibromochloromethane	26.0		"	50.0	0.00	52.0	70-130	Low Bias	5.24	30	
Dibromomethane	31.3		"	50.0	0.00	62.6	70-130	Low Bias	16.2	30	
Dichlorodifluoromethane	17.1		"	50.0	0.00	34.2	70-130	Low Bias	15.6	30	
Ethyl Benzene	26.3		"	50.0	0.00	52.6	70-130	Low Bias	1.15	30	
Hexachlorobutadiene	13.9		"	50.0	0.00	27.7	70-130	Low Bias	22.0	30	
Isopropylbenzene	24.9		"	50.0	0.00	49.8	70-130	Low Bias	7.37	30	
Methyl Methacrylate	36.1		"	50.0	0.00	72.2	70-130		24.3	30	
Methyl tert-butyl ether (MTBE)	28.3		"	50.0	0.00	56.7	70-130	Low Bias	2.07	30	

Volatile Organic Compounds by GC/MS - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50889 - EPA 5035A											
Matrix Spike Dup (BH50889-! Matrix Spike Dup	*Source sample: 25H0361-01 (SS-01)								Prepared & Analyzed: 08/12/2025		
Methylene chloride	36.6		ug/L	50.0	2.38	68.5	70-130	Low Bias	3.39	30	
Naphthalene	17.8		"	50.0	0.00	35.5	70-130	Low Bias	10.6	30	
n-Butylbenzene	19.2		"	50.0	0.00	38.3	70-130	Low Bias	13.8	30	
n-Propylbenzene	23.8		"	50.0	0.00	47.5	70-130	Low Bias	7.38	30	
o-Xylene	25.7		"	50.0	0.00	51.3	70-130	Low Bias	1.10	30	
p- & m- Xylenes	52.2		"	100	0.00	52.2	70-130	Low Bias	1.41	30	
p-Isopropyltoluene	21.6		"	50.0	0.00	43.3	70-130	Low Bias	11.1	30	
sec-Butylbenzene	21.9		"	50.0	0.00	43.8	70-130	Low Bias	13.1	30	
Styrene	20.0		"	50.0	0.00	40.0	70-130	Low Bias	0.150	30	
tert-Butylbenzene	22.9		"	50.0	0.00	45.8	70-130	Low Bias	10.4	30	
Tetrachloroethylene	21.3		"	50.0	0.00	42.6	70-130	Low Bias	4.22	30	
Tetrahydrofuran	30.5		"	50.0	0.00	60.9	70-130	Low Bias	4.68	30	
Toluene	28.6		"	50.0	0.00	57.1	70-130	Low Bias	2.97	30	
trans-1,2-Dichloroethylene	31.8		"	50.0	0.00	63.7	70-130	Low Bias	3.45	30	
trans-1,3-Dichloropropylene	22.8		"	50.0	0.00	45.6	70-130	Low Bias	4.80	30	
trans-1,4-dichloro-2-butene	28.3		"	50.0	0.00	56.5	70-130	Low Bias	2.83	30	
Trichloroethylene	25.9		"	50.0	0.00	51.9	70-130	Low Bias	14.6	30	
Trichlorofluoromethane	33.3		"	50.0	0.00	66.6	70-130	Low Bias	10.4	30	
Vinyl Chloride	34.1		"	50.0	0.00	68.2	70-130	Low Bias	11.0	30	
Surrogate: SURR: 1,2-Dichloroethane-d4	*50.6*		*"*	*50.0*		*101*	*70-130*				
Surrogate: SURR: Toluene-d8	*52.1*		*"*	*50.0*		*104*	*70-130*				
Surrogate: SURR: p-Bromofluorobenzene	*48.1*		*"*	*50.0*		*96.3*	*70-130*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50645 - EPA 3546 PPCB											
Blank (BH50645-BLK1) Blank									Prepared: 08/08/2025 Analyzed: 08/10/2025		
4,4'-DDD	ND	0.00248	mg/kg wet								
4,4'-DDE	ND	0.00248	"								
4,4'-DDT	ND	0.00248	"								
Alachlor	ND	0.00248	"								
Aldrin	ND	0.00248	"								
alpha-BHC	ND	0.00248	"								
beta-BHC	ND	0.00248	"								
Chlordane, total	ND	0.0330	"								
delta-BHC	ND	0.00248	"								
Dieldrin	ND	0.00248	"								
Endosulfan I	ND	0.00248	"								
Endosulfan II	ND	0.00248	"								
Endosulfan sulfate	ND	0.00248	"								
Endrin	ND	0.00248	"								
Endrin aldehyde	ND	0.00248	"								
Endrin ketone	ND	0.00248	"								
gamma-BHC (Lindane)	ND	0.00248	"								
Heptachlor	ND	0.00248	"								
Heptachlor epoxide	ND	0.00248	"								
Methoxychlor	ND	0.0124	"								
Toxaphene	ND	0.125	"								
Surrogate: Decachlorobiphenyl	*0.0589*		*"*	*0.100*		*58.9*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0428*		*"*	*0.100*		*42.8*	*30-150*				
LCS (BH50645-BS1) LCS									Prepared: 08/08/2025 Analyzed: 08/12/2025		
4,4'-DDD	0.0385	0.00248	mg/kg wet	0.0500		77.0	40-140				
4,4'-DDE	0.0408	0.00248	"	0.0500		81.6	40-140				
4,4'-DDT	0.0413	0.00248	"	0.0500		82.5	40-140				
Alachlor	0.0415	0.00248	"	0.0500		83.0	40-140				
Aldrin	0.0399	0.00248	"	0.0500		79.9	40-140				
alpha-BHC	0.0389	0.00248	"	0.0500		77.9	40-140				
beta-BHC	0.0452	0.00248	"	0.0500		90.3	40-140				
delta-BHC	0.0247	0.00248	"	0.0500		49.4	40-140				
Dieldrin	0.0399	0.00248	"	0.0500		79.8	40-140				
Endosulfan I	0.0415	0.00248	"	0.0500		83.0	40-140				
Endosulfan II	0.0425	0.00248	"	0.0500		85.0	40-140				
Endosulfan sulfate	0.0388	0.00248	"	0.0500		77.6	40-140				
Endrin	0.0404	0.00248	"	0.0500		80.8	40-140				
Endrin aldehyde	0.0444	0.00248	"	0.0500		88.7	40-140				
Endrin ketone	0.0418	0.00248	"	0.0500		83.6	40-140				
gamma-BHC (Lindane)	0.0384	0.00248	"	0.0500		76.8	40-140				
Heptachlor	0.0386	0.00248	"	0.0500		77.3	40-140				
Heptachlor epoxide	0.0414	0.00248	"	0.0500		82.8	40-140				
Methoxychlor	0.0484	0.0124	"	0.0500		96.8	40-140				
Surrogate: Decachlorobiphenyl	*0.0682*		*"*	*0.100*		*68.2*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0533*		*"*	*0.100*		*53.3*	*30-150*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50871 - EPA 3546 PPCB											
Blank (BH50871-BLK1) Blank									Prepared & Analyzed: 08/12/2025		
4,4'-DDD	ND	0.00164	mg/kg wet								
4,4'-DDE	ND	0.00164	"								
4,4'-DDT	ND	0.00164	"								
Alachlor	ND	0.00164	"								
Aldrin	ND	0.00164	"								
alpha-BHC	ND	0.00164	"								
beta-BHC	ND	0.00164	"								
Chlordane, total	ND	0.0219	"								
delta-BHC	ND	0.00164	"								
Dieldrin	ND	0.00164	"								
Endosulfan I	ND	0.00164	"								
Endosulfan II	ND	0.00164	"								
Endosulfan sulfate	ND	0.00164	"								
Endrin	ND	0.00164	"								
Endrin aldehyde	ND	0.00164	"								
Endrin ketone	ND	0.00164	"								
gamma-BHC (Lindane)	ND	0.00164	"								
Heptachlor	ND	0.00164	"								
Heptachlor epoxide	ND	0.00164	"								
Methoxychlor	ND	0.00822	"								
Toxaphene	ND	0.0831	"								
Surrogate: Decachlorobiphenyl	*0.00696*		*"*	*0.0664*		*10.5*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0433*		*"*	*0.0664*		*65.1*	*30-150*				
LCS (BH50871-BS1) LCS									Prepared & Analyzed: 08/12/2025		
4,4'-DDD	0.0234	0.00164	mg/kg wet	0.0332		70.4	40-140				
4,4'-DDE	0.0254	0.00164	"	0.0332		76.4	40-140				
4,4'-DDT	0.0251	0.00164	"	0.0332		75.5	40-140				
Alachlor	0.0265	0.00164	"	0.0332		79.9	40-140				
Aldrin	0.0256	0.00164	"	0.0332		77.0	40-140				
alpha-BHC	0.0264	0.00164	"	0.0332		79.6	40-140				
beta-BHC	0.0290	0.00164	"	0.0332		87.3	40-140				
delta-BHC	0.0247	0.00164	"	0.0332		74.3	40-140				
Dieldrin	0.0254	0.00164	"	0.0332		76.5	40-140				
Endosulfan I	0.0266	0.00164	"	0.0332		80.1	40-140				
Endosulfan II	0.0267	0.00164	"	0.0332		80.3	40-140				
Endosulfan sulfate	0.0266	0.00164	"	0.0332		80.0	40-140				
Endrin	0.0249	0.00164	"	0.0332		75.0	40-140				
Endrin aldehyde	0.0289	0.00164	"	0.0332		87.1	40-140				
Endrin ketone	0.0270	0.00164	"	0.0332		81.2	40-140				
gamma-BHC (Lindane)	0.0256	0.00164	"	0.0332		76.9	40-140				
Heptachlor	0.0245	0.00164	"	0.0332		73.7	40-140				
Heptachlor epoxide	0.0263	0.00164	"	0.0332		79.3	40-140				
Methoxychlor	0.0274	0.00822	"	0.0332		82.6	40-140				
Surrogate: Decachlorobiphenyl	*0.0395*		*"*	*0.0664*		*59.4*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0304*		*"*	*0.0664*		*45.7*	*30-150*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50871 - EPA 3546 PPCB											
Matrix Spike (BH50871-MS1) Matrix Spike	*Source sample: 25H0361-04 (AG-01)								Prepared: 08/12/2025 Analyzed: 08/13/2025		
4,4'-DDD	0.0189	0.00175	mg/kg dry	0.0353	ND	53.6	30-150				
4,4'-DDE	0.0180	0.00175	"	0.0353	0.00446	38.3	30-150				
4,4'-DDT	0.0210	0.00175	"	0.0353	0.00473	46.2	30-150				
Alachlor	0.0206	0.00175	"	0.0353	ND	58.4	30-150				
Aldrin	0.0162	0.00175	"	0.0353	ND	45.7	30-150				
alpha-BHC	0.0159	0.00175	"	0.0353	ND	44.9	30-150				
beta-BHC	0.0172	0.00175	"	0.0353	ND	48.8	30-150				
delta-BHC	0.0150	0.00175	"	0.0353	ND	42.4	30-150				
Dieldrin	0.0168	0.00175	"	0.0353	ND	47.5	30-150				
Endosulfan I	0.0170	0.00175	"	0.0353	ND	48.1	30-150				
Endosulfan II	0.0192	0.00175	"	0.0353	ND	54.3	30-150				
Endosulfan sulfate	0.0159	0.00175	"	0.0353	ND	45.1	30-150				
Endrin	0.0171	0.00175	"	0.0353	ND	48.4	30-150				
Endrin aldehyde	0.0170	0.00175	"	0.0353	ND	48.2	30-150				
Endrin ketone	0.0186	0.00175	"	0.0353	ND	52.6	30-150				
gamma-BHC (Lindane)	0.0158	0.00175	"	0.0353	ND	44.8	30-150				
Heptachlor	0.0166	0.00175	"	0.0353	ND	47.0	30-150				
Heptachlor epoxide	0.0172	0.00175	"	0.0353	ND	48.6	30-150				
Methoxychlor	0.0177	0.00874	"	0.0353	ND	50.1	30-150				
Surrogate: Decachlorobiphenyl	*0.0234*		*"*	*0.0707*		*33.1*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0258*		*"*	*0.0707*		*36.5*	*30-150*				
Matrix Spike Dup (BH50871-! Matrix Spike Dup	*Source sample: 25H0361-04 (AG-01)								Prepared: 08/12/2025 Analyzed: 08/13/2025		
4,4'-DDD	0.0183	0.00175	mg/kg dry	0.0353	ND	51.9	30-150		3.08	30	
4,4'-DDE	0.0176	0.00175	"	0.0353	0.00446	37.1	30-150		2.39	30	
4,4'-DDT	0.0157	0.00175	"	0.0353	0.00473	31.1	30-150		29.0	30	
Alachlor	0.0220	0.00175	"	0.0353	ND	62.4	30-150		6.53	30	
Aldrin	0.0149	0.00175	"	0.0353	ND	42.1	30-150		8.22	30	
alpha-BHC	0.0148	0.00175	"	0.0353	ND	41.9	30-150		7.08	30	
beta-BHC	0.0163	0.00175	"	0.0353	ND	46.0	30-150		5.71	30	
delta-BHC	0.0142	0.00175	"	0.0353	ND	40.1	30-150		5.50	30	
Dieldrin	0.0157	0.00175	"	0.0353	ND	44.5	30-150		6.40	30	
Endosulfan I	0.0160	0.00175	"	0.0353	ND	45.2	30-150		6.32	30	
Endosulfan II	0.0179	0.00175	"	0.0353	ND	50.6	30-150		7.07	30	
Endosulfan sulfate	0.0148	0.00175	"	0.0353	ND	42.0	30-150		7.19	30	
Endrin	0.0160	0.00175	"	0.0353	ND	45.2	30-150		6.79	30	
Endrin aldehyde	0.0161	0.00175	"	0.0353	ND	45.7	30-150		5.36	30	
Endrin ketone	0.0163	0.00175	"	0.0353	ND	46.3	30-150		12.9	30	
gamma-BHC (Lindane)	0.0147	0.00175	"	0.0353	ND	41.5	30-150		7.63	30	
Heptachlor	0.0153	0.00175	"	0.0353	ND	43.2	30-150		8.46	30	
Heptachlor epoxide	0.0162	0.00175	"	0.0353	ND	45.8	30-150		6.01	30	
Methoxychlor	0.0148	0.00874	"	0.0353	ND	42.0	30-150		17.6	30	
Surrogate: Decachlorobiphenyl	*0.0212*		*"*	*0.0707*		*30.0*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0247*		*"*	*0.0707*		*34.9*	*30-150*				

Gas Chromatography/Flame Ionization Detector - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50710 - EPA 3546 ETPH											
Blank (BH50710-BLK1) Blank								Prepared & Analyzed: 08/10/2025			
ETPH (Extractable Total Petroleum Hydrocarbons)	ND	39.6	mg/kg wet								
Surrogate: 1-Chlorooctadecane	*8.15*		"	*9.90*		*82.3*	*50-150*				
LCS (BH50710-BS1) LCS								Prepared & Analyzed: 08/10/2025			
ETPH (Extractable Total Petroleum Hydrocarbons)	85.5	39.6	mg/kg wet	74.3		115	39.8-123				
Surrogate: 1-Chlorooctadecane	*9.27*		"	*9.90*		*93.6*	*50-150*				
Matrix Spike (BH50710-MS1) Matrix Spike *Source sample: 25H0361-11 (LB-01)								Prepared & Analyzed: 08/10/2025			
ETPH (Extractable Total Petroleum Hydrocarbons)	57.4	42.2	mg/kg dry	79.2	ND	72.5	50-150				
Surrogate: 1-Chlorooctadecane	*6.93*		"	*10.6*		*65.6*	*50-150*				
Matrix Spike Dup (BH50710-! Matrix Spike Dup *Source sample: 25H0361-11 (LB-01)								Prepared & Analyzed: 08/10/2025			
ETPH (Extractable Total Petroleum Hydrocarbons)	80.5	42.2	mg/kg dry	79.2	ND	102	50-150		33.4	30	Non-dir.
Surrogate: 1-Chlorooctadecane	*10.1*		"	*10.6*		*96.1*	*50-150*				

Metals by ICP - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50793 - EPA 3050B											
Blank (BH50793-BLK1) Blank									Prepared: 08/11/2025 Analyzed: 08/12/2025		
Antimony	ND	1.74	mg/kg wet								
Arsenic	ND	1.04	"								
Barium	ND	1.73	"								
Beryllium	ND	0.035	"								
Cadmium	ND	0.208	"								
Chromium	ND	0.348	"								
Copper	ND	1.39	"								
Lead	ND	0.348	"								
Nickel	ND	0.692	"								
Selenium	ND	1.74	"								
Silver	ND	0.350	"								
Thallium	ND	1.74	"								
Vanadium	ND	0.692	"								
Zinc	ND	1.73	"								
Duplicate (BH50793-DUP1) Duplicate *Source sample: 25H0361-01 (SS-01)									Prepared: 08/11/2025 Analyzed: 08/12/2025		
Antimony	ND	1.99	mg/kg dry		ND					35	
Arsenic	4.84	1.19	"		4.37				10.4	35	
Barium	63.9	1.99	"		55.7				13.8	35	
Beryllium	0.541	0.040	"		0.443				19.8	35	
Cadmium	0.611	0.239	"		0.497				20.7	35	
Chromium	23.6	0.398	"		20.4				14.3	35	
Copper	18.9	1.59	"		16.4				14.0	35	
Lead	25.4	0.398	"		21.5				16.6	35	
Nickel	14.5	0.793	"		12.9				11.8	35	
Selenium	ND	1.99	"		ND					35	
Silver	ND	0.401	"		ND					35	
Thallium	ND	1.99	"		ND					35	
Vanadium	35.6	0.793	"		30.4				15.9	35	
Zinc	72.8	1.98	"		61.5				16.9	35	

Metals by ICP - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50793 - EPA 3050B											
Matrix Spike (BH50793-MS1) Matrix Spike	*Source sample: 25H0361-01 (SS-01)							Prepared: 08/11/2025 Analyzed: 08/12/2025			
Antimony	7.69	1.99	mg/kg dry	23.9	ND	32.2	75-125	Low Bias			
Arsenic	179	1.19	"	191	4.37	91.4	75-125				
Barium	238	1.99	"	191	55.7	95.4	75-125				
Beryllium	5.00	0.040	"	4.78	0.443	95.3	75-125				
Cadmium	4.66	0.239	"	4.78	0.497	87.2	75-125				
Chromium	38.5	0.398	"	19.1	20.4	94.5	75-125				
Copper	40.5	1.59	"	23.9	16.4	101	75-125				
Lead	62.1	0.398	"	47.8	21.5	84.8	75-125				
Nickel	57.6	0.793	"	47.8	12.9	93.7	75-125				
Selenium	169	1.99	"	191	ND	88.2	75-125				
Silver	4.44	0.401	"	4.78	ND	93.0	75-125				
Thallium	172	1.99	"	191	ND	90.2	75-125				
Vanadium	75.3	0.793	"	47.8	30.4	94.2	75-125				
Zinc	104	1.98	"	47.8	61.5	89.5	75-125				
Post Spike (BH50793-PS1) Post Spike	*Source sample: 25H0361-01 (SS-01)							Prepared: 08/11/2025 Analyzed: 08/12/2025			
Antimony	0.246		ug/mL	0.250	-0.012	98.6	75-125				
Arsenic	1.91		"	2.00	0.046	93.2	75-125				
Barium	2.46		"	2.00	0.583	93.7	75-125				
Beryllium	0.052		"	0.0500	0.005	95.4	75-125				
Cadmium	0.049		"	0.0500	0.005	87.6	75-125				
Chromium	0.396		"	0.200	0.214	91.3	75-125				
Copper	0.428		"	0.250	0.172	103	75-125				
Lead	0.668		"	0.500	0.225	88.4	75-125				
Nickel	0.599		"	0.500	0.134	92.8	75-125				
Selenium	1.82		"	2.00	-0.002	91.0	75-125				
Silver	0.040		"	0.0500	-0.002	80.2	75-125				
Thallium	1.82		"	2.00	-0.006	90.9	75-125				
Vanadium	0.783		"	0.500	0.318	93.1	75-125				
Zinc	1.08		"	0.500	0.644	87.9	75-125				

Metals by ICP - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50793 - EPA 3050B											
Reference (BH50793-SRM1) Reference											
Prepared: 08/11/2025 Analyzed: 08/12/2025											
Antimony	59.8	1.74	mg/kg wet	101		59.2	0.1-199				
Arsenic	144	1.04	"	148		97.4	81.1-119.6				
Barium	184	1.73	"	191		96.2	81.7-118.3				
Beryllium	242	0.035	"	240		101	82.1-117.5				
Cadmium	173	0.208	"	190		91.1	82.1-118.4				
Chromium	132	0.348	"	132		99.9	81.1-118.9				
Copper	250	1.39	"	234		107	82.9-117.5				
Lead	91.8	0.348	"	98.6		93.1	81.8-117.6				
Nickel	153	0.692	"	155		98.7	81.9-118.1				
Selenium	119	1.74	"	124		96.3	78.5-121				
Silver	55.3	0.350	"	54.9		101	79.4-120.8				
Thallium	174	1.74	"	183		94.9	80.3-119.7				
Vanadium	137	0.692	"	137		100	78.1-121.9				
Zinc	326	1.73	"	345		94.5	79.4-120.6				

Mercury by EPA 7000/200 Series Methods - Quality Control Data

York Analytical Laboratories, Inc.

Analyte		Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50507 - EPA 7473 soil												
Blank (BH50507-BLK1)	Blank								Prepared & Analyzed: 08/07/2025			
Mercury		ND	0.0300	mg/kg wet								
Duplicate (BH50507-DUP1)	Duplicate	*Source sample: 25H0361-01 (SS-01)							Prepared & Analyzed: 08/07/2025			
Mercury		0.0488	0.0344	mg/kg dry		0.0726				39.1	35	Non-dir.
Matrix Spike (BH50507-MS1)	Matrix Spike	*Source sample: 25H0361-01 (SS-01)							Prepared & Analyzed: 08/07/2025			
Mercury		0.840		mg/kg	1.00	0.0633	77.7	75-125				
Reference (BH50507-SRM1)	Reference								Prepared & Analyzed: 08/07/2025			
Mercury		17.095		mg/kg	24.0		71.2	55.8-109.6				

Miscellaneous Physical Parameters - Quality Control Data

York Analytical Laboratories, Inc.

Analyte		Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH50636 - % Solids Prep												
Duplicate (BH50636-DUP1)	Duplicate	*Source sample: 25H0361-01 (SS-01)								Prepared & Analyzed: 08/08/2025		
% Solids		87.2	0.100	%		87.2				0.0109	20	
Batch BH50658 - % Solids Prep												
Duplicate (BH50658-DUP1)	Duplicate	*Source sample: 25H0361-04 (AG-01)								Prepared & Analyzed: 08/08/2025		
% Solids		94.2	0.100	%		94.0				0.175	20	
Batch BH50741 - % Solids Prep												
Duplicate (BH50741-DUP1)	Duplicate	*Source sample: 25H0361-11 (LB-01)								Prepared & Analyzed: 08/11/2025		
% Solids		93.7	0.100	%		93.8				0.106	20	

Volatile Analysis Sample Containers

Lab ID	Client Sample ID	Volatile Sample Container
25H0361-01	SS-01	40mL Vial with Stir Bar-Cool 4° C
25H0361-02	SS-02	40mL Vial with Stir Bar-Cool 4° C
25H0361-03	SS-03	40mL Vial with Stir Bar-Cool 4° C
25H0361-11	LB-01	40mL Vial with Stir Bar-Cool 4° C
25H0361-12	LB-02	40mL Vial with Stir Bar-Cool 4° C
25H0361-13	LB-03	40mL Vial with Stir Bar-Cool 4° C
25H0361-14	Trip Blanks	40mL Clear Vial (pre-pres.) HCl; Cool to 4° C

Sample and Data Qualifiers Relating to This Work Order

S-GC	Two surrogates are used for this analysis. One surrogate recovered within control limits therefore the analysis is acceptable.
S-08	The recovery of this surrogate was outside of QC limits.
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QL-02	This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.
M-DUPS	The RPD between the native sample and the duplicate is outside of limits due to sample non-homogeneity
M-CCV1	The recovery for this element in the Continuing Calibration Verification (CCV) was outside the 90-110% recovery criteria.
ICVE20	The value reported is ESTIMATED. The value is estimated due to its behavior during initial calibration verification (recovery exceeded 20% of expected value).
ICVE	The value reported is ESTIMATED. The value is estimated due to its behavior during initial calibration verification (recovery exceeded 30% of expected value).
CCVE	The value reported is ESTIMATED. The value is estimated due to its behavior during continuing calibration verification (>20% Difference for average Rf or >20% Drift for quadratic fit).

Definitions and Other Explanations

*	Analyte is not certified or the state of the samples origination does not offer certification for the Analyte.
ND	NOT DETECTED - the analyte is not detected at the Reported to level (LOQ/RL or LOD/MDL)
RL	REPORTING LIMIT - the minimum reportable value based upon the lowest point in the analyte calibration curve.
LOQ	LIMIT OF QUANTITATION - the minimum concentration of a target analyte that can be reported within a specified degree of confidence. This is the lowest point in an analyte calibration curve that has been subjected to all steps of the processing/analysis and verified to meet defined criteria. This is based upon NELAC 2009 Standards and applies to all analyses.
LOD	LIMIT OF DETECTION - a verified estimate of the minimum concentration of a substance in a given matrix that an analytical process can reliably detect. This is based upon NELAC 2009 Standards and applies to all analyses conducted under the auspices of EPA SW-846.
MDL	METHOD DETECTION LIMIT - a statistically derived estimate of the minimum amount of a substance an analytical system can reliably detect with a 99% confidence that the concentration of the substance is greater than zero. This is based upon 40 CFR Part 136 Appendix B and applies only to EPA 600 and 200 series methods.
Reported to	This indicates that the data for a particular analysis is reported to either the LOD/MDL, or the LOQ/RL. In cases where the "Reported to" is located above the LOD/MDL, any value between this and the LOQ represents an estimated value which is "J" flagged accordingly. This applies to volatile and semi-volatile target compounds only.
NR	Not reported
RPD	Relative Percent Difference
Wet	The data has been reported on an as-received (wet weight) basis
Low Bias	Low Bias flag indicates that the recovery of the flagged analyte is below the laboratory or regulatory lower control limit. The data user should take note that this analyte may be biased low but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.
High Bias	High Bias flag indicates that the recovery of the flagged analyte is above the laboratory or regulatory upper control limit. The data user should take note that this analyte may be biased high but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.
Non-Dir.	Non-dir. flag (Non-Directional Bias) indicates that the Relative Percent Difference (RPD) (a measure of precision) among the MS and MSD data is outside the laboratory or regulatory control limit. This alerts the data user where the MS and MSD are from site-specific samples that the RPD is high due to either non-homogeneous distribution of target analyte between the MS/MSD or indicates poor reproducibility for other reasons.

If EPA SW-846 method 8270 is included herein it is noted that the target compound N-nitrosodiphenylamine (NDPA) decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine (DPA). These results could actually represent 100% DPA, 100% NDPA or some combination of the two. For this reason, York reports the combined result for n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration as Diphenylamine.

If Total PCBs are detected and the target aroclors reported are "Not detected", the Total PCB value is reported due to the presence of either or both Aroclors 1262 and 1268 which are non-target aroclors for some regulatory lists.

2-chloroethylvinyl ether readily breaks down under acidic conditions. Samples that are acid preserved, including standards will exhibit breakdown. The data user should take note.

Certification for pH is no longer offered by NYDOH ELAP.

Semi-Volatile and Volatile analyses are reported down to the LOD/MDL, with values between the LOD/MDL and the LOQ being "J" flagged as estimated results.

For analyses by EPA SW-846-8270D, the Limit of Quantitation (LOQ) reported for benzidine is based upon the lowest standard used for calibration and is not a verified LOQ due to this compound's propensity for oxidative losses during extraction/concentration procedures and non-reproducible chromatographic performance.

Field Chain-of-Custody Record

YORK ANALYTICAL LABORATORIES INC

York Analytical Laboratories, Inc. (YORK)'s Standard Terms & Conditions are listed on the back side of this document. This legal document serves as your written authorization for YORK to proceed with the analyses requested below. Your signature binds you to YORK's Standard Terms & Conditions.

120 Research Drive Stratford, CT 06615 132-02 89th Ave Queens, NY 11418 56 Church Hill Rd. #2 Newtown, CT 06470 2161 Whitesville Rd Toms River, NJ 08755 clientservices@yorklab.com 800-306-YORK

YORK Project Number: 25H0361

Page 1 of 1

Report To:	Invoice To:
Company: Langan CT, Inc.	Company:
Address: 555 Long Wharf Dr. New Haven, CT 06511	Address: SAME
Phone.: 203 780 1376	Phone.:
Contact: William Adsit	Contact:
E-mail: wadsit@langan.com	E-mail:

YOUR Project Name / Number: 140325901 Hillcrest MS

PO Number:

Samples Collected From: NY ☐ NJ ☐ CT ☒ PA ☐ Other: (please specify)

Turn-Around Time: RUSH - Next Day ☐ RUSH - Two Day ☐ RUSH - Three Day ☐ RUSH - Four Day ☐ RUSH - Five Day ☐ Standard (6-9 Day) ☒ PFAS Standard 7-10 Day ☐

Please print clearly and legibly. All information must be complete. Samples will not be logged in and the turn-around-time clock will not begin until any questions by YORK are resolved.

William Adsit
Samples Collected by: (print AND sign your name)

Matrix Codes: S - soil/solid/sludge; GW - groundwater; DW - drinking water; SW - surface water; WW - wastewater; O - Oil; Other

Preservative (please list number of containers)

Analyses Requested

Sample Identification		Date	Time	Matrix	Unpreserved	HCl (hydrochloric acid)	MeOH (methanol)	HNO_3 (nitric acid)	H_2SO_4 (sulfuric acid)	NaOH (sodium hydroxide)	$Na_2S_2O_3$ (sodium thio.)	Trizma	Ammonium Acetate	Other: DI	VOCs	PAHs	ETPH	CT-list metals	RCRA	Pesticides	SVOCs						Grab or Comp.
SS-01	MS/MSD VOCs + metals	8/6/25	11:10	S	2		1							2	X			X									G
SS-02			10:55		1		1							1	X			X									
SS-03			11:40		1		1							1	X			X									
AG-01	MS/MSD pesticides		9:00		1															X							
AG-02			8:25		1															X							
AG-03			9:15		1															X							
AG-04			9:55		1															X							
AG-05			9:35		1															X							
AG-06			10:15		1															X							
DUP			—		1															X							
LB-01	MS/MSD SVOCs		13:45		4		1							2	X		X				X							
LB-02			14:05		1		1							1	X	X	X										
LB-03			14:50		1		1							1	X	X	X										
Trip Blanks			15:00	Ag		2									X												

Report Type (circle): QA Report; Summary (Results Only); NY ASP B Package; NJ Reduced; NJ DKQP; NJ Full; CT RCP

EDD Type (circle): EQuIS (standard); NYSDEC EQuIS; NJDEP SRP Haz Site; Standard Excel; CMDP; Other:

Regulatory Comparative: Compared to the following Regulation(s): (please fill in) DEC PMC

Field Filtered ☐ Lab Filtered ☐

Comments: RLs must meet CTDEEP RSRs & APS criteria. MS/MSD samples identified in Sample Identification column above. Please cc: results to Dave Gramuglia & Hannah Griesbach

Samples iced/chilled at time of lab pickup? circle: Yes or No

Lab Sample Receiving Checklist (to be completed by the receiving laboratory only) Circle Y / N

Custody Seals: Y / N Containers Intact: Y / N COC/Labels Agree: Y / N Preservation Confirmed: Y / N
COC Complete: Y / N COC Received: Y / N Appropriate Sample Volumes: Y / N Appropriate Sample Containers: Y / N
Cooler Temperature Confirmed: Y / N Samples Submitted within Holding Times: Y / N Corrective Action Form Required: Y / N

Samples Relinquished by / Company	Date/Time	1. Samples Received by / Company	Date/Time	2. Samples Relinquished by / Company	Date/Time
[signature]	8/6/25 15:35				
Samples Received by / Company	Date/Time	3. Samples Relinquished by / Company	Date/Time	3. Samples Received by / Company	Date/Time
Samples Relinquished by / Company	Date/Time	4. Samples Received by / Company	Date/Time	Samples Received in LAB by	Date/Time / Temperature
				[signature]	08/06/25 15:35 2.8 Degrees C

Technical Report

prepared for:

Langan Engineering & Environmental Services (CT)
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511-6107
Attention: William Adsit

Report Date: 08/15/2025
Client Project ID: 140325901
York Project (SDG) No.: 25H0413

Report Date: 08/15/2025
Client Project ID: 140325901
York Project (SDG) No.: 25H0413

Langan Engineering & Environmental Services (CT)
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511-6107
Attention: William Adsit

Purpose and Results

This report contains the analytical data for the sample(s) identified on the attached chain-of-custody received in our laboratory on August 07, 2025 and listed below. The project was identified as your project: **140325901**.

The analyses were conducted utilizing appropriate EPA, Standard Methods, and ASTM methods as detailed in the data summary tables.

All samples were received in proper condition meeting the customary acceptance requirements for environmental samples except those indicated under the Sample and Analysis Qualifiers section of this report.

All analyses met the method and laboratory standard operating procedure requirements except as indicated by any data flags, the meaning of which are explained in the Sample and Data Qualifiers Relating to This Work Order section of this report and case narrative if applicable.

The results of the analyses, which are all reported on dry weight basis (soils) unless otherwise noted, are detailed in the following pages.

Please contact Client Services at 203.325.1371 with any questions regarding this report.

York Sample ID	Client Sample ID	Matrix	Date Collected	Date Received
25H0413-01	AG-07	Soil	08/07/2025	08/07/2025
25H0413-02	AG-08	Soil	08/07/2025	08/07/2025
25H0413-03	AG-09	Soil	08/07/2025	08/07/2025
25H0413-04	AG-10	Soil	08/07/2025	08/07/2025
25H0413-05	AG-11	Soil	08/07/2025	08/07/2025
25H0413-06	AG-12	Soil	08/07/2025	08/07/2025

General Notes for York Project (SDG) No.: 25H0413

1. The RLs and MDLs (Reporting Limit and Method Detection Limit respectively) reported are adjusted for any dilution necessary due to the levels of target and/or non-target analytes and matrix interference. The RL(REPORTING LIMIT) is based upon the lowest standard utilized for the calibration where applicable.
2. Samples are retained for a period of thirty days after submittal of report, unless other arrangements are made.
3. York's liability for the above data is limited to the dollar value paid to York for the referenced project.
4. This report shall not be reproduced without the written approval of York Analytical Laboratories, Inc.
5. All analyses conducted met method or Laboratory SOP requirements. See the Sample and Data Qualifiers Section for further information.
6. It is noted that no analyses reported herein were subcontracted to another laboratory, unless noted in the report.
7. This report reflects results that relate only to the samples submitted on the attached chain-of-custody form(s) received by York.
8. Analyses conducted at York Analytical Laboratories, Inc. Stratford, CT are indicated by NY Cert. No. 10854; those conducted at York Analytical Laboratories, Inc., Richmond Hill, NY are indicated by NY Cert. No. 12058.

Approved By  **Date:** 08/15/2025

Cassie L. Mosher
Laboratory Manager

Sample Information

Client Sample ID: AG-07 **York Sample ID:** 25H0413-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 9:00 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0339	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00254	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0127	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.128	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:42	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-07 **York Sample ID:** 25H0413-01

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 9:00 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*38.9 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*67.1 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**96.4**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications: CTDPH-PH-0840			

Sample Information

Client Sample ID: AG-08 **York Sample ID:** 25H0413-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 9:15 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0374	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00281	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0140	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.142	5	EPA 8081B	08/13/2025 14:20	08/14/2025 11:59	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-08 **York Sample ID:** 25H0413-02

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 9:15 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*22.5 %*	S-GC, S-08	*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*37.9 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**87.3**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications: CTDPH-PH-0840			

Sample Information

Client Sample ID: AG-09 **York Sample ID:** 25H0413-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:45 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.00719	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.000539	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.00269	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.0272	1	EPA 8081B	08/14/2025 13:53	08/14/2025 23:46	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-09 **York Sample ID:** 25H0413-03

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:45 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*51.8 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*57.0 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**90.9**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications: CTDPH-PH-0840			

Sample Information

Client Sample ID: AG-10 **York Sample ID:** 25H0413-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:20 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.00729	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.000547	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.00273	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.0276	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:02	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-10 **York Sample ID:** 25H0413-04

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:20 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*54.5 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*59.6 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**89.6**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications:	CTDPH-PH-0840		

Sample Information

Client Sample ID: AG-11 **York Sample ID:** 25H0413-05

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:10 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	4,4'-DDE	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	4,4'-DDT	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.0366	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.00275	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.0137	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.139	5	EPA 8081B	08/13/2025 14:20	08/14/2025 12:50	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-11 **York Sample ID:** 25H0413-05

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:10 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*33.5 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*42.9 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**89.2**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications: CTDPH-PH-0840			

Sample Information

Client Sample ID: AG-12 **York Sample ID:** 25H0413-06

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:00 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
72-54-8	4,4'-DDD	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-55-9	**4,4'-DDE**	**0.00126**		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
50-29-3	**4,4'-DDT**	**0.00146**		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
15972-60-8	Alachlor	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840		
309-00-2	Aldrin	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-84-6	alpha-BHC	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
319-85-7	beta-BHC	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
57-74-9	Chlordane, total	ND		mg/kg dry	0.00772	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:			
319-86-8	delta-BHC	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
60-57-1	Dieldrin	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
959-98-8	Endosulfan I	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
33213-65-9	Endosulfan II	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854		
1031-07-8	Endosulfan sulfate	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-20-8	Endrin	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
7421-93-4	Endrin aldehyde	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
53494-70-5	Endrin ketone	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
58-89-9	gamma-BHC (Lindane)	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
76-44-8	Heptachlor	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
1024-57-3	Heptachlor epoxide	ND		mg/kg dry	0.000579	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
72-43-5	Methoxychlor	ND		mg/kg dry	0.00290	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		
8001-35-2	Toxaphene	ND		mg/kg dry	0.0292	1	EPA 8081B	08/14/2025 13:53	08/15/2025 00:17	RJ
							Certifications:	CTDPH-PH-0840,NYSDOH-NY10854,NJDEP-CT005,PADEP-68-0		

Sample Information

Client Sample ID: AG-12 **York Sample ID:** 25H0413-06

York Project (SDG) No.	Client Project ID	Matrix	Collection Date/Time	Date Received
25H0413	140325901	Soil	August 7, 2025 8:00 am	08/07/2025

Pesticides, CT RCP Target List

Log-in Notes:

Sample Notes:

Sample Prepared by Method: EPA 3546 PCB-RCP

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
	Surrogate Recoveries	**Result**		**Acceptance Range**						
2051-24-3	*Surrogate: Decachlorobiphenyl*	*76.2 %*		*30-150*						
877-09-8	*Surrogate: Tetrachloro-m-xylene*	*72.6 %*		*30-150*						

Total Solids

Log-in Notes:

Sample Notes:

Sample Prepared by Method: % Solids Prep

CAS No.	Parameter	Result	Flag	Units	Reported to LOQ	Dilution	Reference Method	Date/Time Prepared	Date/Time Analyzed	Analyst
solids	**% Solids**	**84.6**		%	0.100	1	SM 2540G	08/12/2025 08:14	08/12/2025 12:05	BF
							Certifications: CTDPH-PH-0840			

Analytical Batch Summary

Batch ID: BH50859 **Preparation Method:** % Solids Prep **Prepared By:** BNF

YORK Sample ID	Client Sample ID	Preparation Date
25H0413-01	AG-07	08/12/25
25H0413-02	AG-08	08/12/25
25H0413-03	AG-09	08/12/25
25H0413-04	AG-10	08/12/25
25H0413-05	AG-11	08/12/25
25H0413-06	AG-12	08/12/25

Batch ID: BH51038 **Preparation Method:** EPA 3546 PCB-RCP **Prepared By:** FA

YORK Sample ID	Client Sample ID	Preparation Date
25H0413-01	AG-07	08/13/25
25H0413-02	AG-08	08/13/25
25H0413-05	AG-11	08/13/25
BH51038-BLK1	Blank	08/13/25
BH51038-BS1	LCS	08/13/25

Batch ID: BH51133 **Preparation Method:** EPA 3546 PCB-RCP **Prepared By:** JAA

YORK Sample ID	Client Sample ID	Preparation Date
25H0413-03	AG-09	08/14/25
25H0413-04	AG-10	08/14/25
25H0413-06	AG-12	08/14/25
BH51133-BLK1	Blank	08/14/25
BH51133-BS1	LCS	08/14/25
BH51133-MS1	Matrix Spike	08/14/25
BH51133-MSD1	Matrix Spike Dup	08/14/25

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH51038 - EPA 3546 PCB-RCP											
Blank (BH51038-BLK1) Blank									Prepared: 08/13/2025 Analyzed: 08/14/2025		
4,4'-DDD [2C]	ND	0.00248	mg/kg wet								
4,4'-DDE [2C]	ND	0.00248	"								
4,4'-DDT	ND	0.00248	"								
Alachlor	ND	0.00248	"								
Aldrin [2C]	ND	0.00248	"								
alpha-BHC	ND	0.00248	"								
beta-BHC	ND	0.00248	"								
Chlordane, total	ND	0.0330	"								
delta-BHC	ND	0.00248	"								
Dieldrin [2C]	ND	0.00248	"								
Endosulfan I [2C]	ND	0.00248	"								
Endosulfan II	ND	0.00248	"								
Endosulfan sulfate	ND	0.00248	"								
Endrin	ND	0.00248	"								
Endrin aldehyde	ND	0.00248	"								
Endrin ketone	ND	0.00248	"								
gamma-BHC (Lindane)	ND	0.00248	"								
Heptachlor	ND	0.00248	"								
Heptachlor epoxide	ND	0.00248	"								
Methoxychlor	ND	0.0124	"								
Toxaphene	ND	0.125	"								
Surrogate: Decachlorobiphenyl	*0.0446*		*"*	*0.100*		*44.6*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0818*		*"*	*0.100*		*81.8*	*30-150*				
LCS (BH51038-BS1) LCS									Prepared: 08/13/2025 Analyzed: 08/14/2025		
4,4'-DDD [2C]	0.0497	0.00248	mg/kg wet	0.0500		99.4	40-140				
4,4'-DDE [2C]	0.0436	0.00248	"	0.0500		87.1	40-140				
4,4'-DDT	0.0383	0.00248	"	0.0500		76.7	40-140				
Alachlor	0.0452	0.00248	"	0.0500		90.3	40-140				
Aldrin [2C]	0.0376	0.00248	"	0.0500		75.3	40-140				
alpha-BHC	0.0383	0.00248	"	0.0500		76.6	40-140				
beta-BHC	0.0437	0.00248	"	0.0500		87.5	40-140				
delta-BHC	0.0363	0.00248	"	0.0500		72.6	40-140				
Dieldrin [2C]	0.0424	0.00248	"	0.0500		84.9	40-140				
Endosulfan I [2C]	0.0432	0.00248	"	0.0500		86.4	40-140				
Endosulfan II	0.0458	0.00248	"	0.0500		91.6	40-140				
Endosulfan sulfate	0.0418	0.00248	"	0.0500		83.7	40-140				
Endrin	0.0432	0.00248	"	0.0500		86.4	40-140				
Endrin aldehyde	0.0366	0.00248	"	0.0500		73.1	40-140				
Endrin ketone	0.0402	0.00248	"	0.0500		80.3	40-140				
gamma-BHC (Lindane)	0.0390	0.00248	"	0.0500		78.1	40-140				
Heptachlor	0.0409	0.00248	"	0.0500		81.8	40-140				
Heptachlor epoxide	0.0429	0.00248	"	0.0500		85.8	40-140				
Methoxychlor	0.0406	0.0124	"	0.0500		81.3	40-140				
Surrogate: Decachlorobiphenyl	*0.0350*		*"*	*0.100*		*35.0*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0686*		*"*	*0.100*		*68.6*	*30-150*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH51133 - EPA 3546 PCB-RCP											
Blank (BH51133-BLK1) Blank								Prepared & Analyzed: 08/14/2025			
4,4'-DDD	ND	0.000493	mg/kg wet								
4,4'-DDE	ND	0.000493	"								
4,4'-DDT	ND	0.000493	"								
Alachlor	ND	0.000493	"								
Aldrin	ND	0.000493	"								
alpha-BHC	ND	0.000493	"								
beta-BHC	ND	0.000493	"								
Chlordane, total	ND	0.00657	"								
delta-BHC	ND	0.000493	"								
Dieldrin	ND	0.000493	"								
Endosulfan I	ND	0.000493	"								
Endosulfan II	ND	0.000493	"								
Endosulfan sulfate	ND	0.000493	"								
Endrin	ND	0.000493	"								
Endrin aldehyde	ND	0.000493	"								
Endrin ketone	ND	0.000493	"								
gamma-BHC (Lindane)	ND	0.000493	"								
Heptachlor	ND	0.000493	"								
Heptachlor epoxide	ND	0.000493	"								
Methoxychlor	ND	0.00246	"								
Toxaphene	ND	0.0249	"								
Surrogate: Decachlorobiphenyl	*0.0789*		"	*0.0995*		*79.3*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0858*		"	*0.0995*		*86.2*	*30-150*				
LCS (BH51133-BS1) LCS								Prepared & Analyzed: 08/14/2025			
4,4'-DDD	0.0398	0.000493	mg/kg wet	0.0498		80.1	40-140				
4,4'-DDE	0.0433	0.000493	"	0.0498		87.1	40-140				
4,4'-DDT	0.0392	0.000493	"	0.0498		78.8	40-140				
Alachlor	0.0379	0.000493	"	0.0498		76.2	40-140				
Aldrin	0.0426	0.000493	"	0.0498		85.6	40-140				
alpha-BHC	0.0423	0.000493	"	0.0498		85.1	40-140				
beta-BHC	0.0429	0.000493	"	0.0498		86.3	40-140				
delta-BHC	0.0423	0.000493	"	0.0498		84.9	40-140				
Dieldrin	0.0422	0.000493	"	0.0498		84.9	40-140				
Endosulfan I	0.0435	0.000493	"	0.0498		87.5	40-140				
Endosulfan II	0.0447	0.000493	"	0.0498		89.8	40-140				
Endosulfan sulfate	0.0433	0.000493	"	0.0498		87.1	40-140				
Endrin	0.0401	0.000493	"	0.0498		80.5	40-140				
Endrin aldehyde	0.0458	0.000493	"	0.0498		92.1	40-140				
Endrin ketone	0.0422	0.000493	"	0.0498		84.9	40-140				
gamma-BHC (Lindane)	0.0412	0.000493	"	0.0498		82.8	40-140				
Heptachlor	0.0390	0.000493	"	0.0498		78.4	40-140				
Heptachlor epoxide	0.0424	0.000493	"	0.0498		85.3	40-140				
Methoxychlor	0.0386	0.00246	"	0.0498		77.5	40-140				
Surrogate: Decachlorobiphenyl	*0.0757*		"	*0.0995*		*76.1*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0847*		"	*0.0995*		*85.1*	*30-150*				

Organochlorine Pesticides by GC/ECD - Quality Control Data

York Analytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source* Result	%REC	%REC Limits	Flag	RPD	RPD Limit	Flag
Batch BH51133 - EPA 3546 PCB-RCP											
Matrix Spike (BH51133-MS1) Matrix Spike	*Source sample: 25H0413-06 (AG-12)							Prepared & Analyzed: 08/14/2025			
4,4'-DDD	0.0480	0.000582	mg/kg dry	0.0588	ND	81.6	30-150				
4,4'-DDE	0.0483	0.000582	"	0.0588	0.00126	80.0	30-150				
4,4'-DDT	0.0500	0.000582	"	0.0588	0.00146	82.6	30-150				
Alachlor	0.0414	0.000582	"	0.0588	ND	70.4	30-150				
Aldrin	0.0466	0.000582	"	0.0588	ND	79.3	30-150				
alpha-BHC	0.0468	0.000582	"	0.0588	ND	79.6	30-150				
beta-BHC	0.0476	0.000582	"	0.0588	ND	81.0	30-150				
delta-BHC	0.0478	0.000582	"	0.0588	ND	81.4	30-150				
Dieldrin	0.0485	0.000582	"	0.0588	ND	82.4	30-150				
Endosulfan I	0.0487	0.000582	"	0.0588	ND	82.8	30-150				
Endosulfan II	0.0513	0.000582	"	0.0588	ND	87.3	30-150				
Endosulfan sulfate	0.0506	0.000582	"	0.0588	ND	86.1	30-150				
Endrin	0.0489	0.000582	"	0.0588	ND	83.3	30-150				
Endrin aldehyde	0.0525	0.000582	"	0.0588	ND	89.3	30-150				
Endrin ketone	0.0518	0.000582	"	0.0588	ND	88.2	30-150				
gamma-BHC (Lindane)	0.0443	0.000582	"	0.0588	ND	75.4	30-150				
Heptachlor	0.0453	0.000582	"	0.0588	ND	77.1	30-150				
Heptachlor epoxide	0.0480	0.000582	"	0.0588	ND	81.6	30-150				
Methoxychlor	0.0516	0.00291	"	0.0588	ND	87.8	30-150				
Surrogate: Decachlorobiphenyl	*0.0912*		"	*0.118*		*77.6*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0926*		"	*0.118*		*78.8*	*30-150*				
Matrix Spike Dup (BH51133-M Matrix Spike Dup	*Source sample: 25H0413-06 (AG-12)							Prepared & Analyzed: 08/14/2025			
4,4'-DDD	0.0459	0.000582	mg/kg dry	0.0588	ND	78.1	30-150		4.41	30	
4,4'-DDE	0.0453	0.000582	"	0.0588	0.00126	75.0	30-150		6.34	30	
4,4'-DDT	0.0436	0.000582	"	0.0588	0.00146	71.7	30-150		13.8	30	
Alachlor	0.0393	0.000582	"	0.0588	ND	66.8	30-150		5.18	30	
Aldrin	0.0431	0.000582	"	0.0588	ND	73.4	30-150		7.69	30	
alpha-BHC	0.0432	0.000582	"	0.0588	ND	73.5	30-150		7.97	30	
beta-BHC	0.0448	0.000582	"	0.0588	ND	76.2	30-150		6.03	30	
delta-BHC	0.0449	0.000582	"	0.0588	ND	76.4	30-150		6.28	30	
Dieldrin	0.0453	0.000582	"	0.0588	ND	77.0	30-150		6.80	30	
Endosulfan I	0.0455	0.000582	"	0.0588	ND	77.4	30-150		6.70	30	
Endosulfan II	0.0486	0.000582	"	0.0588	ND	82.6	30-150		5.54	30	
Endosulfan sulfate	0.0483	0.000582	"	0.0588	ND	82.2	30-150		4.56	30	
Endrin	0.0462	0.000582	"	0.0588	ND	78.6	30-150		5.76	30	
Endrin aldehyde	0.0492	0.000582	"	0.0588	ND	83.8	30-150		6.38	30	
Endrin ketone	0.0503	0.000582	"	0.0588	ND	85.5	30-150		3.06	30	
gamma-BHC (Lindane)	0.0415	0.000582	"	0.0588	ND	70.7	30-150		6.51	30	
Heptachlor	0.0419	0.000582	"	0.0588	ND	71.2	30-150		7.91	30	
Heptachlor epoxide	0.0449	0.000582	"	0.0588	ND	76.4	30-150		6.55	30	
Methoxychlor	0.0466	0.00291	"	0.0588	ND	79.2	30-150		10.2	30	
Surrogate: Decachlorobiphenyl	*0.0891*		"	*0.118*		*75.8*	*30-150*				
Surrogate: Tetrachloro-m-xylene	*0.0873*		"	*0.118*		*74.2*	*30-150*				

Sample and Data Qualifiers Relating to This Work Order

S-GC Two surrogates are used for this analysis. One surrogate recovered within control limits therefore the analysis is acceptable.

S-08 The recovery of this surrogate was outside of QC limits.

Definitions and Other Explanations

* Analyte is not certified or the state of the samples origination does not offer certification for the Analyte.

ND NOT DETECTED - the analyte is not detected at the Reported to level (LOQ/RL or LOD/MDL)

RL REPORTING LIMIT - the minimum reportable value based upon the lowest point in the analyte calibration curve.

LOQ LIMIT OF QUANTITATION - the minimum concentration of a target analyte that can be reported within a specified degree of confidence. This is the lowest point in an analyte calibration curve that has been subjected to all steps of the processing/analysis and verified to meet defined criteria. This is based upon NELAC 2009 Standards and applies to all analyses.

LOD LIMIT OF DETECTION - a verified estimate of the minimum concentration of a substance in a given matrix that an analytical process can reliably detect. This is based upon NELAC 2009 Standards and applies to all analyses conducted under the auspices of EPA SW-846.

MDL METHOD DETECTION LIMIT - a statistically derived estimate of the minimum amount of a substance an analytical system can reliably detect with a 99% confidence that the concentration of the substance is greater than zero. This is based upon 40 CFR Part 136 Appendix B and applies only to EPA 600 and 200 series methods.

Reported to This indicates that the data for a particular analysis is reported to either the LOD/MDL, or the LOQ/RL. In cases where the "Reported to" is located above the LOD/MDL, any value between this and the LOQ represents an estimated value which is "J" flagged accordingly. This applies to volatile and semi-volatile target compounds only.

NR Not reported

RPD Relative Percent Difference

Wet The data has been reported on an as-received (wet weight) basis

Low Bias Low Bias flag indicates that the recovery of the flagged analyte is below the laboratory or regulatory lower control limit. The data user should take note that this analyte may be biased low but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.

High Bias High Bias flag indicates that the recovery of the flagged analyte is above the laboratory or regulatory upper control limit. The data user should take note that this analyte may be biased high but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.

Non-Dir. Non-dir. flag (Non-Directional Bias) indicates that the Relative Percent Difference (RPD) (a measure of precision) among the MS and MSD data is outside the laboratory or regulatory control limit. This alerts the data user where the MS and MSD are from site-specific samples that the RPD is high due to either non-homogeneous distribution of target analyte between the MS/MSD or indicates poor reproducibility for other reasons.

If EPA SW-846 method 8270 is included herein it is noted that the target compound N-nitrosodiphenylamine (NDPA) decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine (DPA). These results could actually represent 100% DPA, 100% NDPA or some combination of the two. For this reason, York reports the combined result for n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration as Diphenylamine.

If Total PCBs are detected and the target aroclors reported are "Not detected", the Total PCB value is reported due to the presence of either or both Aroclors 1262 and 1268 which are non-target aroclors for some regulatory lists.

2-chloroethylvinyl ether readily breaks down under acidic conditions. Samples that are acid preserved, including standards will exhibit breakdown. The data user should take note.

Certification for pH is no longer offered by NYDOH ELAP.

Semi-Volatile and Volatile analyses are reported down to the LOD/MDL, with values between the LOD/MDL and the LOQ being "J" flagged as estimated results.

For analyses by EPA SW-846-8270D, the Limit of Quantitation (LOQ) reported for benzidine is based upon the lowest standard used for calibration and is not a verified LOQ due to this compound's propensity for oxidative losses during extraction/concentration procedures and non-reproducible chromatographic performance.

Field Chain-of-Custody Record

YORK ANALYTICAL LABORATORIES INC

York Analytical Laboratories, Inc. (YORK)'s Standard Terms & Conditions are listed on the back side of this document. This legal document serves as your written authorization for YORK to proceed with the analyses requested below. Your signature binds you to YORK's Standard Terms & Conditions.

120 Research Drive Stratford, CT 06615 132-02 89th Ave Queens, NY 11418 56 Church Hill Rd. #2 Newtown, CT 06470 2161 Whitesville Rd Toms River, NJ 08755 clientservices@yorklab.com 800-306-YORK

YORK Project Number: 25H0413

Report To:
Company: Langan CT, Inc.
Address: 555 Long Wharf Dr. New Haven, CT 06511
Phone.: 203 780 1376
Contact: William Adsit
E-mail: wadsit@langan.com

Invoice To:
Company:
Address: SAME
Phone.:
Contact:
E-mail:

YOUR Project Name / Number: 140325901 Hillcrest MS

PO Number:

Samples Collected From: NY, NJ, CT, PA, Other: (please specify)

Turn-Around Time: RUSH - Next Day; RUSH - Two Day; RUSH - Three Day; RUSH - Four Day; RUSH - Five Day; Standard (6-9 Day) X; PFAS Standard 7-10 Day

Please print clearly and legibly. All information must be complete. Samples will not be logged in and the turn-around-time clock will not begin until any questions by YORK are resolved.

wsit
William Adsit

Samples Collected by: (print AND sign your name)

Matrix Codes: S - soil/solid/sludge; GW - groundwater; DW - drinking water; SW - surface water; WW - wastewater; O - Oil; Other

Preservative (please list number of containers)

Analyses Requested

Sample Identification	Date	Time	Matrix	Unpreserved	HCl (hydrochloric acid)	MeOH (methanol)	HNO_3 (nitric acid)	H_2SO_4 (sulfuric acid)	NaOH (sodium hydroxide)	$Na_2S_2O_3$ (sodium thio.)	Trizma	Ammonium Acetate	Other:	VOCs	PAHs	ETPH	CT-list metals	PCBs	Pesticides	SVOCs	Grab or Comp.
AG-07	8/7/25	9:00	S	1															X		G
AG-08		9:15																	X		
AG-09		8:45																	X		
AG-10		8:20																	X		
AG-11		8:10																	X		
AG-12		8:00																	X		

Report Type (circle): QA Report; Summary (Results Only); NY ASP B Package; NJ Reduced; NJ DKQP; NJ Full; CT RCP

EDD Type (circle): EQuIS (standard); NYSDEC EQuIS; NJDEP SRP Haz Site; Standard Excel; CMDP; Other:

Regulatory Comparative
Compared to the following Regulation(s): (please fill in)
DEC
PMC

Field Filtered
Lab Filtered

Comments: RLs must meet CTDEEP RSRs + APS criteria
cc: results to Dave Gramucci + Hannah Griesbach.

Samples iced/chilled at time of lab pickup? circle: Yes or No

Lab Sample Receiving Checklist (to be completed by the receiving laboratory only) Circle Y / N
Custody Seals: Y / N Containers Intact: Y / N COC/Labels Agree: Y / N Preservation Confirmed: Y / N
COC Complete: Y / N COC Received: Y / N Appropriate Sample Volumes: Y / N Appropriate Sample Containers: Y / N
Cooler Temperature Confirmed: Y / N Samples Submitted within Holding Times: Y / N Corrective Action Form Required: Y / N

Samples Relinquished by / Company	Date/Time	1. Samples Received by / Company	Date/Time	2. Samples Relinquished by / Company	Date/Time
[signature]	8/7/25 10:43				
Samples Received by / Company	**Date/Time**	**3. Samples Relinquished by / Company**	**Date/Time**	**3. Samples Received by / Company**	**Date/Time**
Samples Relinquished by / Company	**Date/Time**	**4. Samples Received by / Company**	**Date/Time**	**Samples Received in LAB by**	**Date/Time** / **Temperature**
				TC [signature]	8/7/25 1043 / 2.5 Degrees C

3 October 2025
Revised 20 April 2026

Michael Scott
TSKP Studio
146 Wyllys Street
Bldg. 1-203
Hartford, Connecticut 06106

Re: Geotechnical Engineering Letter Report
Hillcrest Middle School
Trumbull, Connecticut
Langan Project No.: 140325901

Dear Mr. Scott,

This report presents our geotechnical engineering study for the proposed Hillcrest Middle School in Trumbull, Connecticut. The purposes of this study were to explore subsurface conditions, evaluate feasible foundation options, and develop geotechnical engineering design and construction recommendations. Services were performed in accordance with our authorized proposal (15 August 2025).

Our approach and recommendations have been developed considering a plan entitled "Site Plan, Hillcrest Middle School" provided by TKSP Studio (21 August 2025). We understand that concepts are currently being developed and the proposed grading in the above-referenced plan is preliminary. Any changes to the design scheme must be reviewed by Langan for impacts on our recommendations.

Elevations noted here are taken from a "Partial Boundary & Topographic Survey" prepared by Langan (11 July 2025) which references the North American Vertical Datum of 1988 (NAVD88).

SITE DESCRIPTION

The existing school site is bound by an asphalt driveway with Trumbull Agriscience, auxilary buildings and landscaping to the north; athletic fields and parking lots to the east; residential properties and wooded areas to the south; and Daniels Farm Road and residential properties to the west. Figure 1 shows the site location and surrounding area.

The existing school footprint is about 146,000 square feet (SF) with a finished floor elevation (FFE) between about el +393.3 and +397.6. Surrounding site features includes concrete walkways, asphalt parking lots, drive aisles, auxiliary structures, landscape areas, grass fields, and sports fields.

Overall site grades slope down from the northwest to the south (about el +405 to +368). A slope with an about 14-foot grade change is located in the middle of the site and divides the site into the northern and southern parts. The northern half of the site contains the existing school building and upper fields, where site grades slope down from northwest to the east between about el +405 and +385. In the southern half of the site with the sports fields, the site grades slope down from north to south between about el +390 and +368.

Underground utilities including electric, communication, sanitary, stormwater, and gas are present throughout the existing development. Electric service runs overhead along the eastern perimeter of the school then to the west with service connections along Daniels Farm Road.

PROPOSED CONSTRUCTION

The proposed development will include the demolition of the existing school and parking lots and the construction of a new one- to three-story school building. The proposed building will have a footprint of about 48,900 SF and FFE of about el +391 to the north and about el +377 to the south. No basement levels are proposed.

Associated site features include new concrete sidewalks, asphalt parking lots, drive aisles, landscape features, site utilities, and athletic fields. A finalized grading plan is not available at this time, but we anticipate fills up to about 14 feet to reach proposed finished floor elevations and site fill retaining walls where steep grade changes occur.

The structural engineer has noted maximum column loads of 250 kips for the proposed structure.

REVIEW OF AVAILABLE INFORMATION

Regional Geology

The 1992 "Surficial Materials Map of Connecticut" (Figure 2) and the 1985 "Bedrock Geological Map of Connecticut," (Figure 3) both prepared by the Connecticut Geological and Natural Resource Survey, show that the overburden material is till and the bedrock is Straits Schist (DSt), defined as silvery to gray, coarse-grained schist and Trap Falls Formation (Otfc), defined as interlayered gray, rusty-weathering schist and light gray gneiss.

Federal Emergency Management Agency Flood Map

We reviewed the Flood Insurance Rate Map (FIRM) for the town of Trumbull published by the Federal Emergency Management Agency (FEMA), Map No. 09001C0289F effective 18 June 2010 (Figure 4). The site is located in Zone X – unshaded, "Areas determined to be outside the 500-year floodplain."

SUBSURFACE EXPLORATION

Langan performed a subsurface exploration consisting of eight geotechnical borings within and adjacent to the proposed building footprint. A boring location plan is shown in Figure 5.

Borings

Eight borings (LB-01 through LB-08) were advanced between 23 and 24 of July 2025 by General Borings, Inc. under Langan's full-time observation. The borings were advanced with a Diedrich D-50 track mounted drill rig using hollow-stem-auger drilling techniques. Borings were terminated between about 8 to 25 feet below grade (bottom of borings between about el +358 and +375).

The borings were hand cleared to a depth of 5 feet then Standard Penetration Test N-values[1] were documented and soil samples were generally obtained continuously to a depth of 13 feet and every 5 feet thereafter using hollow-stem-auger drilling techniques. Disturbed soil samples were obtained using a standard 2-inch-outer-diameter split-spoon sampler driven by a 140-pound automatic hammer in accordance with ASTM D1586, Standard Penetration Test.

Recovered soil samples were visually examined and classified in the field in general accordance with the Unified Soil Classification System (USCS). Soil classifications, N-values, and other field observations were recorded on our field logs provided in Appendix A.

Laboratory Tests

Select samples were sent to a testing laboratory to confirm visual classifications and to determine physical and mechanical index properties. As part of our assessment, we performed four grain size determinations and four moisture content tests. Laboratory results are provided in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions generally consist of a surficial layer of topsoil underlain by layers of fill, glacial till, weathered rock, and finally bedrock. Bedrock was inferred between about 8 to 25 feet below existing grades as indicated by auger and split spoon refusal. Groundwater was observed in some borings between about 12 and 14 feet below existing grades. A detailed description of subsurface materials encountered is provided below in order of increasing depth.

[1] The Standard Penetration Test (SPT) is an in situ testing technique used to infer soil density and consistency. The SPT N-value is defined as the number of blows required to drive a 2-inch-diameter split-barrel sampler 12 inches after an initial penetration of 6-inches using a 140-pound hammer falling freely from 30 inches.

Surficial Material – An about 6-inch-thick layer of topsoil was encountered in all borings. The topsoil is generally composed of brown sand with varying amounts of gravel, silt, and roots.

Fill – Below the surficial material, an about 2.5- to 9.5-foot-thick layer of fill (bottom of layer corresponding to between about el +366.5 and +386) was encountered in all borings, except LB-08. The fill is generally composed of brown sand with varying proportions of gravel, silt, and roots. The SPT N-values within the fill layer vary from about 2 to 4 blows per foot (bpf). However, SPT N-values were not obtained within the top 5 feet due to hand clearing. Laboratory testing of one sample from the fill layer indicated a fines content of about 29% and a moisture content of about 16%.The fill layer is generally classified as silty sand (SM) in accordance with the USCS.

Glacial Till – Below the fill, an about 2- to 15-foot-thick layer of glacial till (top of layer corresponding to between about el +366.5 and +386) was encountered in all borings. The glacial till is generally composed of gray to brown sand with varying proportions of silt and gravel. The SPT N-values within the glacial till layer vary from about 19 bpf to split spoon refusal (greater than 50 blows to penetrate 6 inches). Laboratory testing of the glacial till layer indicated a fines content between about 18% and 19% and a moisture content between about 8% and 11%. The glacial till layer is generally classified as poorly graded sand and silty sand (SP/SM) in accordance with the USCS.

Weathered Rock – Below the glacial till, an about 2- to 10-foot-thick layer of weathered rock was encountered in all the borings (top of layer corresponding to between about el +361.5 and +378). The weathered rock is generally composed of gray weathered rock fragments with varying proportions of sand, silt and gravel. The SPT N-values within the weathered rock layer vary from about 31 bpf to split-spoon refusal. Laboratory testing of the weathered rock layer indicated a fines content of about 14% and a moisture content of about 2%. The layer is generally classified as silty sand or poorly graded sand (SM/SP) in accordance with the USCS.

Bedrock – Bedrock was encountered between about 8 and 25 feet below grade (top of bedrock between about el +358 and +375) as inferred by refusal of drilling equipment or by rock cores. The bedrock underlying the site consists of gray schist. Bedrock was cored in one boring, LB-01; the REC for was about 97% and the RQD was about 49%, indicating poor to fair quality bedrock.

Groundwater – Groundwater was encountered in borings LB-02, LB-04, LB-06, and LB-07. Groundwater was encountered at depths ranging from about 12 to 14 feet below existing grades (between about el +364.5 and +377). Groundwater should be expected to fluctuate with time as a result of seasonal changes, utility breaks, precipitation, construction, etc.

GEOTECHNICAL DESIGN RECOMMENDATIONS

Seismic Evaluation

This section presents seismic design recommendations for use with the 2022 Connecticut State Building Code (2021 International Building Code). We have considered the soil conditions encountered in the borings to be consistent and representative of the soil conditions in the top 100 feet of soil at this site. The soil conditions found in the borings were used to determine site class and recommendations.

Based on the spectral accelerations and the anticipated risk category, we have estimated the Seismic Design Category (SDC). The structural engineer is responsible for confirming the appropriate use group, occupancy category, and final SDC for the proposed structure.

Table 1. Seismic Design Values

Description	Parameter	Recommended Value
Mapped Spectral Acceleration for short periods:	S_s	0.210 g
Mapped Spectral Acceleration for 1-sec period:	S_1	0.054 g
Site Class:	--	**C – Very dense soil & soft rock**
Site Coefficient:	F_a	1.3
Site Coefficient:	F_v	1.5
5% damped design spectral response acceleration at short periods:	**S_{DS}**	**0.182 g**
5% damped design spectral response acceleration at 1-sec period:	**S_{D1}**	**0.054 g**
Anticipated Risk Category	--	**III**
Seismic Design Category	**--**	**B**

The Building Code requires an evaluation of the liquefaction potential of non-cohesive soils below the groundwater table. Subsurface materials below the foundations are typically dense soils and rock. Thus, liquefaction potential is not a concern and need not be considered in the design.

Foundation System

The materials encountered at the anticipated footing elevation (about el +387.5 and +373.5) consist of fill, glacial till, or will consists of structural fill used to raise grades. The surficial materials and existing fills are not suitable for foundation support and should be completely removed in accordance with the removal and replacement section of this report prior to final grading and fill operations.

Following the removal and replacement program, the proposed building can be supported on shallow foundations bearing on structural fill or natural glacial till with an allowable bearing pressure of 4 kips per square foot (ksf).

All exterior footings should be constructed 42 inches or deeper below the lowest adjacent grade for frost protection. Interior footings in heated spaces should be at least 1.5 feet below the finished-floor elevation. Isolated column footings should have a minimum dimension of 3 feet and strip footings should have a minimum width of 2 feet even if smaller dimensions can be justified using the recommended allowable bearing pressure.

Foundations should not be located such that one foundation is located within the zone of influence of an adjacent foundation. The zone of influence is taken as a 1 horizontal to 1 vertical (1H:1V) projection extending outward and downward from the edge of the foundation. Additionally, the zone of influence for proposed footings should not intersect adjacent footings.

For mass concrete poured directly against approved subgrade materials, the following coefficient of sliding friction values can be used and are per the Connecticut State Building Code:

- 0.25 – Compacted, approved soil subgrade, and
- 0.35 – Minimum of 6-inch-thick layer of compacted clean stone aggregate on top of the approved, compacted soil subgrade.

Settlement

Total settlements of the structure are estimated to be on the order of 1 inch or less, provided the bearing pressures and removal/replacement approaches recommended here are used and the subgrade preparation work described here is performed. Differential settlements of adjacent new structure columns are expected to be about ½ inch. The majority of the settlement is expected to take place during construction.

Slab Design

We recommend that ground-floor slabs be constructed as a slab-on-grade bearing on proof-compacted existing fill, structural fill, or natural glacial till in accordance with the recommendations herein. Subgrade must be prepared in accordance with the recommendations in this report. Slab-on-grade should be designed using a modulus of subgrade reaction of 125 pounds per cubic inch (pci).

Slab-on-grade areas should be protected from moisture with a minimum 6-inch-thick layer of ¾-inch clean crushed stone. A vapor barrier should be used below the ground-floor slab to limit transmission of water vapor through the slab (and below-grade walls). We recommend a robust

membrane such as the Florprufe product by GCP Applied Technologies. Omission of a vapor barrier can lead to floor-covering problems including delamination and mold.

Permanent Groundwater Control

We recommend a perimeter foundation drain be installed to intercept and divert groundwater flow away from the structure during prolonged precipitation, snowmelt, or utility breaks. Where the building steps down with existing grade, the perimeter drain should be installed at the uphill side of the structure to prevent water from accumulating behind buried walls. Manufactured geocomposite drainage panels (such as Hydroduct) or a 12-inch-wide layer of ¾-inch clean crushed stone encased in filter fabric should be installed against the outside of all below-grade perimeter walls and should extend to within 1 foot of adjacent surface grade. The drainage panels (or crushed stone) should connect to a perforated PVC footing drainpipe, having a minimum diameter of 6-inches, installed at the base of the footing. The footing drain should be encased in 6 inches of washed ¾-inch clean crushed stone encased in a filter fabric (such as Mirafi 140N). The footing drains should be connected to the site stormwater system, and where possible, drain by gravity. Where used, drainage panels must be secured in place and the filter-fabric side must face the soil.

Below-Grade Walls

Permanent below-grade walls considered to be fixed against rotation, should be designed to resist soil and surcharge pressures. We recommend that the below-grade foundation walls (i.e. fixed walls) be designed using a triangular earth-pressure distribution having an equivalent fluid weight 60 lb/ft^2 per foot of depth. This design lateral pressure provided presumes that groundwater levels coincide with the bottom of wall and free-draining clean stone is used as backfill or a manufactured drain panel is installed behind the walls. Surcharge loading on the below-grade foundation walls should be included by adding a uniform stress equal to one-half the surcharge load in addition to the soil loading. Backfill should not be placed against below-grade walls until the wall concrete has reached its 28-day compressive design strength and has been approved by the structural engineer.

Site Retaining Walls

Site fill retaining walls may be designed as geogrid reinforced modular block walls (such as Mesa, Keystone, Versa-lok, or Redi-Rock type walls) or gravity-type retaining walls, depending on the final location, size, and loading of the proposed walls. The retaining walls can be preliminarily designed using a moist unit weight of 135 pounds per cubic foot, a drained angle of internal friction of 32°, and a coefficient of active earth pressure of Ka = 0.31. The walls should be designed to include drainage features to avoid water build up behind the wall face.

We recommend the same allowable bearing pressure and subgrade preparation recommendations for foundations noted herein be used for design of the walls. Removal and replacement may also need to be performed below retaining walls to reach suitable bearing materials. A minimum 1-foot-thick granular pad (such as ¾-inch clean crushed stone) should be used for the base of the wall.

The proposed retaining wall designs (including calculations and global stability) and construction means and methods signed and sealed by a Professional Engineer licensed in Connecticut should be submitted by the contractor for review.

Soil Slopes

Permanent cut and fill slopes will be used across the site. We recommend that cut or fill slopes in soil be designed with a slope inclination of 3H:1V, or flatter, wherever feasible. Soil slopes steeper than 3H:1V should be stabilized with horizontal layers of geogrid or surface protection such as riprap underlain by a non-woven geotextile. Temporary stabilization, keying and benching, or other measures may be required during steep slope construction until the final condition is completed. Slope angles steeper than 2H:1V are not recommended for soil slopes. Critical slopes should be analyzed for global stability. The slope design recommendations above are based on an average angle of internal friction of about 30 to 32 degrees for on-site fill materials and natural soils in the slope areas.

Surface armoring (i.e., riprap underlain by a non-woven geotextile, vegetative cover, etc.) should be established on the slope surfaces as soon as practical after final grading to reduce erosion and the potential for sloughing failures. The thickness of organic topsoil on the surface of vegetated slopes should be 12 inches or less, unless otherwise approved by the Geotechnical Engineer.

GEOTECHNICAL CONSTRUCTION RECOMMENDATIONS

Site Preparation

All existing foundations, floor slabs, pavements, utilities, and building remnants should be completely removed within 10 feet of the proposed building footprint unless specified to remain. If encountered, buried debris should be completely removed beneath proposed building slab and footing locations. Below-grade structures outside of the building footprint can be abandoned in place provided they are removed to at least 4 feet below finished subgrade levels, 3 feet below proposed utilities, and to eliminate conflicts with new utilities or structures. Existing utilities outside of the proposed building footprints should be removed or abandoned in place by completely filling with grout. Slabs left in place should be sufficiently broken up to allow water to drain, and so that a geotechnical engineer can observe if voids exist beneath the slab. Existing asphalt pavement and concrete walkways should be completely removed.

Excavations made to remove below-grade elements should be backfilled with approved, compacted fill in accordance with the Excavation, Fill, Placement, and Compaction Criteria section of this report and any environmental requirements.

Clearing and grubbing of any vegetation designated for removal (including root systems) should be performed. Topsoil should be stripped from the proposed building and pavement areas and should be stockpiled and protected from erosion. Topsoil should be evaluated by a landscape architect for reuse in landscape areas (if permitted by the environmental engineer). All clearing and stripping activities should be performed in strict accordance with the approved soil-erosion and sediment-control plan and the environmental reports prepared for the project.

All demolition and site-clearing work should be performed in accordance with any environmental requirements established for the site, and all local, state, and federal regulations. All debris and trees and other vegetation should be properly disposed of off-site in accordance with applicable regulations. All construction work should be performed so as not to adversely impact the neighboring buildings, nearby structures or utilities, including the existing utilities and trees that are to remain. Protection of these elements should be provided as necessary. Before beginning grading or placing fill, any miscellaneous trash, debris, or other unsuitable materials should be removed from the site.

Subgrade Preparation

All footing and utility-trench soil subgrades should be proofrolled with six overlapping coverages of a double-drum 1-ton walk-behind vibratory roller. All slab subgrade areas should be proofrolled with six overlapping coverages of a vibratory drum roller having a minimum static drum weight of 10 tons.

Soft areas identified during proofrolling should be excavated and replaced with approved structural fill as described in the Excavation, Fill, Placement and Compaction Criteria section. The actual extent of necessary removal and replacement should be determined by a qualified Langan geotechnical engineer. Care should be taken when proofrolling near any existing underground utilities that are to remain.

Soil footing subgrades should be excavated level and if any cobbles or boulders are encountered at the footing subgrade level such that a relatively level subgrade is not achieved, the cobbles or boulders should be removed and replaced with compacted structural fill, compacted ¾-inch crushed stone, or lean concrete. All soil subgrades for footings or slabs should be compacted to the project specified compaction criteria.

Steps should be taken by the contractor to control and remove surface-water runoff and precipitation. When soil is wet and subjected to construction traffic, previously acceptable subgrades can soften and become unacceptable. A smooth drum roller should be used to seal

the surface and provide for better drainage. We also recommend crowning or sloping the subgrade to provide positive drainage off the subgrades. If foundations are not poured in a timely manner, the subgrade should be protected with a lean concrete mud mat to protect the footing subgrades. Any approved footing bottom exposed to precipitation must be reinspected prior to concrete placement.

Removal and Replacement

The fill in its current state is unsuitable to support the proposed building foundations. Some areas of the proposed building footprint require mass fills and therefore recommend the removal and replacement program be performed prior to mass filling to minimize over-excavation depths during foundation construction.

We estimate over-excavations up to about 7 feet below existing elevations to reach the native soils. Where encountered beneath foundations, the fill should be removed within the foundation zone of influence (i.e. 1H to 1V downward projection from the edge of footing). The resulting native subgrade material should be proofrolled in accordance with the Subgrade Preparation section outlined herein. The resulting excavation should be backfilled with structural fill, performed in accordance with the Excavation, Fill, Placement, and Compaction Criteria recommendations outlined herein.

Excavation, Fill, Placement, and Compaction Criteria

Excavation

Excavation through the fill and the underlying glacial till can likely be performed using conventional earthmoving equipment (e.g., backhoes, excavators, dozers, etc.). Excavations made for footings and utilities should be conducted to minimize disturbance to the subgrade (i.e., backhoe with a smooth-edge bucket).

All excavations should be properly sloped or braced and conform with applicable OSHA regulations including, but not limited to, temporary shoring, trench boxes, temporary rock stabilization, or proper benching or both.

Fill Materials

The following types of fill can be used:

Structural Fill – Structural fill should be well-graded sand and gravel having a maximum particle size of 3 inches and no more than 10% passing the No. 200 sieve. Additionally, the structural fill should be free of organics, clay, roots, concrete, other non-soil constituents, and other deleterious or compressible materials. Any approved imported structural fill

should be certified "clean fill" free of hazardous substances and meeting all local, state, and federal regulations.

Material Reuse – The contractor may reuse the on-site fill or glacial till as structural fill provided the soils meet the requirements for structural fill outlined above and is approved by the environmental engineer. Note that samples obtained within the fill have reported fines contents (passing the #200 sieve) of up to 29% and may be sensitive to moisture. The overall amount of soil that can be reused will be dependent on the amount of fines present within the soil, the time of year the earthwork is carried out (e.g., potentially inclement weather), and the earthwork contractor's ability to stage, aerate and process the material to facilitate placement and compaction.

General Fill – On-site soils not meeting the requirements for structural fill can be used as general fill for site landscape and other nonstructural areas (e.g., landscaped areas) if environmentally suitable for reuse. The fill layers may be used as general fill, if required.

Compaction Criteria

All fill should be placed in uniform 12-inch-thick loose lifts and compacted. Fill in landscaped areas should be compacted to 90% of its maximum dry unit weight as determined by ASTM D1557; all other fill should be compacted to at least 95%. In restricted areas where only hand-operated compactors can be used, the maximum lift thickness should be limited to 8 inches. The appropriate water content at the time of compaction should be plus or minus 2% points of optimum as determined by the laboratory compaction tests of proposed fill. No backfill should be placed on areas where free water is standing or on frozen subsoil areas.

Temporary Groundwater Control

We anticipate that dewatering will likely be required during construction. Water infiltration to the foundation excavation, during the removal and replacement program, and utility construction can be controlled using gravity-fed sump pumps via gravel trenches or sumps assisted with collector trenches. More robust dewatering mean (well points, etc.) may be required where excavations extend below the groundwater table). The final dewatering measures required should be evaluated and designed by the contractor. The dewatering measures implemented should adequately dewater all foundation-related excavations such that compaction of footing subgrades is feasible.

Collection of rainwater runoff will also be needed during the excavation of the removal and replacement program and during the subgrade preparation work. Water runoff is expected to be controlled with the use of gravel-lined collection trenches, pits and submersible pumps. Care should be taken to provide drainage during all phases of excavation work. Environmental

pretreatment of groundwater, if necessary, is beyond the scope of this work. Collected water should be discharged in accordance with applicable regulations.

LIMITATIONS

The geotechnical conclusions and recommendations provided in this study result from our interpretation of the geotechnical conditions existing at the site inferred from a limited number of borings as well as concept information, and information provided by the project team. They are the result of limited engineering studies and our interpretations of the geotechnical conditions existing at the site at the time of investigation. Actual subsurface conditions may vary. Recommendations provided are dependent upon one another and no recommendation should be followed independent of the others.

Any proposed changes to the structures and site features or their locations should be brought to Langan's attention as soon as possible so we can determine whether such changes affect our geotechnical conclusions and recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of our exploration. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation because they may affect our recommendations.

This report has been prepared to assist the owner, architect, structural engineer, and site civil engineer in the design process and is only applicable to the design of the specific project identified. Our firm prepared this report for the exclusive use of our client and their representatives on this project in accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our investigation. No warranty is expressed or implied. The information in this report cannot be used or depended on by engineers or contractors involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties beyond the limits of that which is the specific subject of this report. This report shall not be used for the design of temporary works including scaffolding, construction hoists, and crane pads.

CLOSING

We have appreciated being of service on this project and look forward to working with you to successfully complete this project.

Sincerely,
Langan CT, Inc.

Taylor Dalling, P.E.
Senior Project Engineer

Alfred Jones, P.E.
Senior Associate

OA/C/tsd/aj

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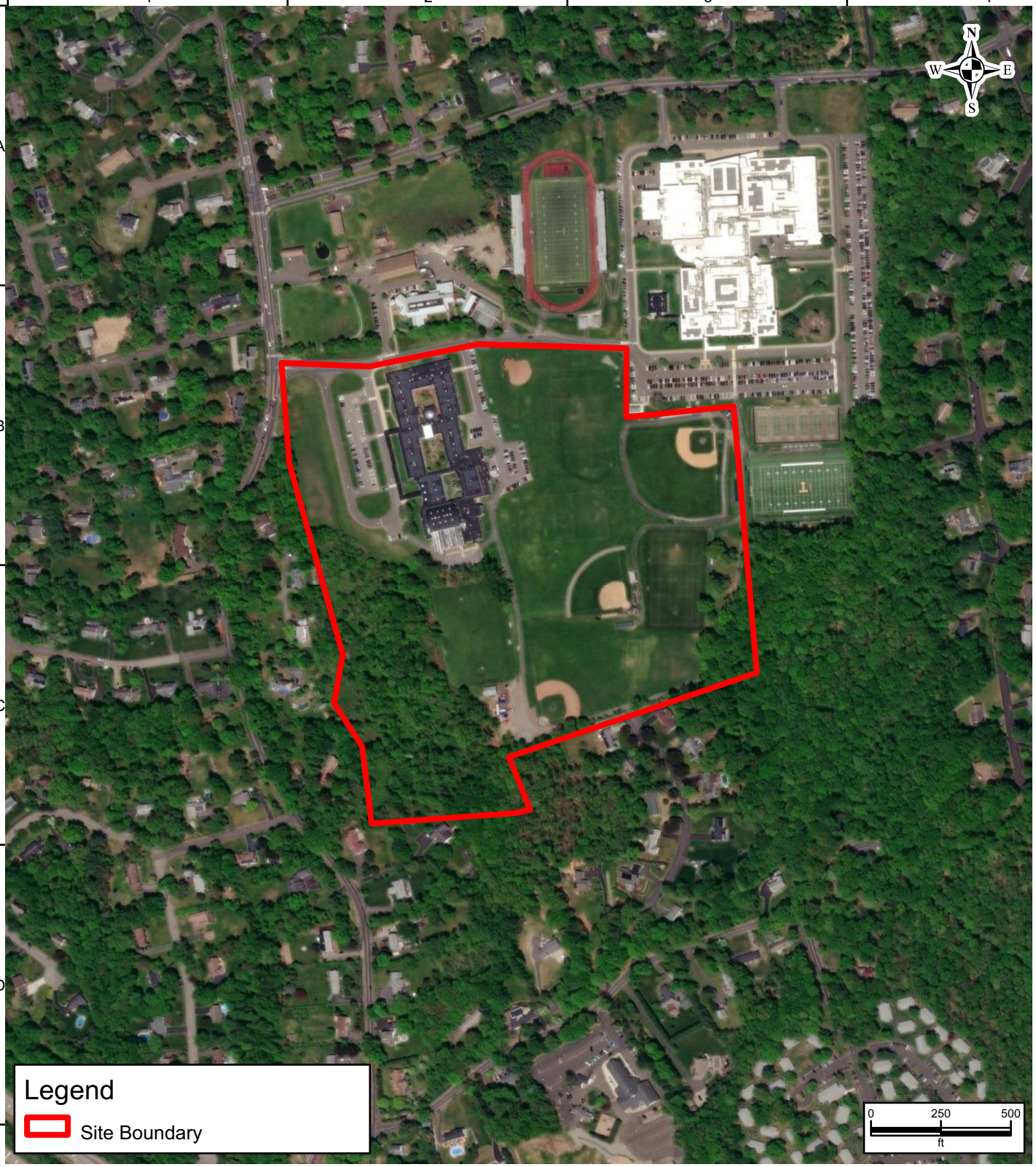
Attachments:

Figure 1	Aerial Map
Figure 2	CT Surficial Materials Map
Figure 3	CT Bedrock Geology
Figure 4	Effective FEMA FIRM
Figure 5	Boring Location Plan
Appendix A	Boring Logs
Appendix B	Laboratory Testing

FIGURES



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Project
Hillcrest Middle School
TRUMBULL
FAIRFIELD CT

Figure Title
AERIAL

Project No.	140325901
Date	10/3/2025
Scale	1 inch = 500 feet
Drawn By	Site Analyzer
Submission Date	10/3/2025

Figure 1

Sheet 1 of 4

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Figure Title
CT SURFICIAL MATERIALS

Project No.	140325901
Date	10/3/2025
Scale	1 inch = 500 feet
Drawn By	Site Analyzer
Submission Date	10/3/2025

Figure 1

Sheet 3 of 4

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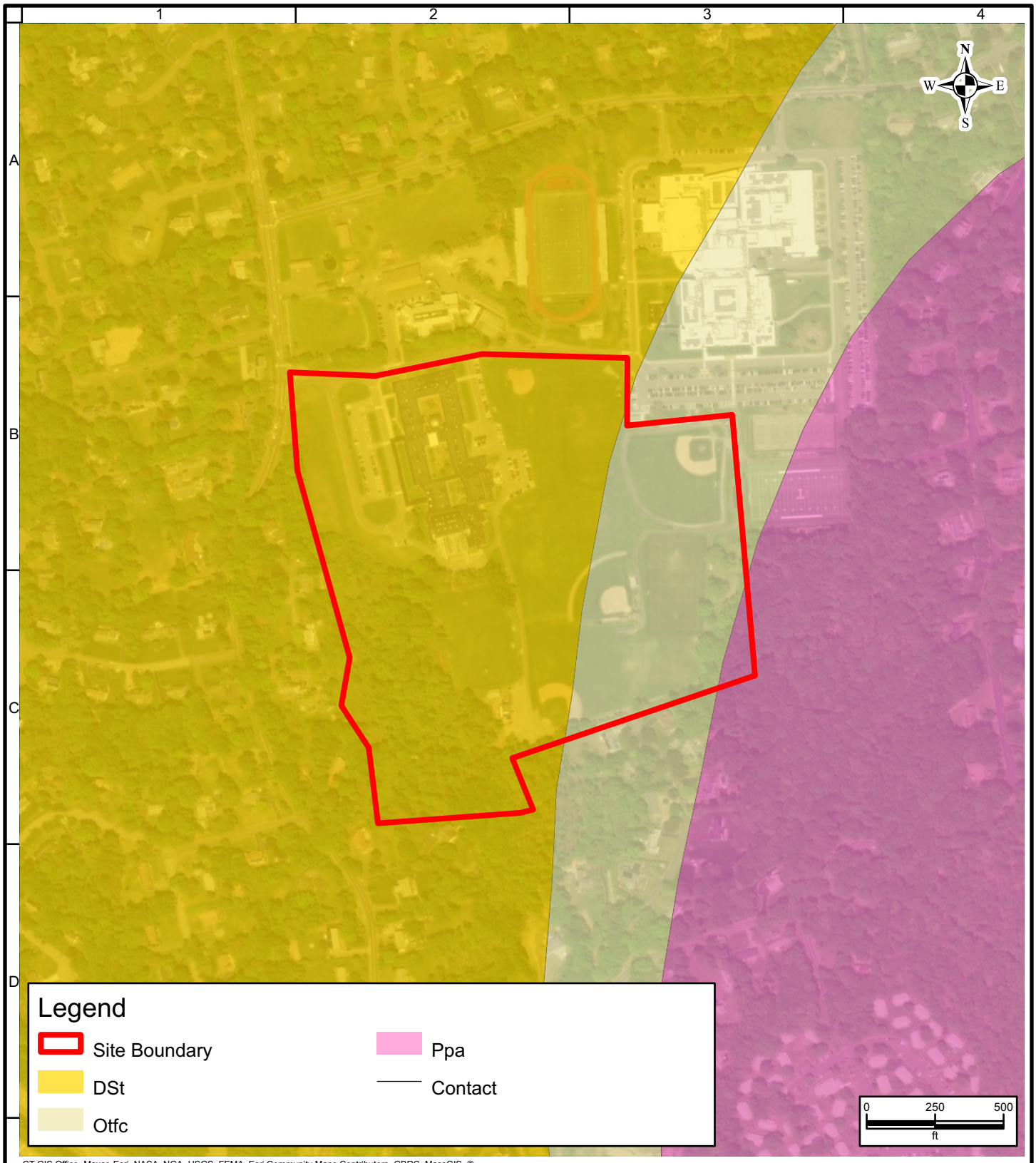

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Figure Title
CT BEDROCK GEOLOGY

Project No.	140325901
Date	10/3/2025
Scale	1 inch = 500 feet
Drawn By	Site Analyzer
Submission Date	10/3/2025

Figure 3

Sheet 3 of 4

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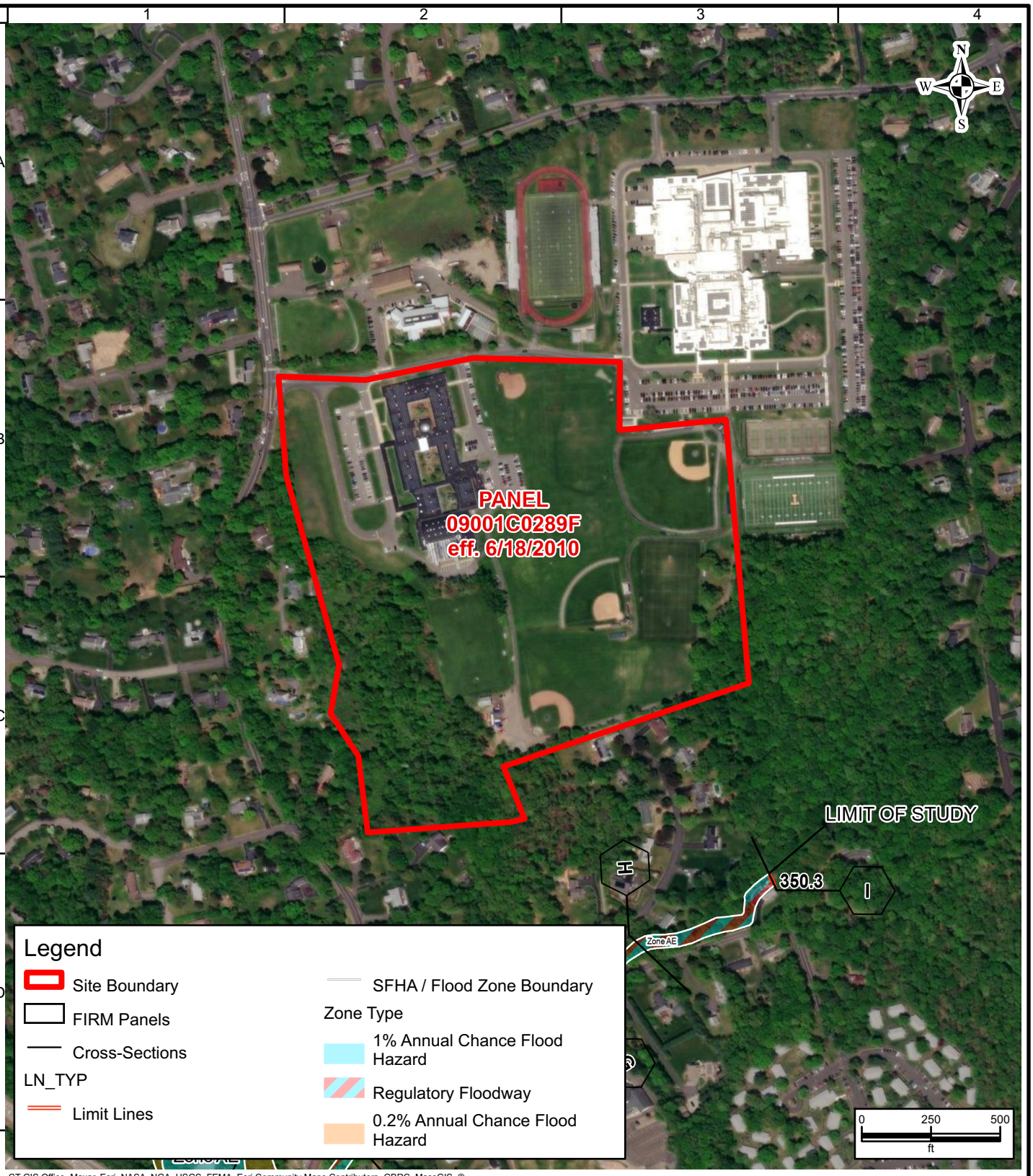

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Figure Title
EFFECTIVE FEMA FIRM

Project No.	140325901
Date	10/3/2025
Scale	1 inch = 500 feet
Drawn By	Site Analyzer
Submission Date	10/3/2025

Figure 4

Sheet 4 of 4

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GENERAL NOTES

1. ALL BORING LOCATIONS ARE APPROXIMATE.
2. BUILDING FOOTPRINT TAKEN FROM A SITE PLAN PROVIDED BY TKSP ON 21 AUGUST 2025.
3. BACKGROUND INFORMATION OBTAINED FROM A DRAFT SURVEY BY LANGAN DATED 15 JULY 2025.
4. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. LB-01 THROUGH LB-08 WERE PERFORMED BY GENERAL BORINGS, INC. BETWEEN 23 JULY 2025 AND 24 JULY 2025 UNDER FULL-TIME OBSERVATION OF A LANGAN ENGINEER.

LEGEND

LB-04 — 2025 LANGAN BORING LOCATION

LB-01
LB-02
LB-03
LB-04
LB-05
LB-06
LB-07
LB-08

FFE = ±391

FFE = ±377

PROPOSED BUILDING FOOTPRINT

SCALE: 1 INCH = 30 FEET

Project	TRUMBULL MS
	TRUMBULL GREATER BRIDGEPORT P CONNECTICUT
Drawing Title	BORING LOCATION PLAN
Project No.	140325901
Date	7/15/2025
Drawn By	MC
Checked By	OAC
Figure	5
Sheet	1 of 1

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Project No. 140325901
Date: 8/25/2025 Time: 15:25 User: abuyyankar Style Table: Langan.stb Layout: Layout1 Document Code: FG05-140325901-0201-BL101-0101

APPENDIX A
BORING LOGS

LANGAN

Log of Boring **LB-01** Sheet 1 of 1

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 377.0 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 14.5 ft — Rock Depth: 7.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 3, Undisturbed 0, Core 1
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A — Completion ▼ N/A — 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale
	+377.0		0
	+376.5	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]	
		Brown fine to medium SAND, some fine gravel, trace silt (dry) [FILL]	1
			2
	+374.0		3
		Brown fine to medium SAND, some fine gravel, trace silt (dry) [TILL]	4
			5
			6
	+370.0		7
		Grayish brown fine to medium SAND, some weathered rock fragments, trace silt (dry) [WEATHERED ROCK]	8
	+367.5		9
		Gray to white micaceous SCHIST; fine to medium grained moderately weathered to fresh; very close to close fracture spacing; fractures near horizontal; rock quality very poor; [BEDROCK]	10
			11
			12
			13
			14
	+362.5	End of Boring at 14.5ft.	15
			16

Sample Data					Remarks
Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	(Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
					Precleared to 5ft depth
PD-1	DIST	0			
					advance auger to 9ft, moderate to hard drilling, heavy chattering.
S-1	SS	17	8 13 14 16	27	
S-2	SS	19	17 26 23 50/3"	49	
					Refusal encountered at 9.5 ft.
C-1	RC	REC=58"/60"=97%	RQD=30"/60"=49%		
					Bottom of Boring Encountered at 14.5 ft. Boring backfilled to grade with cuttings.

LANGAN

Log of Boring **LB-02** Sheet 1 of 1

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 390.0 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 15.2 ft — Rock Depth: 12.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 6, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ 13.0, 24 HR. ▽ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+390.0		0						
	+389.5	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]							Precleared to 5ft depth
		Brown SAND, trace fine gravel, trace silt (dry) [FILL]	1						
			2						
			3	PD-1	DIST	0			
			4						
	+385.0		5						
		Brown fine to medium SAND, trace gravel, trace silt (moist) [TILL]					9		advance auger to 10ft, moderate to hard drilling, heavy chattering
			6	S-1	SS	18	9 12 25	21	
		Brown fine to medium SAND, trace gravel, trace silt (moist) [TILL]	7	S-2	SS	7	31 60/1"	60/1"	
			8						
			9						
		Grayish brown fine to medium SAND, trace fine gravel, trace silt, trace weathered rock. (moist) [TILL]	10				12		advance auger to 15ft, medium to hard drilling, heavy chattering
			11	S-3	SS	19	20 24	44	
	+378.0						29		
		Grayish brown fine to coarse SAND, some weathered rock fragments, trace silt (wet) [WEATHERED ROCK]	12				12		
			13	S-4	SS	24	12 19	31	
			14				45		
									Refusal encountered at 15.5 ft. Boring backfilled to grade with cuttings.
	+374.8	Grayish brown fine to coarse SAND, some weathered rock fragments, trace silt (wet) [WEATHERED ROCK]	15	S-5	SS	3	75/3"	75/3"	
		End of Boring at 15.2ft.	16						

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Log of Boring **LB-03** Sheet 1 of 1

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 378.5 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 8.0 ft — Rock Depth: 5.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 2, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A — Completion ▼ N/A — 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+378.5		0						Precleared to 5ft depth
	+378.0	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]	1						
		Brown fine to medium SAND, trace fine gravel, trace silt (dry) [FILL]	2	PD-1	DIST	0			
	+375.5		3						
		INFERRED GLACIAL TILL	4						
	+373.5		5	S-1	SS	6	51 50/2"	50/2"	advance auger to 8ft, hard drilling, heavy chattering
		Gray fine to medium SAND, some weathered rock fragments, trace silt (dry) [WEATHERED ROCK]	6						
	+370.5		7						
		End of Boring at 8.0ft.	8						Refusal encountered at 8ft. Boring backfilled to grade with cuttings.
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						

LANGAN

Log of Boring **LB-04** Sheet 1 of 2

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 388.0 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 25.2 ft — Rock Depth: 14.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 8, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ 14.0, 24 HR. ▽ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+388.0		0						
	+387.5	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]							Precleared to 5ft depth
		Brown fine to medium SAND, trace fine gravel, trace silt (dry) [FILL]	1						
			2	PD-1	DIST	0			
	+385.0		3						
		Grayish brown fine to medium SAND, some fine gravel, trace silt (dry) [TILL]	4						
			5				25		Advance auger to 10ft, easy to hard drilling, some chattering
			6	S-1	SS	20	23 32	55	
		Brown fine to medium SAND, trace fine gravel, trace silt (dry) [TILL]	7				35		
			8	S-2	SS	12	34 41 43	84	
		Grayish brown fine to medium SAND, trace fine gravel, trace silt, trace weathered rock (moist) [TILL]	9				44		
			10	S-3	SS	20	17 14 15 34	29	advance auger to 15ft, easy to medium drilling, some chattering
		Grayish brown fine to medium SAND, some fine gravel, trace silt, some weathered rock (moist) [TILL]	11						
			12	S-4	SS	17	36 40 35 28	75	
			13						
			14						
	+373.0		15						
		Brown fine to medium SAND, some weathered rock fragments, some silt (dry) [WEATHERED ROCK]		S-5	SS	12	55 50/2"	50/2"	advance auger to 20ft, easy to medium drilling, some chattering
			16						

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Log of Boring **LB-04** Sheet 2 of 2

Project	Project No.
Trumbull Hillcrest MS	140325902
Location	**Elevation and Datum**
530 Daniels Farm Rd, Trumbull, CT	Approx. el. 388.0 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+372.0		16						
			17						
			18						
			19						
			20	S-6	SS	3	60/3"	60/3"	advance auger to 25ft, easy to moderate drilling, some chattering
		Gray fine to medium SAND, some weathered rock fragments, trace silt (wet) [WEATHERED ROCK]	21						
			22						
			23						
			24						
	+362.8	Light gray fine to medium SAND, some weathered rock fragments (wet) [WEATHERED ROCK]	25	S-7	SS	2	100/2"	100/2"	Bottom of Boring Encountered at 25.17 ft. Boring backfilled to grade with cuttings.
		End of Boring at 25.2ft.	26						
			27						
			28						
			29						
			30						
			31						
			32						
			33						
			34						
			35						
			36						

LANGAN

Log of Boring **LB-05** Sheet 1 of 1

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 377.0 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 11.5 ft — Rock Depth: 9.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 4, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description
	+377.0	
	+376.5	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]
		Brown fine to medium SAND, trace silt, trace fine gravel (dry) [FILL]
	+372.0	
		No Recovery. INFERRED GLACIAL TILL
		Grayish brown fine to medium SAND, trace fine gravel, trace silt, some weathered rock (dry) [TILL]
	+367.0	
		Grayish brown fine to medium SAND, trace silt, trace fine gravel, some weathered rock fragments (moist) [WEATHERED ROCK]
	+365.8	
		End of Boring at 11.5ft.

Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
0					10 20 30 40	Precleared to 5ft depth
1						
2						
3						
4						
5	PD-1	DIST	0			advance auger to 10ft,easy to moderate drilling, some chattering.
6	S-1	SS	0	10 15 19 22	34	
7						
8	S-2	SS	13	12 17 24 25	41	
9						
10	S-3	SS	11	7 14 50/1"	50/1"	advance auger to 11.5ft, moderate to hard drilling, heavy chattering
11						Refusal encountered at 11.5 ft. Boring backfilled to grade with cuttings.
12						
13						
14						
15						
16						

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Log of Boring **LB-06** Sheet 1 of 2

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 382.0 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/23/2025 — Date Finished: 7/23/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 24.0 ft — Rock Depth: 12.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 6, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ 13.0, Completion ▼ N/A, 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description
	+382.0	
	+381.5	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]
		Brown fine to medium SAND, trace silt (dry) [FILL]
	+377.0	
		Brown fine to medium SAND, some fine gravel, trace silt (dry) [TILL]
		Grayish brown fine to medium SAND, trace fine gravel, trace silt (dry) [TILL]
		Grayish brown fine to medium SAND, some fine gravel, trace silt, trace weathered rock (moist) [TILL]
		Brown fine to medium SAND, trace weathered rock (wet) [TILL]

Depth Scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Sample Data

Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
PD-1A	DIST	0			Precleared to 5ft depth
PD-1B					
S-1	SS	24	12, 17, 20, 19	37	Advance Auger to 5ft, easy drilling.
S-2	SS	20	16, 15, 18, 21	33	
S-3	SS	16	14, 22, 100/5"	100/5"	Advance auger to 9ft, easy to moderate drilling, slight rig chatter
S-4	SS	2	50/2"	50/2"	Advance auger to 14ft, moderate to hard drilling, rig chattering.

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-06** Sheet 2 of 2

Project	Project No.
Trumbull Hillcrest MS	140325902
Location	**Elevation and Datum**
530 Daniels Farm Rd, Trumbull, CT	Approx. el. 382.0 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+366.0		16						
			17						
			18						
			19						
	+362.0		20						
		Gray fine to medium SAND, some silt, some weathered rock fragments (wet) [WEATHERED ROCK]	21	S-5	SS	3	50/3"	50/3"	advance auger to 20ft, hard drilling, rig chattering
			22						
			23						
	+358.0		24						
		End of Boring at 24.0ft.	25						Refusal encountered at 24ft. Boring backfilled to grade with cuttings.
			26						
			27						
			28						
			29						
			30						
			31						
			32						
			33						
			34						
			35						
			36						

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Log of Boring **LB-07** Sheet 1 of 2

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 376.5 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 17.0 ft — Rock Depth: 15.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 6, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ 12.0, Completion ▼ N/A, 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+376.5							10 20 30 40	
	+376.0	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]	0						Precleared to 5ft depth
		Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [FILL]	1						
			2	PD-1	DIST	0			
			3						
			4						
		Grayish brown fine to medium SAND, trace fine gravel, trace silt, trace roots (moist) [FILL]	5						advance auger to 10ft, easy drilling
			6	S-1	SS	8	2 1 1	2	
		Grayish brown fine to medium SAND, trace fine gravel, trace silt, trace roots (moist) [FILL]	7						
			8	S-2	SS	1	2 2 2	4	
			9						
	+366.5								
		Gray fine to medium SAND, some silt, trace fine gravel (moist) [TILL]	10						advance auger to 15ft, easy to moderate drilling, some chattering
			11	S-3	SS	24	3 7 12	19	
		Gray fine to medium SAND, some silt, trace fine gravel (wet) [TILL]	12				10		
			13	S-4	SS	16	9 11 13	24	
			14				19		
	+361.5								
		Gray fine to medium SAND, some weathered rock fragments, trace silt (wet) [WEATHERED ROCK]	15	S-5	SS	3	100/4"	100/4"	advance auger to 17ft, moderate to hard drilling, heavy chattering
			16						

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Log of Boring **LB-07** Sheet 2 of 2

Project	Project No.
Trumbull Hillcrest MS	140325902
Location	**Elevation and Datum**
530 Daniels Farm Rd, Trumbull, CT	Approx. el. 376.5 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+360.5		16						
	+359.5	End of Boring at 17.0ft.	17						Refusal encountered at 17 ft. Boring backfilled to grade with cuttings.
			18						
			19						
			20						
			21						
			22						
			23						
			24						
			25						
			26						
			27						
			28						
			29						
			30						
			31						
			32						
			33						
			34						
			35						
			36						

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Log of Boring **LB-08** Sheet 1 of 1

Project: Trumbull Hillcrest MS	Project No.: 140325902
Location: 530 Daniels Farm Rd, Trumbull, CT	Elevation and Datum: Approx. el. 377.5 (NAVD 88)
Drilling Company: General Borings, Inc.	Date Started: 7/24/2025 — Date Finished: 7/24/2025
Drilling Equipment: Diedrich D-50	Completion Depth: 9.0 ft — Rock Depth: 5.0 ft
Size and Type of Bit: 4in Hollow Stem Auger	Number of Samples: Disturbed 3, Undisturbed 0, Core 0
Casing Diameter (in): N/A — Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A, Completion ▼ N/A, 24 HR. ▼ N/A
Casing Hammer: N/A — Weight (lbs): N/A — Drop (in): N/A	Drilling Foreman: Jim Casson
Sampler: 2in OD Split Spoon	Field Engineer: Matthew Chin
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description
	+377.5	
	+377.0	Brown fine to medium SAND, trace fine gravel, trace silt, trace roots (dry) [TOPSOIL]
		Brown fine to medium SAND, trace fine gravel, trace silt (dry) [FILL]
		INFERRED GLACIAL TILL
	+374.5	
	+372.5	Gray fine to medium SAND, some weathered rock fragments, some silt (dry) [WEATHERED ROCK]
		Light gray fine SAND, some weathered rock fragments (dry) [WEATHERED ROCK]
	+368.5	End of Boring at 9.0ft.

Depth Scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Sample Data

Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) (10 20 30 40)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
					Advance auger to 5ft, easy drilling. Precleared to 5ft depth
PD-1	DIST	0			
S-1	SS	4	100/4"	100/4"	advance auger to 7ft, moderate to hard drilling, rig chattering
S-2	SS	2	50/2"	50/2"	Advance Auger to 9ft, moderate to hard drilling. Drill grinding.
					Refusal encountered at 9 ft. Boring backfilled to grade with cuttings.

APPENDIX B
LABORATORY TESTING RESULTS

Client:	Langan Engineering				
Project:	Trumbull MS-TSKP				
Location:	Trumbull, CT			Project No:	GTX-321494
Boring ID:	---	Sample Type:	---	Tested By:	ajl
Sample ID:	---	Test Date:	07/30/25	Checked By:	ank
Depth :	---	Test Id:	826207		

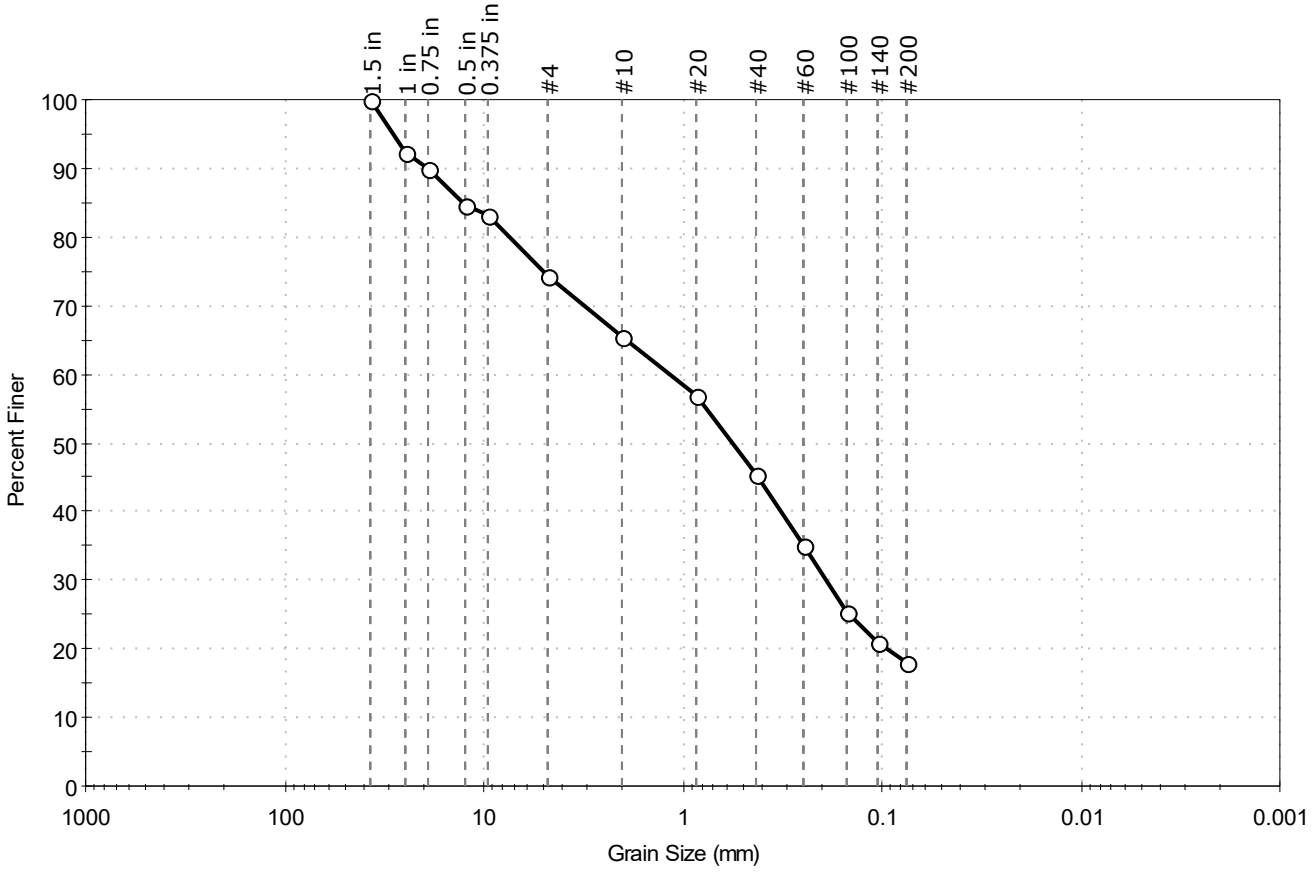
Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
LB-01	S- 1	5-7'	Moist, dark yellowish brown silty sand with gravel	11.0
LB-04	S- 1	5-7'	Moist, yellowish brown silty sand with gravel	7.8
LB-07	S- 1	5-7'	Moist, brown silty sand with organics	16.1
LB-08	S- 1	5-7'	Moist, brown silty sand with gravel	1.9

Notes: Temperature of Drying : 110º Celsius

Client:	Langan Engineering				
Project:	Trumbull MS-TSKP				
Location:	Trumbull, CT			Project No:	GTX-321494
Boring ID:	LB-01	Sample Type:	Jar	Tested By:	ajl
Sample ID:	S-1	Test Date:	07/31/25	Checked By:	ank
Depth :	5-7'	Test Id:	826200		
Test Comment:	---				
Visual Description:	Moist, dark yellowish brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	25.7	56.4	17.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	90		
0.5 in	12.50	85		
0.375 in	9.50	83		
#4	4.75	74		
#10	2.00	65		
#20	0.85	57		
#40	0.42	45		
#60	0.25	35		
#100	0.15	25		
#140	0.11	21		
#200	0.075	18		

Coefficients

D_{85} = 12.7010 mm	D_{30} = 0.1912 mm
D_{60} = 1.1602 mm	D_{15} = N/A
D_{50} = 0.5597 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

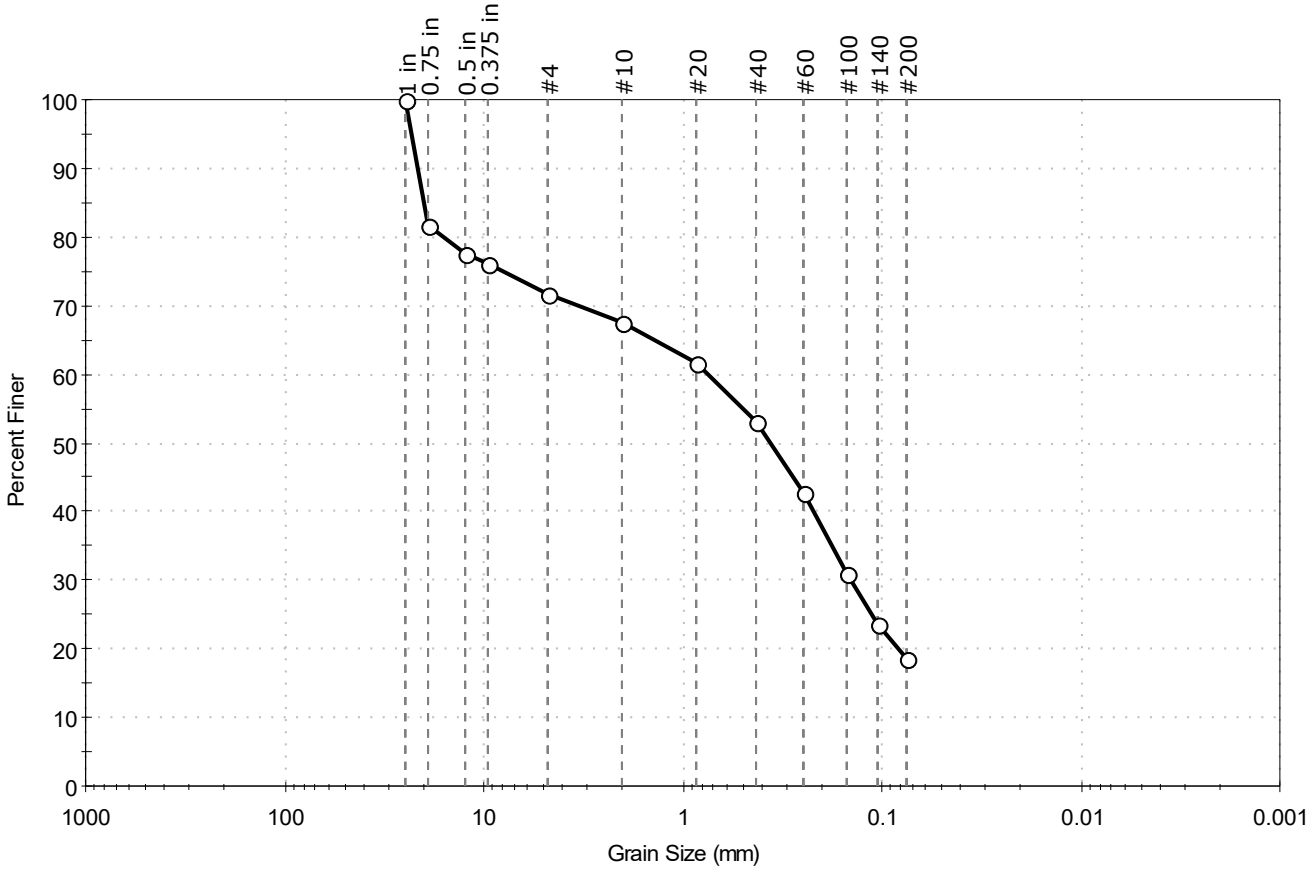
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	Trumbull MS-TSKP				
Location:	Trumbull, CT			Project No:	GTX-321494
Boring ID:	LB-04	Sample Type:	Jar	Tested By:	ajl
Sample ID:	S-1	Test Date:	07/31/25	Checked By:	ank
Depth :	5-7'	Test Id:	826201		
Test Comment:	---				
Visual Description:	Moist, yellowish brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	28.2	53.2	18.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	82		
0.5 in	12.50	77		
0.375 in	9.50	76		
#4	4.75	72		
#10	2.00	67		
#20	0.85	62		
#40	0.42	53		
#60	0.25	43		
#100	0.15	31		
#140	0.11	23		
#200	0.075	19		

Coefficients

D_{85} = 19.9611 mm D_{30} = 0.1435 mm

D_{60} = 0.7512 mm D_{15} = N/A

D_{50} = 0.3636 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

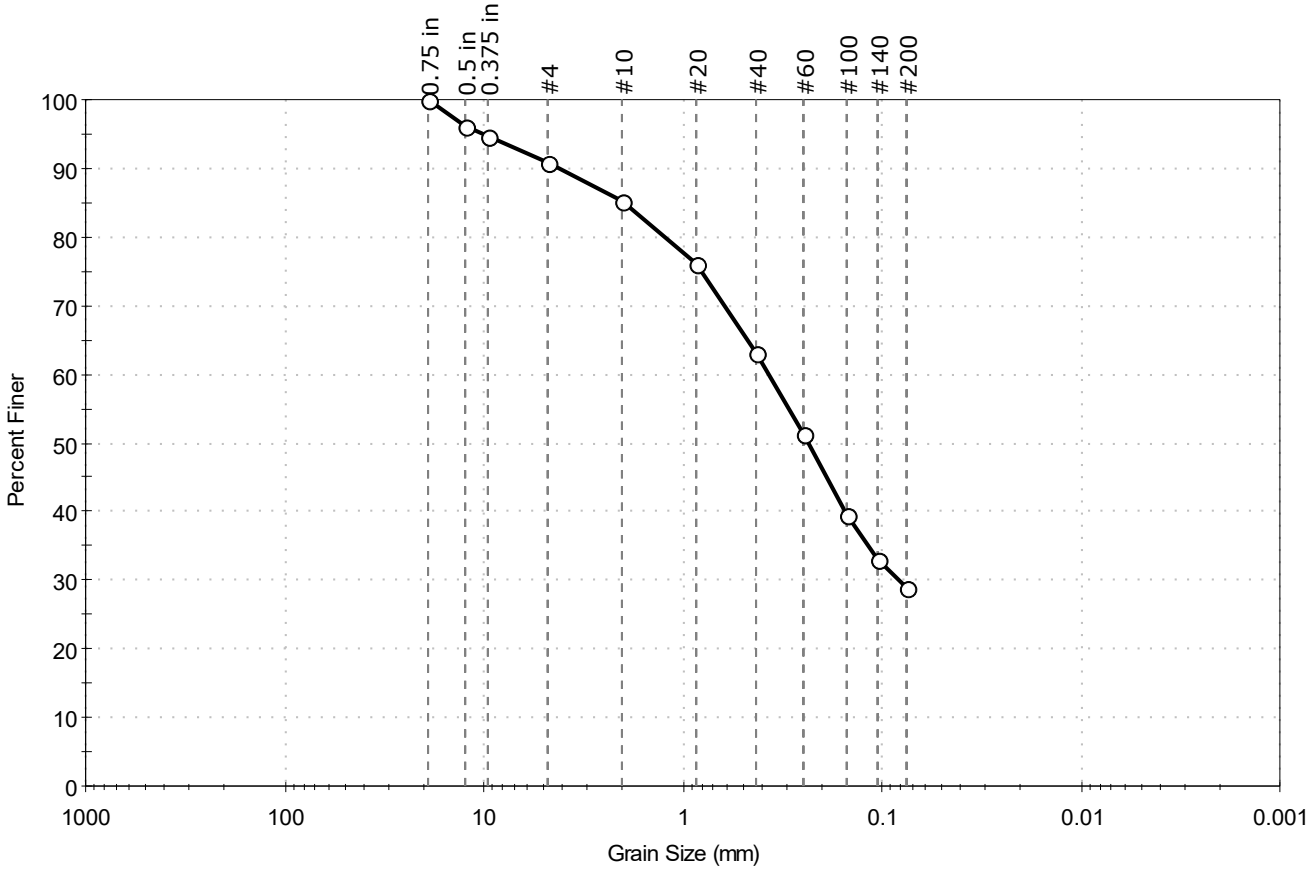
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	Trumbull MS-TSKP				
Location:	Trumbull, CT			Project No:	GTX-321494
Boring ID:	LB-07	Sample Type:	Jar	Tested By:	ajl
Sample ID:	S-1	Test Date:	07/30/25	Checked By:	ank
Depth :	5-7'	Test Id:	826202		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with organics				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	9.3	61.9	28.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	95		
#4	4.75	91		
#10	2.00	85		
#20	0.85	76		
#40	0.42	63		
#60	0.25	51		
#100	0.15	39		
#140	0.11	33		
#200	0.075	29		

Coefficients

D_{85} = 1.9737 mm D_{30} = 0.0825 mm

D_{60} = 0.3695 mm D_{15} = N/A

D_{50} = 0.2353 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

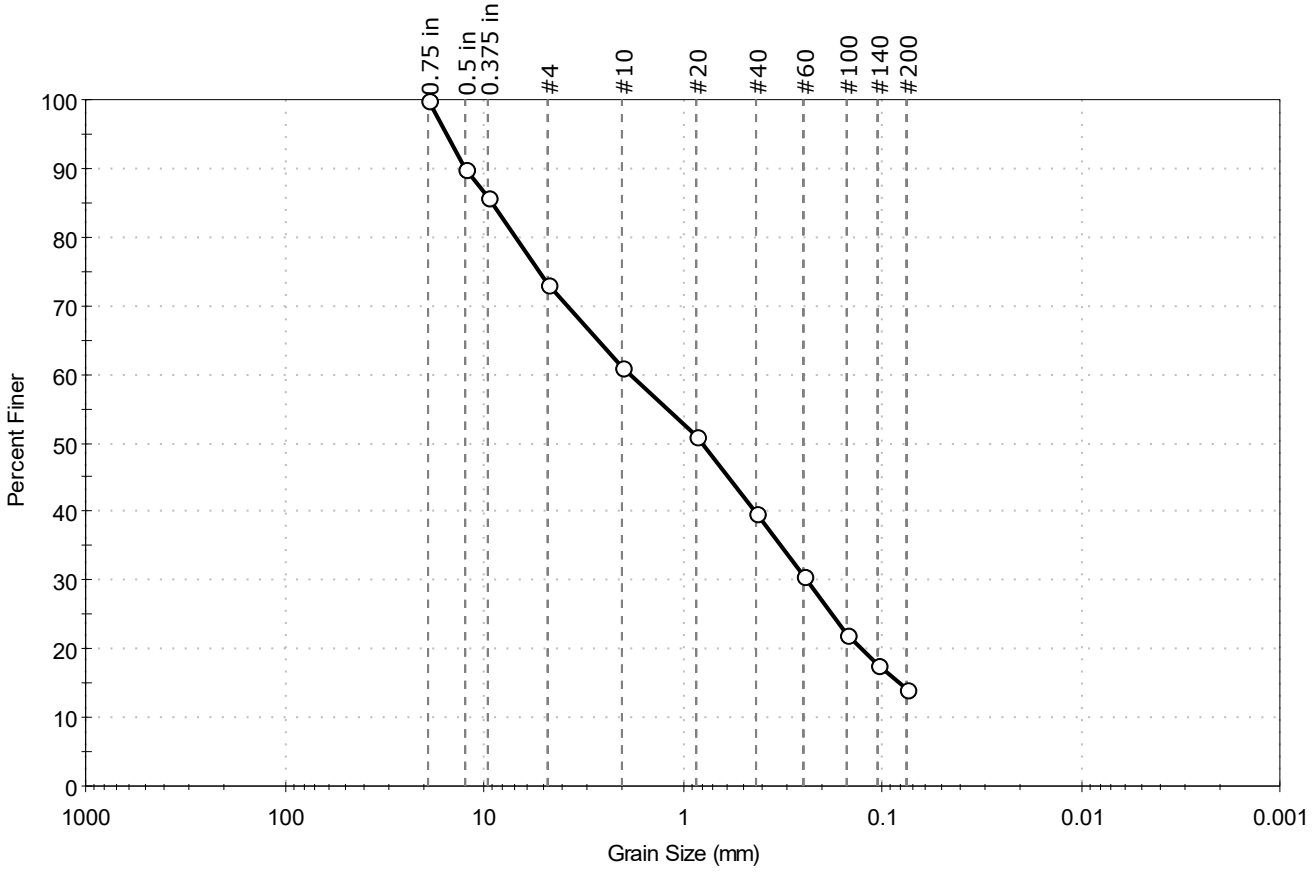
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	Trumbull MS-TSKP				
Location:	Trumbull, CT			Project No:	GTX-321494
Boring ID:	LB-08	Sample Type:	Jar	Tested By:	ajl
Sample ID:	S-1	Test Date:	07/30/25	Checked By:	ank
Depth :	5-7'	Test Id:	826203		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	27.0	58.7	14.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	90		
0.375 in	9.50	86		
#4	4.75	73		
#10	2.00	61		
#20	0.85	51		
#40	0.42	40		
#60	0.25	31		
#100	0.15	22		
#140	0.11	18		
#200	0.075	14		

Coefficients

D_{85} = 9.0772 mm	D_{30} = 0.2404 mm
D_{60} = 1.8239 mm	D_{15} = 0.0806 mm
D_{50} = 0.7985 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD







Hillcrest Middle School
Phase 2 CD Review

June 18, 2026

ARCADIS

TSKP STUDIO
ARCHITECTURE | PLANNING | INTERIORS

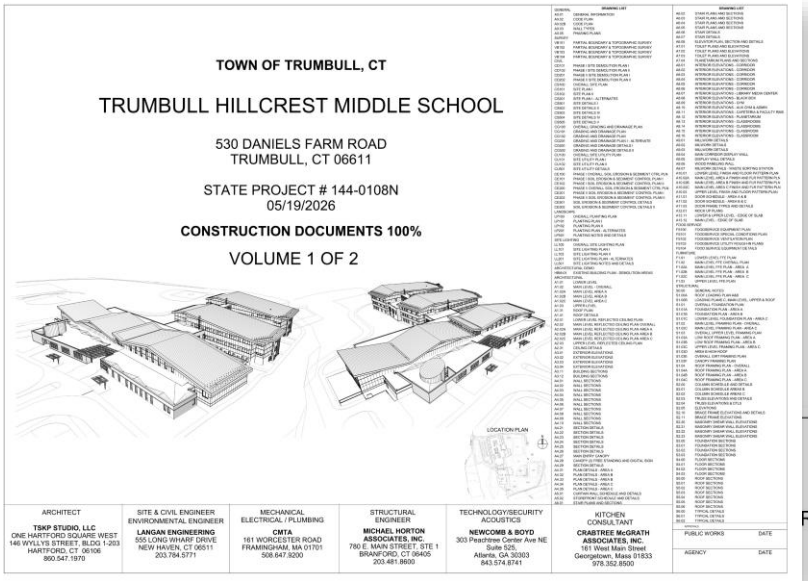
Bismark
Construction Managers | General Contractors

AGENDA

PHASE 2 - 100% CD SUMMARY

- Documents
- Site
- Building

DOCUMENTS
Drawings



TOWN OF TRUMBULL, CT

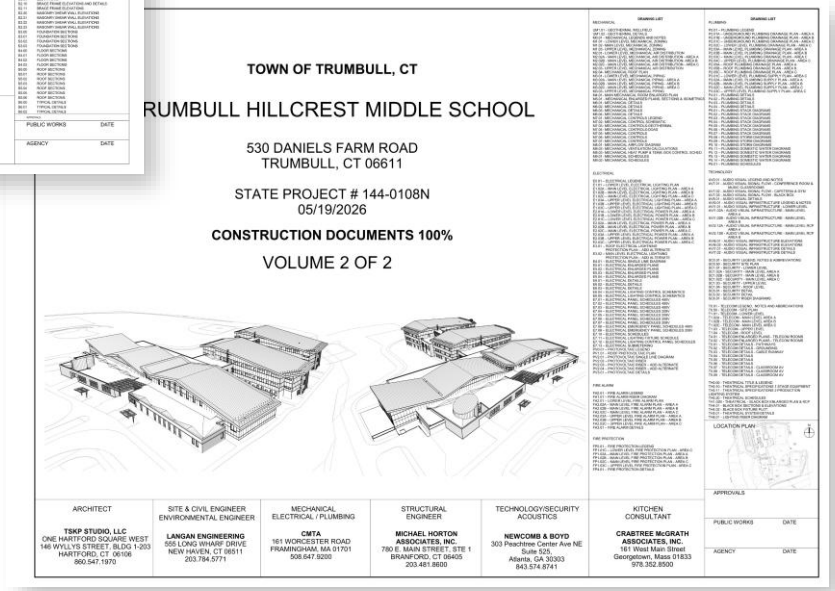
TRUMBULL HILLCREST MIDDLE SCHOOL

530 DANIELS FARM ROAD
TRUMBULL, CT 06611

STATE PROJECT # 144-0108N
05/19/2026

CONSTRUCTION DOCUMENTS 100%

VOLUME 1 OF 2



TOWN OF TRUMBULL, CT

TRUMBULL HILLCREST MIDDLE SCHOOL

530 DANIELS FARM ROAD
TRUMBULL, CT 06611

STATE PROJECT # 144-0108N
05/19/2026

CONSTRUCTION DOCUMENTS 100%

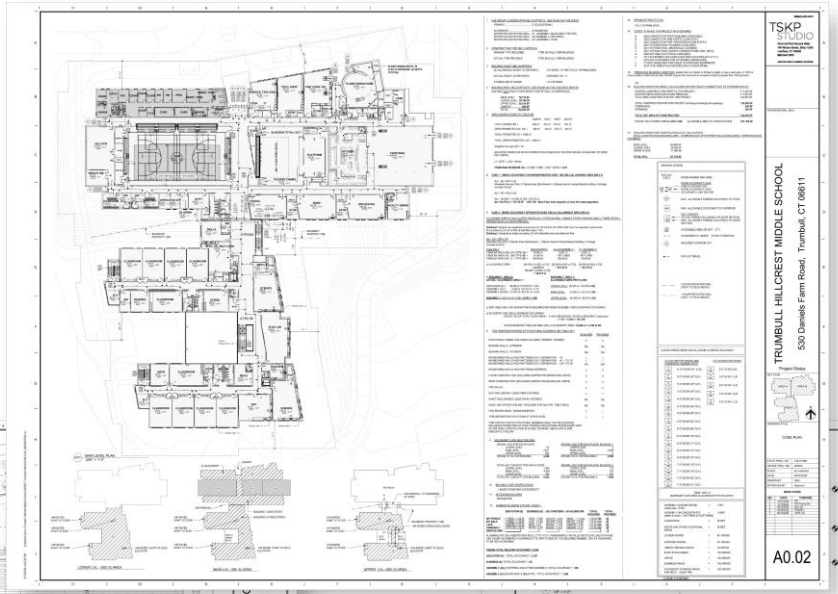
VOLUME 2 OF 2

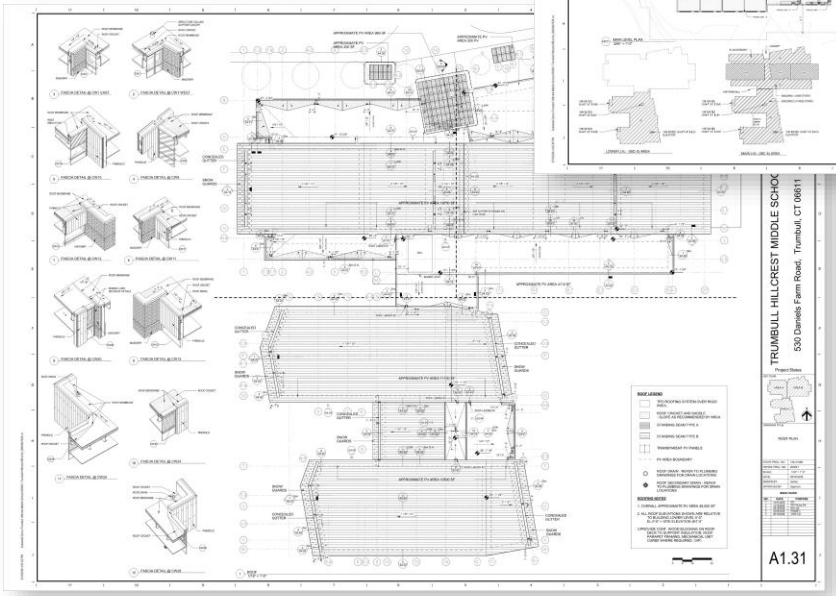
Two volumes

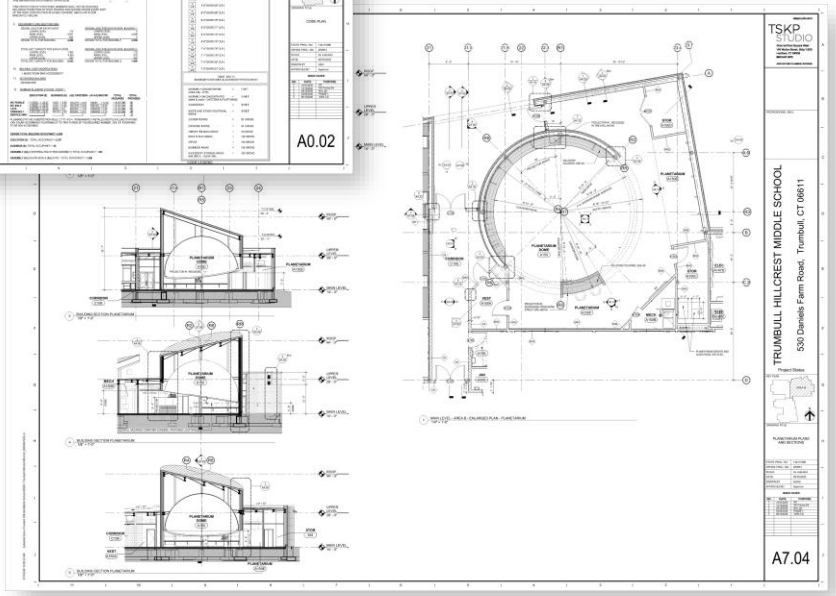
397 sheets

All disciplines

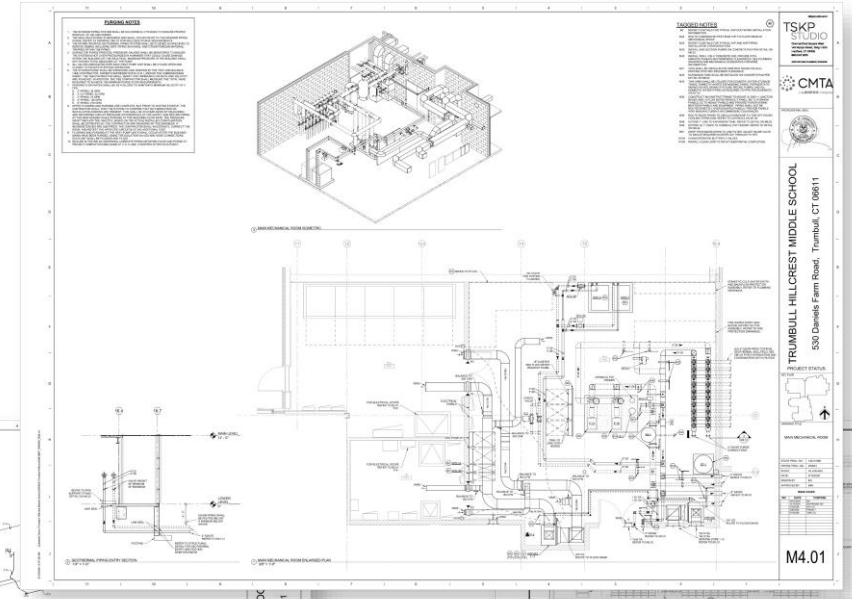
DOCUMENTS
Drawings

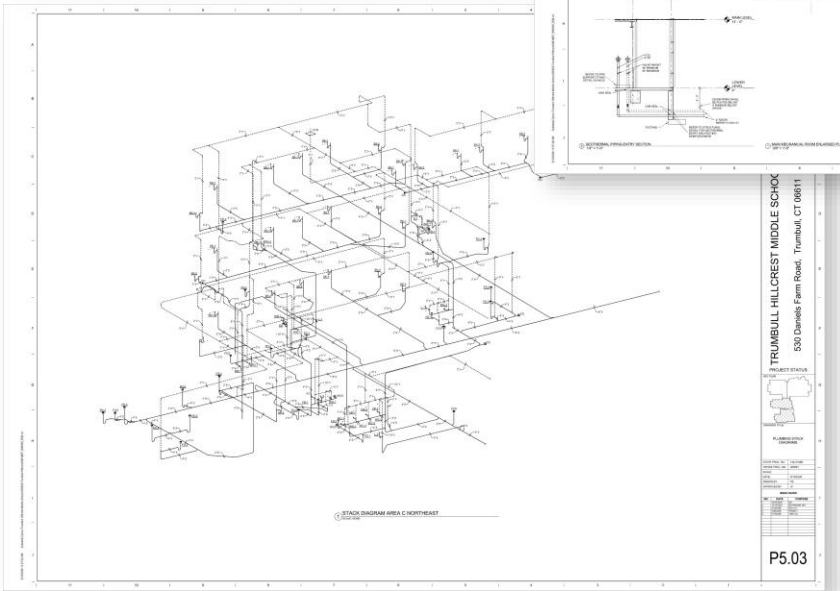


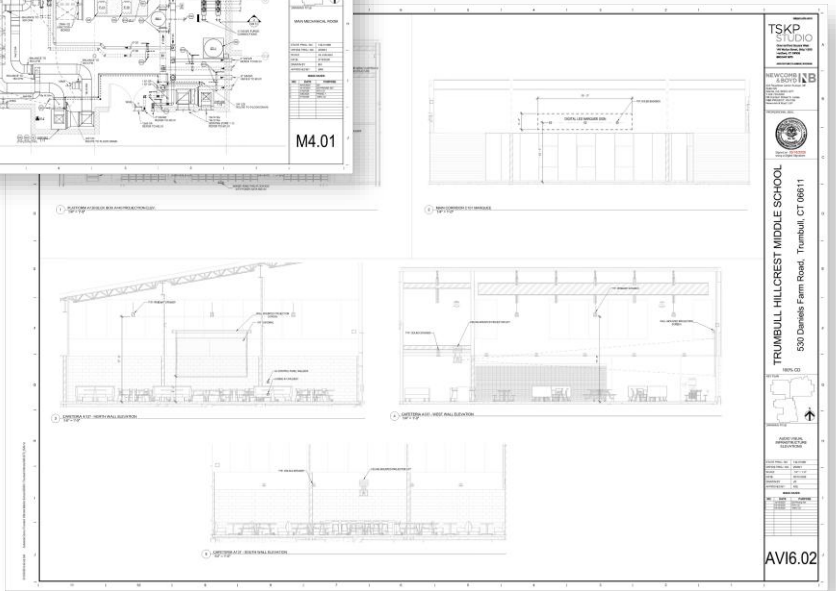




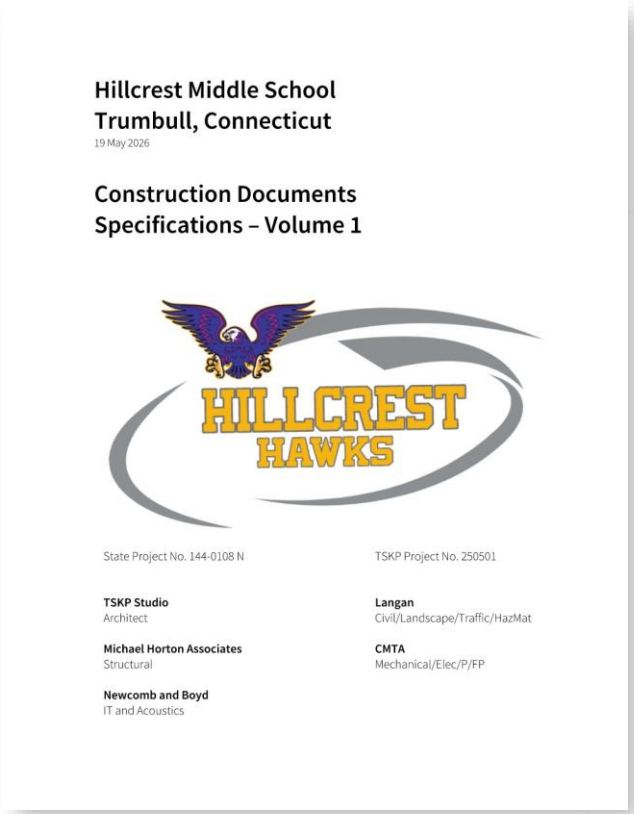
DOCUMENTS
Drawings







DOCUMENTS
Project Manual


Hillcrest Middle School
Trumbull, Connecticut
19 May 2026

Construction Documents
Specifications – Volume 1

HILLCREST HAWKS

State Project No. 144-0108 N

TSKP Project No. 250501

TSKP Studio
Architect

Langan
Civil/Landscape/Traffic/HazMat

Michael Horton Associates
Structural

CMTA
Mechanical/Elec/P/FP

Newcomb and Boyd
IT and Acoustics


Hillcrest Middle School
Trumbull, Connecticut
19 May 2026

Construction Documents
Specifications – Volume 2

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Two volumes

2412 pages

Bidding, contracts, specifications, and reports

SITE PLAN


HS PARKING
40 SPACES
(ALTERNATE)
JV SOFTBALL
FIELD 5
FIELD
200' x 360'
FIELD 14
POTENTIAL
ADDITIONAL FIELD
200' x 360'
VARSITY
BASEBALL
FIELD 2
PICKLEBALL
COURTS
(ALTERNATE)
FIELD 9
FLAG POLE
ENTRY
VARSITY
SOFTBALL
FIELD 4
JV GRASS
FIELD 7
FIELD 10
STUMP FIELD
FIELD 15
EXISTING
SERVICE
YARD
JV BASEBALL
FIELD 3
IMPROVED GATE
ACCESS
DANIELS FARM ROAD
DANIELS FARM ROAD
DANIELS FARM ROAD
TSKP STUDIO

EXTERIOR MASSING



EXTERIOR MASSING



ENTRY



INTERIOR ENVIRONMENT



INTERIOR ENVIRONMENT



INTERIOR ENVIRONMENT



INTERIOR ENVIRONMENT



INTERIOR ENVIRONMENT



ALTERNATES

PHASE 2:

Alternate #2.1: Add PV array, racks, and equipment on roof depicted on PV-0.01 Array 1

Alternate #2.2: Add PV array, racks, and equipment on roof depicted on PV-0.01 Array 1 and Array 2

Alternate #2.3: Delete Folding partition at B041, replace with corridor partition with GFCMU

Alternate #2.4: Delete horizontal and vertical solar shading devices on Curtain Wall and Storefront assemblies

Alternate #2.5: Delete exterior steel bus canopies, foundations, and cladding depicted on A4.28.

Alternate #2.6: Delete irrigation system

Questions

