

**Section VIII**

**Technical Specifications**

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

##### B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.2 PROJECT INFORMATION

##### A. Project Identification: Stern Village Energy Improvements.

1. Project Location: 200 Hedgehog Road, Trumbull, Connecticut

##### B. Owner: Trumbull Housing Authority

1. Owner's Representative: Frank Stellato, Millennium Development & Construction Services, LLC
2. Architect: Wiles Architects, 155 Brooklawn Ave, Bridgeport, Ct 06604, 203-366-6003, wilesarch.com.

##### C. Project Web Site: A project Web site administered by Architect .

1. See Section 013100 "Project Management and Coordination." for requirements for establishing administering and using Project Web site.

#### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

##### A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Furnish all labor materials, and appliances to provide new Heat Pumps to all Living Units including but not limited to Site Work, General Construction Mechanical Electrical, and Plumbing for the new Heat Pump Living Units systems

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, Tenants and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

- a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.

- D. All units shall remain occupied during the project. Maintain all Living Unit building systems at all times.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's & Tenants day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or

- used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's & Tenants operations.

#### 1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  1. Notify Owner not less than two days in advance of proposed utility interruptions.
  2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  1. Notify Owner not less than two days in advance of proposed disruptive operations.
  2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 75 feet of entrances, operable windows, or outdoor-air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

#### 1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.
  3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 011000**

## **SECTION 012500 - SUBSTITUTION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### **1.2 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

#### **1.3 ACTION SUBMITTALS**

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. Certificates and qualification data, where applicable or requested.
    - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

### PART 2 - PRODUCTS

#### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Requested substitution will not adversely affect Contractor's construction schedule.
  - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - d. Requested substitution is compatible with other portions of the Work.
  - e. Requested substitution has been coordinated with other portions of the Work.
  - f. Requested substitution provides specified warranty.
  - g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice of Award.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - d. Requested substitution will not adversely affect Contractor's construction schedule.
    - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - f. Requested substitution is compatible with other portions of the Work.
    - g. Requested substitution has been coordinated with other portions of the Work.
    - h. Requested substitution provides specified warranty.
    - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 012500**

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

#### 1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

#### 1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." Or forms acceptable to Architect.
- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." Or form acceptable to Architect.

#### 1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Work Change Directive: Architect may issue a Construction Work Change Directive on AIA Document G714. Construction Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Work Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 012600**

## **SECTION 012900 - PAYMENT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
  - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
  - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### **1.2 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
  - a. Project name and location.
  - b. Name of Architect.
  - c. Architect's project number.
  - d. Contractor's name and address.
  - e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

### 1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. Schedule of values.
  - 3. Contractor's construction schedule (preliminary if not final).
  - 4. Submittal schedule (preliminary if not final).
  - 5. List of Contractor's staff assignments.
  - 6. List of Contractor's principal consultants.
  - 7. Copies of building permits.
  - 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

9. Initial progress report.
  10. Report of preconstruction conference.
  11. Certificates of insurance and insurance policies.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707-1994, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 012900**

## **SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination drawings.
  - 2. Requests for Information (RFIs).
  - 3. Project Web site.
  - 4. Project meetings.
  
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

#### **1.2 DEFINITIONS**

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

#### **1.4 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

## 1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

#### 1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

#### 1.7 PROJECT WEB SITE

- A. Provide, administer, and use Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
  1. Project directory.
  2. Project correspondence.
  3. Meeting minutes.
  4. Contract modifications forms and logs.
  5. RFI forms and logs.
  6. Task and issue management.
  7. Photo documentation.
  8. Schedule and calendar management.
  9. Submittals forms and logs.
  10. Payment application forms.
  11. Drawing and specification document hosting, viewing, and updating.
  12. Online document collaboration.
  13. Reminder and tracking functions.
  14. Archiving functions.
- B. Provide up to seven Project Web site user licenses for use of Owner, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for Project Web site users.
- C. On completion of Project, provide one complete archive copy(ies) of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.
- D. Provide one of the following Project Web site software packages under their current published licensing agreements:
  1. Autodesk, Buzzsaw.
  2. Autodesk, Constructware.
  3. Meridian Systems, Prolog.
  4. Newforma Cloud Project bAse
- E. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of AIA Document C106.

#### 1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Meetings shall occur on a bi-weekly basis.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of record documents.
    - l. Use of the premises and existing building.
    - m. Work restrictions.
    - n. Working hours.
    - o. Owner's occupancy requirements.
    - p. Responsibility for temporary facilities and controls.
    - q. Procedures for moisture and mold control.
    - r. Procedures for disruptions and shutdowns.
    - s. Construction waste management and recycling.
    - t. Parking availability.
    - u. Office, work, and storage areas.
    - v. Equipment deliveries and priorities.
    - w. First aid.
    - x. Security.
    - y. Progress cleaning.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Progress cleaning.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Status of RFIs.
    - 14) Status of proposal requests.
    - 15) Pending changes.
    - 16) Status of Change Orders.
    - 17) Pending claims and disputes.
    - 18) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 013100**

## **SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Construction schedule updating reports.
  - 3. Daily construction reports.
  - 4. Site condition reports.

#### **1.2 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time belongs to Owner.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file, where indicated.
  - 2. PDF electronic file.
  - 3. Two paper copies.

- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
  - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.

#### 1.4 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

### PART 2 - PRODUCTS

#### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  5. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
  - 1. Unresolved issues.
  - 2. Unanswered Requests for Information.
  - 3. Rejected or unreturned submittals.
  - 4. Notations on returned submittals.
  - 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
  - 1. Use Microsoft Project, Scheduling component of Project Web site software specified in Section 013100 "Project Management and Coordination," for Windows XP operating system.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  - 1. List of subcontractors at Project site.
  - 2. List of separate contractors at Project site.
  - 3. Approximate count of personnel at Project site.
  - 4. Equipment at Project site.
  - 5. Material deliveries.
  - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
  - 7. Accidents.
  - 8. Meetings and significant decisions.
  - 9. Unusual events.

10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Work Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

**END OF SECTION 013200**

## **SECTION 013300 - SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### **1.2 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

#### **1.3 ACTION SUBMITTALS**

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

#### **1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
  - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

- a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
  - b. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

- j. Number and title of appropriate Specification Section.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Use AIA Document G810.
  - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Destination (To:).
    - 4) Source (From:).
    - 5) Name and address of Architect.
    - 6) Name of Construction Manager.
    - 7) Name of Contractor.
    - 8) Name of firm or entity that prepared submittal.
    - 9) Names of subcontractor, manufacturer, and supplier.
    - 10) Category and type of submittal.
    - 11) Submittal purpose and description.
    - 12) Specification Section number and title.
    - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
    - 14) Drawing number and detail references, as appropriate.
    - 15) Indication of full or partial submittal.
    - 16) Transmittal number, numbered consecutively.
    - 17) Submittal and transmittal distribution record.
    - 18) Remarks.
    - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.

- a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
  - a. Project name.
  - b. Date.
  - c. Name and address of Architect.
  - d. Name of Construction Manager.
  - e. Name of Contractor.
  - f. Name of firm or entity that prepared submittal.
  - g. Names of subcontractor, manufacturer, and supplier.
  - h. Category and type of submittal.
  - i. Submittal purpose and description.
  - j. Specification Section number and title.
  - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - l. Drawing number and detail references, as appropriate.
  - m. Location(s) where product is to be installed, as appropriate.
  - n. Related physical samples submitted directly.
  - o. Indication of full or partial submittal.
  - p. Transmittal number, numbered consecutively.
  - q. Submittal and transmittal distribution record.
  - r. Other necessary identification.
  - s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
  - a. Project name.
  - b. Number and title of appropriate Specification Section.
  - c. Manufacturer name.
  - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

#### A. General Submittal Procedure Requirements:

1. Post electronic submittals as PDF electronic files directly to specifically established for Project.
  - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Submit electronic submittals via email as PDF electronic files.
  - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
  - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

#### B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
    - b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.

- b. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).
    - c. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
  - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Submit product schedule in the following format:
    - a. PDF electronic file.
    - b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. LEED Submittals: Comply with requirements specified in Section 018113.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations," Section 018113.16 "Sustainable Design Requirements - LEED for Commercial Interiors," Section 018113.19 "Sustainable Design Requirements - LEED for Core and Shell Development," and Section 018113.23 "Sustainable Design Requirements - LEED for Schools."
- M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of

- Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  - P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  - Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
  - R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
  - S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
  - T. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
  - U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
  - V. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
  - W. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
  - X. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
  - Y. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
  - Z. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and

a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

**END OF SECTION 013300**

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 3. Specific test and inspection requirements are not specified in this Section.

#### 1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

## 1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - d. When testing is complete, remove test specimens, assemblies, and mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## 1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency and special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION 014000**

## SECTION 014200 - REFERENCES

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

### 1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org).
  - 8. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 9. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 10. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 11. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 12. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 14. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 15. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 16. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 17. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 18. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 19. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 20. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 21. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
  - 22. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
  - 23. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
  - 24. API - American Petroleum Institute; [www.api.org](http://www.api.org).

25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
28. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
31. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
32. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
33. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
34. ASTM - ASTM International; (American Society for Testing and Materials International); [www.astm.org](http://www.astm.org).
35. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
36. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
37. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); [www.awpa.com](http://www.awpa.com).
40. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
41. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
42. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
43. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
44. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.com](http://www.bifma.com).
46. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
47. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bwfbadminton.org](http://www.bwfbadminton.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
51. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
52. CFFA - Chemical Fabrics & Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
53. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
54. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
55. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
56. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
57. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
58. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
59. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
60. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
61. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
62. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
63. CSA - Canadian Standards Association; [www.csa.ca](http://www.csa.ca).

64. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
65. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
66. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
70. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
71. ECA - Electronic Components Association; [www.ec-central.org](http://www.ec-central.org).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
75. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
76. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
81. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
82. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarroof.com](http://www.floridarroof.com).
84. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
85. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
86. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
87. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
88. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
89. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
93. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
94. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
95. IAS - International Approval Services; (See CSA).
96. ICBO - International Conference of Building Officials; (See ICC).
97. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
98. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
99. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
100. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
101. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
102. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
103. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).

104. IESNA - Illuminating Engineering Society of North America; (See IES).
105. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
106. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
107. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
108. ILI - Indiana Limestone Institute of America, Inc.; [www.iliai.com](http://www.iliai.com).
109. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
110. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
111. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
112. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
113. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
114. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
115. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
116. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
117. LMA - Laminating Materials Association; (See CPA).
118. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
119. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
120. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
121. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
122. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
123. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
124. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
125. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); [www.wmmpa.com](http://www.wmmpa.com).
126. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
127. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
128. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
129. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
130. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
131. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
132. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
133. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
134. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
135. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
136. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
137. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
138. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
139. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
140. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
141. NFPA - NFPA; (National Fire Protection Association); [www.nfpa.org](http://www.nfpa.org).
142. NFPA - NFPA International; (See NFPA).
143. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
144. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).

145. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
146. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
147. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
148. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
149. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
150. NSF - NSF International; (National Sanitation Foundation International); [www.nsf.org](http://www.nsf.org).
151. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
152. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
153. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
154. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).
155. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
156. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
157. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); [www.plasa.org](http://www.plasa.org).
158. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
159. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
160. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
161. SAE - SAE International; (Society of Automotive Engineers); [www.sae.org](http://www.sae.org).
162. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
163. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
164. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
165. SEFA - Scientific Equipment and Furniture Association; [www.sefalabs.com](http://www.sefalabs.com).
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
167. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
168. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
169. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
171. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
172. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
173. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
174. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
175. SRCC - Solar Rating and Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
176. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
177. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
178. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
179. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
180. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
181. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
182. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); [www.tileusa.com](http://www.tileusa.com).
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
184. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
185. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).

186. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
187. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
188. TPI - Turfgrass Producers International; [www.turfgrasssod.org](http://www.turfgrasssod.org).
189. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
190. UBC - Uniform Building Code; (See ICC).
191. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
192. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
193. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
194. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
195. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
196. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
197. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
198. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
199. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).
200. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); [www.wicnet.org](http://www.wicnet.org).
201. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
202. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
203. WPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN - Deutsches Institut fur Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov](http://www.gpo.gov).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; [www.trb.org](http://www.trb.org).

15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
  16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
  17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
  18. USP - U.S. Pharmacopeia; [www.usp.org](http://www.usp.org).
  19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dia.mil>.
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS - California Department of Health Services; (See CDPH).
  4. CDPH - California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC - California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD - South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS - Texas Forest Service; Forest Resource Development and Sustainable Forestry; <http://txforests-service.tamu.edu>.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 014200**

## **SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

#### **1.2 USE CHARGES**

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

#### 1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

#### 1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

#### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

#### 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service underground unless otherwise indicated.
  - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine in each field office.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.

- c. Contractor's home office.
  - d. Contractor's emergency after-hours telephone number.
  - e. Architect's office.
  - f. Engineers' offices.
  - g. Owner's office.
  - h. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- L. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
  2. Memory: 4 gigabyte.
  3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
  4. Display: 22-inch LCD monitor with 128 Mb dedicated video RAM.
  5. Network Connectivity: 10/100BaseT Ethernet.
  6. Productivity Software:
    - a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
    - b. Adobe Reader 7.0 or higher.
    - c. WinZip 7.0 or higher.
  7. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
  8. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
  9. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

### 3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
  - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touchup signs so they are legible at all times.

- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
  2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  3. Insulate partitions to control noise transmission to occupied areas.
  4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  5. Protect air-handling equipment.
  6. Provide walk-off mats at each entrance through temporary partition.
- N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Discard or replace water-damaged and wet material.
  4. Discard, replace, or clean stored or installed material that begins to grow mold.
  5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

**END OF SECTION 015000**

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

#### 1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

#### 1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product

request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
  - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

#### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

6. Protect stored products from damage and liquids from freezing.

## 1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  3. Products:
    - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
  4. Manufacturers:
    - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
  5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or

texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 016000**

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  
- B. Related Requirements:
  - 1. Section 011000 "Summary" for limits on use of Project site.
  - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

#### 1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
  
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
  
- C. Certified Surveys: Submit two copies signed by land surveyor.
  
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

#### 1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements of Section 018113.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations," Section 018113.16 "Sustainable Design Requirements - LEED for Commercial Interiors," Section 018113.19 "Sustainable Design Requirements - LEED for Core and Shell Development," and Section 018113.23 "Sustainable Design Requirements - LEED for Schools."
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions

outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required,

- and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. **Finished Surfaces:** Cut or drill from the exposed or finished side into concealed surfaces.
  3. **Concrete and Masonry:** Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. **Excavating and Backfilling:** Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. **Mechanical and Electrical Services:** Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. **Patching:** Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. **Inspection:** Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. **Exposed Finishes:** Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
  3. **Floors and Walls:** Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. **Ceilings:** Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. **Exterior Building Enclosure:** Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. **Cleaning:** Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.
- 3.7 **PROGRESS CLEANING**
- A. **General:** Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

**END OF SECTION 017300**

## **SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
  
- B. Related Requirements:
  - 1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
  - 2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
  - 3. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.

#### **1.2 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
  
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
  
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
  
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
  
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
  
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

### 1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator.

## 1.6 QUALITY ASSURANCE

- A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area off-site.
5. Protect items from damage during transport and storage.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  1. Pulverize concrete to maximum 1-1/2-inch size.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  1. Pulverize masonry to maximum 4-inch size.
  2. Clean and stack undamaged, whole masonry units on wood pallets.

- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- K. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

### 3.7 SAMPLE FORMS

**END OF SECTION 017419**

## **SECTION 017700 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
  
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## 1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
  6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Submit list of incomplete items in the following format:
    - a. MS Excel electronic file. Architect will return annotated copy.
    - b. PDF electronic file. Architect will return annotated copy.
    - c. Three paper copies unless otherwise indicated. Architect will return two copies.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.

- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

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**END OF SECTION 017700**

## **SECTION 017823 - OPERATION AND MAINTENANCE DATA**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory.
  2. Emergency manuals.
  3. Operation manuals for systems, subsystems, and equipment.
  4. Product maintenance manuals.
  5. Systems and equipment maintenance manuals.

#### **1.2 CLOSEOUT SUBMITTALS**

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- C. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority.
  - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite

bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.

7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.

4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly, component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

**PART 3 - EXECUTION**

**3.1 MANUAL PREPARATION**

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

**END OF SECTION 017823**

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Requirements:
  - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
      - 3) Submit record digital data files and one set(s) of plots.
      - 4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit three paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
      - 3) Print each drawing, whether or not changes and additional information were recorded.
    - c. Final Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record prints.
      - 2) Submit record digital data files and three set(s) of record digital data file plots.

- 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
  - C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
  1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Record data as soon as possible after obtaining it.
    - c. Record and check the markup before enclosing concealed installations.
  2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
  2. Format: DWG, Version , Microsoft Windows operating system.
  3. Format: Annotated PDF electronic file with comment function enabled.
  4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  5. Refer instances of uncertainty to Architect for resolution.
  6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.

- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

#### 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

### PART 3 - EXECUTION

#### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

**END OF SECTION 017839**

## **SECTION 017900 - DEMONSTRATION AND TRAINING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

#### **1.2 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

#### **1.4 QUALITY ASSURANCE**

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

## 1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.

- g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:

- a. Diagnosis instructions.
- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

#### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish an instructor to describe Owner's operational philosophy.
  3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and a written performance-based test.

#### 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom

instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

**END OF SECTION 017900**

## **SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. OPR and BoD documentation are included by reference for information only.

#### **1.2 SUMMARY**

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Sections:
  - 1. Section 230800 "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

#### **1.3 DEFINITIONS**

- A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxA: Commissioning Authority.
- D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

#### **1.4 COMMISSIONING TEAM**

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project

superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and each Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 EACH CONTRACTOR'S RESPONSIBILITIES

- A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
  3. Attend commissioning team meetings held on a monthly basis.
  4. Integrate and coordinate commissioning process activities with construction schedule.
  5. Review and accept construction checklists provided by the CxA.
  6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
  7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
  8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.

- C. Convene commissioning team meetings.
- D. Provide Project-specific construction checklists and commissioning process test procedures.
- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- F. Prepare and maintain the Issues Log.
- G. Prepare and maintain completed construction checklist log.
- H. Witness systems, assemblies, equipment, and component startup.
- I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 019113**

## **SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

#### **1.2 DEFINITIONS**

- A. Remove:** Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall:** Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain:** Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Predemolition Conference:** Conduct conference at Project site.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data:** For refrigerant recovery technician.
- B. Predemolition Photographs or Video:** Submit before Work begins.
- C. Statement of Refrigerant Recovery:** Signed by refrigerant recovery technician.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Landfill Records:** Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### **1.6 QUALITY ASSURANCE**

- A. Refrigerant Recovery Technician Qualifications:** Certified by an EPA-approved certification program.

## 1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

#### 3.2 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

#### 3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or

- grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  5. Dispose of demolished items and materials promptly.

- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.5 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

**SECTION 033000 - CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply this Section.

**1.2 QUALITY ASSURANCE:**

- A. Codes and Standards: Comply with provisions of following Codes, Specifications and standards, except where more stringent requirements are shown or specified:
  - 1. American Concrete Institute, ACI, "Specifications for Structural Concrete for Buildings" (ACI 301 - latest revision).
  - 2. Concrete Reinforcing Steel Institute, CRSI, "Manual of Standard Practice" latest edition.
- B. Concrete Testing Service: Employ at contractor's expense a testing laboratory to perform materials evaluation tests and to design concrete mixes.
- C. Owner: Employ separate testing laboratory to evaluate concrete delivered to and placed at site.
- D. Certificates: Signed by concrete producer and Contractor, may be submitted in lieu of material testing when acceptable to Engineer.

**1.3 SUBMITTALS:**

- A. Manufacturer's Data: Submit manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials and others as requested by Engineer.
- B. Laboratory Reports: Submit 2 copies of laboratory test or evaluation reports for concrete materials and mix designs.
- C. Shop Drawings Reinforcement: Submit shop drawings per general requirements (minimum of 2 copies or electronically in PDF format) for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (latest edition), showing bar schedules, stirrup spacing, diagrams of bent bars, placing plans and wall elevations showing arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures. Reproduction of the Engineer's Contract Drawings are not acceptable for use as shop drawings.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS:

- A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

### 2.2 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Welded wire fabric (WWF): ASTM A185, welded steel wire fabric.

### 2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type 1 use one brand of cement throughout project.
- B. Normal weight aggregates: ASTM C33, Provide aggregates from a single source for exposed concrete.
- C. Water: Potable.
- D. Air Entraining Admixture: ASTM C260.
- E. Water reducing Admixture: ASTM C494, Type A. and not contain more chloride ions than are present in municipal drinking water.

### 2.4 RELATED MATERIALS:

- A. Membrane-Forming Curing Compound: ASTM C 309, Type 1.

### 2.5 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete in accordance with ACI 301 Section 3.9 "Proportioning on the Basis of Previous Field Experience or Trial Mixtures", Chapter 3 as indicated on drawings.
- B. Mix designs may be adjusted when material characteristics, job conditions, weather, test results or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by Engineer.
- C. Use air entraining admixture in all concrete, providing not less than 4% nor more than 8% entrained air for concrete exposed to freezing and thawing, and from 2% to 4% for other concrete.
- D. Do not use admixtures containing calcium chloride.

### 2.6 CONCRETE MIXING:

- A. Ready mix concrete shall be in accordance with ASTM C94.

- B. For Job-site mixing use drum type batch machine mixture, mixing not less than 1-1/2 minutes for one cu. yd. or smaller capacity. Increase mixing time at least 15 seconds for each additional cu. yd. or fraction thereof.

### PART 3 - EXECUTION

#### 3.1 FORMWORK:

- A. Construct formwork complying with ACI 347 "Recommended Practice for Concrete Formwork", so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
- C. Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required, re-tighten forms during concrete placement if required to eliminate leaks.

#### 3.2 PLACING REINFORCEMENT:

- A. Comply with CRSI, recommended practice for "Placing Reinforcing Bars".
- B. Position, support and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolsters, spacers and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. Install welded wire fabric in as long lengths as practical, lapping at least one mesh.

#### 3.3 JOINTS:

- A. Provide construction, isolation, and control joints as indicated or required. Locate construction joints so as to not impair strength and appearance of structure. Place isolation and control joints in slabs- on-ground to stabilize differential settlement and random cracking.

#### 3.4 INSTALLATION OF EMBEDDED ITEMS:

- A. Set and build into work, anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in- place concrete. Use setting diagrams, templates and instructions provided by others for locations and setting.

#### 3.5 CONCRETE PLACEMENT:

- A. Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.
- B. Consolidate placed concrete using mechanical vibrating equipment with hand

rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into forms.

- C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.

In cold weather comply with ACI 318-83

In hot weather comply with ACI 318-83

### 3.6 CONCRETE FINISHES:

- A. Provide a smooth finish for exposed concrete surfaces and surfaces that are to be covered with a coating or covering material applied directly to concrete. Remove fins and projections, patch defective areas with cement grout, and rub smooth.
- B. Apply trowel finish to monolithic slab surfaces that are exposed-to-view or are to be covered with resilient flooring, paint or other thin film coating. Consolidate concrete surfaces by finish troweling, free of trowel marks, uniform in texture and appearance.

### 3.7 CONCRETE CURING AND PROTECTION:

- A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces.

### 3.8 QUALITY CONTROL:

- A. Owner's testing laboratory will perform sampling and testing during concrete placement, which may include the following, as directed by Engineer. This testing does not relieve Contractor of responsibility of providing concrete in compliance with specifications. Contractor may perform additional testing as necessary, at no expense to Owner, to ensure quality of concrete.

1. Sampling: ASTM C 172.
2. Slump: ASTM C 143, one for each set of compressive strength specimens.
3. Air content: ASTM C 173, one for each set of compressive strength specimens.
4. Compressive strength: ASTM C 39, one set for each 50 cu. yds, or fraction thereof of each class of concrete; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one retained for later testing if required.

When the total quantity of given class of concrete is less than 50 cu. yds., strength tests may be waived by Engineer if field experience indicates

evidence of satisfactory strength.

- B. Test results will be reported in writing to Engineer, Contractor, and concrete producer on same day tests are made.

End of Section 033000

## **SECTION 061000 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 01 Specification Sections, apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK:**

- A. The extent of Rough Carpentry work is shown on the drawings, including schedules, notes and details; it includes framing, sheathing, blocking, nailers, decking, and other carpentry work not specified as part of other sections.
- B. The following work is specified elsewhere; Finished Carpentry, Wood Treatment, elsewhere in Division 6. Heavy Timber (solid wood framing 5"x 5" or larger) elsewhere in Division 06. Gypsum drywall in Division 9.

#### **1.3 QUALITY ASSURANCE:**

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated.
  - 1. Lumber standards: Comply with PS 20-70 "American Softwood Lumber Standard" and with applicable rules of the respective grading and inspecting agencies for species and products indicated.
  - 2. Plywood Product Standards: Comply with PSI (ANSI A 199.1), with applicable APA Performance Standard.
  - 3. National Forest Products Association, NFPA, "National Design Specification and Design Values for Wood Construction".
- B. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

#### **1.4 PRODUCT HANDLING:**

- A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

#### **1.5 JOB CONDITIONS:**

- A. Coordination: Fit carpentry to other work. Scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking grounds and similar supports to allow proper attachment of other work.
- B. Time delivery and installation of carpentry work to avoid delaying other trades whose work is dependent on or attached by the carpentry work.

- C. Installer must examine all parts of the supporting structure and the conditions under which the carpentry work is to be installed and notify the contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

## PART 2 PRODUCTS

### 2.1 LUMBER MATERIALS:

- A. Dimension Lumber General: Nominal sizes are indicated except as shown by detail dimensions; provide lumber complying with grading rules of Section 10 of PS 20-70, ASTM D 245, ASTM D 2555.
- B. Provide dressed lumber, S4S, unless otherwise shown.
- C. Provide seasoned dimension lumber with 19% maximum moisture content at time of dressing and complying with PS 20.
- D. Lumber used for joists, rafters, beams, columns and 2 x 6 or 2 x 8 studs shall be entirely of one species which shall not be less than No. 2 grade and shall have a minimum modulus of elasticity (E) of 1,400,000 PSI and a single member fiber stress in bending (Fb) of 1200 PSI.
- E. All 2 x 4 stud framing in walls and partitions shall be not less than stud of standard grade or better and shall have a compressive stress parallel to grain (Fc) of not less than 600 PSI.
- F. Concealed boards (less than 2" thick): Where boards will be concealed by other work, provide any species graded Construction Boards (WWPA). Provide sizes indicated.
- G. Miscellaneous Lumber: Provide wood for support or attachment of other work including cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members. Provide lumber of sizes shown or specified. Provide construction grade boards (WCLB) or No. 2 boards (WWPA).
- H. Wood Preservative-Treated Lumber: Pressure treat above ground items with waterborne preservatives to minimum retention of 0.25 lb/cu. Ft.
  - 1. After treatment, kiln-dry lumber and plywood to maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
    - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
    - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with concrete.
    - c. Wood framing members less than 18 inches above grade of exterior to the building envelope.
    - d. Wood floor plates installed over concrete slabs directly in contact with earth.
  - 2. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. Ft.
  - 3. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect

each piece of lumber after drying and discard damaged or defective pieces.

## 2.2 PLYWOOD MATERIALS:

- A. Identify each plywood panel with appropriate APA, American Plywood Association, trademark.
- B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D Plugged INT with exterior glue, in thickness indicated, or, if not otherwise indicated not less than 1/2".

## 2.3 MISCELLANEOUS MATERIALS:

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated on construction documents and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommending nails.
- B. Where rough carpentry work is exposed to weather, in ground contact, or in areas of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).
- C. Building Paper: Asphalt saturated felts, non-perforated, ASTM D 226.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate. Work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.
- E. Provide framing members of sizes and of spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for Housing Framing" of National Forest Products Association. Do not splice structural members between supports.

- F. Anchor and nail as shown, and to comply with Appendix E of Basic Building Code and "Recommended Nailing Schedule" of "Manual for House Framing" and other recommendations of the N.F.P.A.
  - G. Firestop concealed spaces with wood blocking not less than 2" thick, if not blocked by other framing members. Provide blocking at each building story level and at ends of joist spans.
- 3.2 WOOD GROUNDS, NAILERS, BLOCKING:
- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for the line and level of work to be attached. Coordinate location with others involved.
  - B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into formwork before concrete placement.
- 3.3 STUD FRAMING:
- A. General: Provide stud framing where shown. Unless otherwise shown, use 2" x 6" wood studs spaced 16" o.c. Provide single bottom plate and double-top plates 2" thick by width of studs, except single plates may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.
  - B. Construct corners and intersections with not less than 3 studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.
  - C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
  - D. Provide continuous horizontal blocking row at 4'-0" intervals as shown using 2" thick members of same width as wall partitions.
- 3.4 INSTALLATION OF PLYWOOD:
- A. General: Comply with applicable recommendations contained in form No. E 304" APA Design/Construction Guide - Residential and Commercial" for types of plywood products and applicants indicated.

End of Section 061000

Stern Village Energy Improvements  
Trumbull, Ct

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## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.

#### 1.2 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where directed by Owner on site.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.
- B. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

### 3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 2. Use only hand methods for grubbing within protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

## SECTION 15010 - GENERAL PROVISIONS - MECHANICAL

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. The following Drawings indicate the work required under this Division.

All Drawings associated with this project.  
And All Other Contract Drawings.

- B. Certain items of work pertaining to the work of this Division are provided under other Divisions of the Specification. These include, but are not limited to the following:

1. Excavating and backfilling for buried utilities, piping, etc.
2. Concrete work for equipment bases, thrust blocks, meter pads, valve boxes, etc.
3. Installation of access doors in finished construction.
4. Installation of pipe sleeves in walls and floors.
5. Wiring of mechanical equipment. (Motor starters furnished under this Section.)
6. Framing of openings in walls, floors, roof for ductwork, piping, fans, etc.
7. Chases, soffits, furred spaces required to conceal work of this Division.
8. Flashings for plumbing vents, roof curbs, etc.

- C. Materials furnished under other Divisions and installed by this Division include, but are not limited to:

1. Refer to Architectural Specifications and Drawings to determine items furnished under other Sections that will require work under this Division and include such work.

- D. Provide coordination for Mechanical and Electrical installations. Provide additional coordination drawings, as directed by Architect, in areas of potential interferences.

- E. All work shall comply with applicable codes and regulations, including, but not limited to the following:

1. Connecticut Building, Fire Safety, and Health Codes, as amended, including all codes, standards and regulations referenced therein.
2. Requirements of Local, State, and Federal authorities having jurisdiction over the

Work.

3. Current regulations of the Occupational Safety and Health Administration (OSHA).
4. Requirements of affected Public Utility Companies.
5. Special requirements set down by the Owner, the Owner's Insurance Carrier, or other concerned entities.

1.2 RELATED DOCUMENTS

- A. Instructions to Bidders, the General Conditions of The Contract, and General Requirements shall apply and be binding to the Contractor and their subcontractors, vendors or suppliers who performs work under this Division.
- B. Where items of the General or Special Conditions are repeated in this Section, it is intended to call particular attention to or qualify them. It is not intended that any parts of the General or Special Conditions be assumed to be omitted if not repeated in this Section.

1.3 INTENT

- A. Intent of the Specifications and Drawings is to call for finished work, tested and ready for operation.
- B. Material and equipment mentioned in Specifications or shown on the Drawings shall be furnished new, completely installed and adjusted, and left in a clean, safe, and satisfactory condition ready for operation. All supplied appliances and connections of every sort necessary shall be furnished and installed to the satisfaction of the Architect and Owner.
- C. Apparatus, appliances, material, or work not shown on the Drawings but mentioned in Specifications, or vice versa, or any incidental accessory items such as valves, unions, fittings, etc., necessary to make the work complete, serviceable, and perfect in all respects and ready for operation, even though not particularly specified or shown, shall be provided and installed without additional cost to the Owner.

- D. Minor details not usually shown or specified, but necessary for the proper installation and operation of the work shall be included as if specified herein.
- E. Prior to submission of bids, give written notice to Architect of any materials or apparatus believed to be inadequate, unsuitable, or in violation of laws, ordinances, rules, or regulations of the authorities having jurisdiction over the work; or any necessary items believed omitted. In absence of such notice, it is mutually agreed that the cost of all required and necessary items has been included in the bid and that all systems specified and shown will function satisfactorily without claim for additional cost to the Owner.

#### 1.4 DEFINITIONS

- A. The following words or terms contractions used for convenience throughout this specification are, unless specifically noted to the contrary, defined as follows:
  - 1. "Architect" means Wiles Architects, Bridgeport, CT 06604.
  - 2. "Engineer" means Acorn Consulting Engineers, Inc., West Simsbury, CT 06092.
  - 3. "contractor" , as used herein, means the Prime Sub-contractor responsible for the work of that specific section of Division 15.
  - 4. "furnish" or "provide" or "supply" means to supply, erect, install, connect, test, and place into operation the particular item or work referred to unless otherwise specified.
  - 5. "work" means all of the labor, material, equipment, and supplies needed to fully execute the intent of this Specification.
  - 6. "Regulating authorities" or "authorities" , means all governmental, utility and insuring authorities having jurisdiction.
  - 7. "piping" includes all pipe, fittings, valves, hangers, insulation, and other accessories relating to piping, and the labor to install same.
  - 8. "concealed" means hidden from view in chases, furred spaces, hung ceilings, embedded in construction, or buried underground. It is intended that all piping, equipment, and accessory items be concealed unless specifically indicated otherwise on the Drawings.
  - 9. "exposed" means "not concealed" as defined above. work in tunnels, crawl spaces, within cabinetry, or otherwise accessible to view shall be considered "exposed" unless specifically noted otherwise.
  - 10. "ductwork" means, in addition to ducts, all fittings, dampers, air control devices, hangers, flexible connectors and other accessories related to such ductwork.

#### 1.5 DRAWINGS

- A. Drawings are generally diagrammatic and are intended to convey the scope and general arrangement of the work. Deviations from the depicted arrangement shall be approved by the Architect.
- B. Location of items shown on the Drawings, or called for in the Specifications, not definitely fixed by dimension, are approximate only. Exact location necessary to secure the best conditions and serviceability shall be determined in the field and shall have the review of the Architect.
- C. Follow the Drawings in laying out the work. Check Architectural, Structural, and other trade Drawings to verify spaces available so that maximum head room and service access can be maintained. Where space conditions appear inadequate, notify Architect before proceeding with the work.
- D. Work on the Drawings is intended to be approximately correct to the scale of the Drawings. Figured dimensions and large scale details shall take precedence over layouts on smaller scale Drawings. Dimensional information shall be taken only from the Architectural or Structural Drawings and details.
- E. Typical details shall apply to each and every occurrence of the item. Drawings make use of symbols and schematic diagrams to indicate and define various items of work. These have no dimensional significance, nor do they necessarily delineate each and every item required to make the work complete. Work shall be installed according to the diagrammatic intent of the Drawings, in conformity with the applicable dimensions, and as required by the finally approved shop and fabrication drawings.
- F. No interpretation shall be made from the limitations of symbols and diagrams that any necessary element or work has been excluded.
- G. If directed by the Architect or Owner, make reasonable modifications in the layout of the work to avoid conflict with work of other trades or for better execution of the work.
- H. Refer to Drawings and Specifications of all other trades to ascertain if any items provided or installed therein require work under this Division so that the final installation will be a complete job, ready for operation, completely coordinated and interconnected. It is understood that indication of any item on the Drawings or in the Specifications carries with it the instruction to furnish and install completely, regardless of whether this instruction is explicitly stated.
- I. No statement in Drawings or Specifications, or any omission in either should be misunderstood as relieving the Contractor from providing a complete job. No inclusion, exclusion or limitation in the language of the Drawings or Specifications shall be interpreted as meaning that any required item or accessory necessary to complete any required system is omitted.
- J. The use of words in the singular shall not be considered as limiting where other indications allude to more than one item being needed.

#### 1.6 VISITING THE SITE

- A. Prior to submitting a bid, visit the site of the work, inspect the Existing Building and conditions so as to determine if these conditions will affect the work. Bidders are cautioned that they will be held responsible for any assumptions made regarding existing conditions.

#### 1.7 SUBSTITUTIONS

- A. Within thirty (30) days after Award of Contract, submit to the Architect for review a list of manufacturers of all materials and equipment proposed for use on the project. Indicate on submittal which items are substitutions.
- B. A review, without exception, of this list does not constitute approval, nor does it guarantee acceptance of the shop drawings when submitted.
- C. The Contractor's intent to purchase the exact make specified does not relieve him from the responsibility to submit this list. Failure to submit this list will require the Contractor to supply the exact item specified as the basis for design.
- D. Submittal of items which differ from those specified or indicated as the basis for design carries the implicit guarantee that the substituted item will provide the intended service and is compatible with other items or systems interfacing with it.
- E. When proposing a substitute item, the Contractor shall be responsible for all costs of accommodating the substitution, including, but not limited to, space and accessibility, modifications required to other systems, structural adequacy and the like.
- F. If substitutions require the Architect or Engineer to prepare sketches or revised drawings in order to become acceptable, the cost of such sketches, drawings, or engineering shall be borne by the Contractor.
- G. When substitutions require Engineer or Architect to spend an inordinate time for review of substitutions, the cost of review over four (4) hours will be charged to the Contractor who made the submittal.

#### 1.8 SHOP DRAWINGS

- A. After acceptance of List of Manufacturers required under paragraph 1.07(A) of this Section, and prior to delivery of materials and equipment to the project site, submit nine (9) copies of shop drawings of each item for review by the Architect.
- B. Each submittal shall contain a complete list of all materials contained within. Include intended use for each item.
- C. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature and complete characteristics of equipment, including, but not limited to, dimensions, capacity, code compliance, motor and drive and testing, construction, electrical characteristics, support, all as required for this project.
- D. Architect may designate submittal of physical samples for review on items where actual color, texture or other characteristics might not be adequately described by a drawing or written material. Upon approval of a sample, each and every item of that sort must be

identical to the approved sample.

- E. Certified performance curves shall be submitted for all fan and pumping equipment. Certified ratings shall be submitted for all operating equipment.
- F. Samples, drawings, specifications, catalogs, etc., submitted for review shall be labeled indicating specific service for which material or equipment is to be used, Section and Article Number of Specification governing, Contractor's name and name of project.
- G. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the Contractor from his responsibility of furnishing material or performing work according to Contract Documents.
- H. Failure to submit shop drawings in ample time for checking shall not be cause for an extension of Contract Time, and no claim by reason of such default will be allowed.
- I. Submittals for all systems which require the interconnection of three or more devices shall include a system block diagram. The diagram shall be of the one line type and with sufficient detail to show interfaces and method of operation.
- J. Material or equipment installed prior to review shall be liable for removal and replacement at no extra charge to the Owner if the material or equipment does not meet the intent of Drawings and Specifications.

#### 1.9 EQUIPMENT AND MATERIALS

- A. Equipment and materials furnished or required shall be new, without blemish or fault. Equipment shall bear labels attesting to approval by Underwriters Laboratories, AGA, or other recognized testing laboratory where specified or required to have such approval.
- B. Where no specific indication as to type or quality is indicated, a first-class article shall be furnished.
- C. All equipment of a type shall be products of a single manufacturer.
- D. Each item shall bear the manufacturer's nameplate showing name, ratings, model numbers and serial numbers. Nameplates of suppliers or distributors will not be acceptable.
- E. Provide line sized valves and unions or flanges on each pipe connection to items of equipment requiring piped connections.

#### 1.10 RECORD DRAWINGS

- A. Obtain from the Architect a clean set of blue-line prints of the work and during construction indicate any deviations in routing, arrangement, elevation or size thereon.
- B. "As-Built" drawings shall be kept up to date concurrently with the execution of the work and

turned over to the Architect for review and approval at the conclusion of the project. Failure to keep up to date on these drawings will require the Contractor to reconstruct his installations, make whatever investigations to accurately locate the installed work are needed, even if he has to cut into finished construction. All costs for this work shall be borne by the Contractor who failed to keep "as-built" drawings up to date.

- C. These drawings shall indicate the exact location and elevation of all utilities, sewers under floor slabs or buried on the site. Dimensions shall refer to the finished walls of the building or to finished grade or floor level. Include, as well, the final location of ducts and pipes concealed in chases, walls or above permanent ceilings.
- D. The location of all valves and cleanouts shall be indicated by dimension.

#### 1.11 LAWS, ORDINANCES, CODES, PERMITS, FEES AND REGULATIONS

- A. Give all necessary notices, obtain all permits, pay all taxes and fees in connection with the work. File all Contract Documents, prepare documents and obtain all approvals of governmental departments having jurisdiction over the work. Obtain Certificates of Inspection and deliver to Architect before Application for Final Payment.
- B. Materials and workmanship shall comply with the rules and regulations of the National Board of Fire Underwriters, applicable Building and Life Safety Codes, the requirements of Boards of Health, Fire Insurance Rating Organizations, Local and State Fire Marshal, and the requirements of all governmental departments having jurisdiction. If contract requirements are in excess of the minimum standards of Codes, the Contract Provisions shall apply.
- C. Provide complete, working utility connections as described in 1.01 (D) above.

#### 1.12 ROYALTIES AND PATENTS

- A. Pay all royalties and defend all suits and claims for infringement of any patent rights and save the Owner harmless on account thereof.
- B. If it is observed that a process or article specified is an infringement of a valid patent, promptly notify the Architect in writing. If work is performed knowing it is an infringement of a patent, all costs arising therefrom shall be borne by the Contractor.

#### 1.13 STANDARD REFERENCES

- A. Certain items may be specified or indicated by reference to recognized standards. These may include the following:

AGA	American Gas Association API American Petroleum Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials

AWS	American Welding Society
AWWA	American Water Works Association
AMCA	Air Moving and Conditioning Association
NBFU	National Board of Fire Underwriters
SBI	Steel Boiler Institute
IBR	Institute of Boiler and Radiator Manufacturers
STI	Steel Tank Institute
NACR	National Association of Corrosion Engineers
NEC	National Electrical Code
ETL	Electrical Testing Laboratories
NEMA	National Electrical Manufacturer's Association
PFMA	Power Fan Manufacturer's Association
UL	Underwriters Laboratories, Inc.
NFPA	National Fire Protection Association
FM	Factory Mutual Insurance Company
IRI	Industrial Risk Insurers
AABC	Associated Air Balance Council
IAPMO	International Association of Plumbing and Mechanical Codes

- B. The particular standard referred to shall be the latest legally defined revision to that standard.

#### 1.14 INTERPRETATION OF PLANS AND SPECIFICATIONS

- A. Questions or disagreements arising as to interpretation of the intent of the Contract Documents, or the kind and quality of work required, shall be decided by the Architect whose interpretation shall be final, conclusive, and binding.

#### 1.15 PROCEDURE OF WORK

- A. Work shall proceed in a planned, orderly manner as approved by the Architect.
- B. Procedure and scheduling of the work shall be coordinated with other trades as approved by the Architect, and may be adjusted from time to time to meet job conditions.

#### 1.16 CHANGES TO THE WORK

- A. During the progress of the work, the Architect may make changes, alterations, additions or deletions to the drawn or specified work after having agreed to an equitable allowance to be added or deducted from the contract price.
- B. Claims for extra cost to cover extra work will not be allowed unless specifically authorized in writing by the Architect prior to the execution of such additional work.

#### 1.17 COORDINATION OF TRADES

- A. Cooperate with other trades in the interchange of information and requirements in a timely manner.
- B. Participate in preparation of Project Coordination Drawings as more fully described in 1.01

(E), above.

1.18 PROTECTION OF WORK AND PROPERTY

- A. Be responsible for maintaining and protecting equipment and materials stored or installed at the project site, from loss or damage of all causes, until final acceptance by Owner.
- B. Be responsible for protection of finished work of other trades from damage or defacement caused by operations. Remedy all such damages at no cost to Owner.
- C. New roof penetrations shall conform with the existing roof system manufacturer's requirements. Provide documentation from the existing roofing system manufacturer at the completion of the project to indicate the integrity of roofing system has been maintained, and that the roof warranty is in force for the remaining warranty period. Provide all material, labor, testing and expenses necessary to satisfy the roofing system manufacturer's requirements so to maintain the Owner's roof bond.

1.19 CUTTING, PATCHING, PAINTING, EXCAVATING AND BACKFILLING

- A. Cutting, patching, painting, excavating and backfilling shall be done under other Divisions unless specifically noted otherwise.
- B. Make sure that sleeves are set, chases and openings provided for, and trenching requirements are established so not to delay progress of the project.
- C. Failure to provide information to other trades making it necessary to cut or patch finished work shall be cause for the cost of the cutting and patching to be borne by the Contractor failing to provide the information.

1.20 TEMPORARY OPENINGS

- A. Determine if any temporary openings will be required for admission of equipment or materials and notify the Architect of these requirements.
- B. Failure to give sufficient notice to arrange for these openings shall result in this Contractor's assumption of all costs associated with making and repairing such temporary openings.

1.21 PIPE EXPANSION

- A. Install piping systems to allow for freedom of movement during expansion and contraction without springing. Provide swing joints, expansion joints, loops, or compensators, complete with guides, where necessary to allow for expansion or contraction.

1.22 INSTRUCTION BOOKS AND OPERATING INSTRUCTIONS

- A. Furnish three (3) sets of Operating and Maintenance Manuals in hard cover covering all Mechanical Systems in the project. Include manufacturer's approved submittal of each item. Submit for review of Architect.

- B. Manuals shall contain, as a minimum, the following:
    - 1. Description of the project and major sub-systems.
    - 2. Descriptive text covering the filling, purging, starting, and adjusting of each system, and procedures for shutting down and making systems secure.
    - 3. Copies of all valve tag lists and equipment schedules.
    - 4. Copies of all control system diagrams and description of operation.
    - 5. A schedule of maintenance based on the manufacturer's recommendations, showing what work is to be performed and at what intervals.
    - 6. Copies of the finally approved submittal for each item, together with the manufacturer's installation, operation, and maintenance instructions and parts lists.
    - 7. List of Firm names, addresses, telephone numbers to be contacted for regular or emergency service, or purchase of parts.
  - C. Manuals shall be arranged in one or more three-ring binders, completely indexed as follows:
    - 1. General information; Items 1, 2, 3, & 7 above.
    - 2. Control system information; Item 4.
    - 3. Approved submittal, maintenance, and parts information; Items 5 & 6.
    - 4. Each Section shall be identified by a permanent index tab.
    - 5. Each item within a major Section shall be separately indexed for quick reference.
  - D. Provide adequate written and/or verbal instructions to the Owner's operating personnel and such others as the Owner may designate. As a minimum, provide for three (3), eight hour working days of instructions. Individual equipment or systems may require additional or different periods of instruction.
- 1.23 ACCESSIBILITY
- A. Install work so that all parts are readily accessible for inspection, maintenance and service.
  - B. Locate connections, valves, unions, strainers, etc. so as to be readily accessible.
  - C. Where items are located in non-access spaces (ceilings, tunnels, chases), provide approved access doors or panels. Group items requiring access to limit the number of access points.
  - D. Access doors shall have the same fire rating as the wall, floor, or ceiling involved. Doors shall be of size required, but no less than 12" X 12" minimum size. Access doors shall be

delivered to the Contractor for installation.

#### 1.24 ELECTRICAL WORK FOR MECHANICAL TRADES

- A. Each trade supplying electrically operated equipment for installation and wiring under Division 16 shall furnish sufficiently detailed information and wiring diagrams in a timely manner.
- B. Equipment including a number of electrical items in a single enclosure or a common base shall be supplied internally wired as a unit to numbered terminals.
- C. Electrical devices having a mechanical element such as a float valve, pressure switch, etc., shall be installed and mechanically connected under this Division and left ready for wiring under Division 16.

#### 1.25 MOTORS AND MOTOR CONTROLS

- A. Motors shall conform to all applicable regulations and be suitable for the load, duty, voltage characteristics, service, and location intended.
- B. Unless otherwise specified, motors shall be rated for continuous duty at rated service factor with a temperature rise not exceeding NEMA standards. Motors shall be able to withstand momentary overloads of 125% of rating without damage or overheating.
- C. Motors 1/3 HP and smaller shall be capacitor start, capacitor run or permanent split capacitor type, designed to run at 120 volts, 1 phase, 60 hertz.
- D. Each trade furnishing motor driven equipment shall provide an approved starting device and deliver same to electrical Contractor for installation and wiring.
- E. Single phase motor starters shall be manual "TT" type toggle switch with melting alloy overload device, unless otherwise indicated.
- F. Polyphase motor starters shall be solid state type soft start equivalent to Allen-Bradley SMC-Flex. The starter shall include electronic overload, integral bypass, modular communication capabilities, motor starting capabilities for both star-delta and standard squirrel-cage induction motors, advanced protection and diagnostics in a compact, maintainable, modular package. The bypass minimizes heat generation during run time and automatically closes when the motor reaches its nominal speed. Features shall include built-in SCR bypass/run contactor, built-in electronic motor overload protection, CT on each phase, metering, LCD display, keypad programming and four programmable auxiliary contacts. Starters shall meet and have the approval of the following standards: UL 508, EN/IEC 60947-4-2, CE Marked (open type) per EMC Directive and Low Voltage Directive. The following are the modes of operation to be provided: Soft Start. Selectable kick-start, current limit start, dual ramp start, full voltage start, linear speed acceleration, preset slow speed, and pump control-start & stop. The starter shall provide the following motor control features: electronic motor overload protection, stall protection and jam detection, underload protection, undervoltage protection, overvoltage protection, voltage unbalance protection, excessive start protection. The starter shall meter current for each phase, power factor, voltage for each phase, motor thermal capacity usage, power in KW,

elapse time and power usage in kWh. A serial interface port shall allow connection to a Bulletin 20 Human Interface Module.

- G. Single phase motors requiring automatic control interlocking shall be solid state type soft start having the same requirements as polyphase motor starters.
- H. Provide, for each starter requiring automatic control, one normally open and one normally closed auxiliary contact.
- I. All motor starters shall be furnished in NEMA 1 enclosure with reset button in cover unless otherwise indicated elsewhere.
- J. Certain large or special purpose motors may require reduced voltage starting. In this case, the appropriate section of the equipment specifications will give complete specifications on the type of motor controller required.
- K. All motor starters being automatically controlled shall be provided with a fused control circuit transformer, 120 or 24 volts as required by control system. Control circuit transformers shall also be provided in all starters operating at line voltages over 250 volts, whether or not automatically controlled.
- L. Provide premium energy efficient motors. Motor name plates shall indicate the nominal efficiency per NEMA Standard MG-12.54. Minimum efficiency shall be as follows:

1. Open Drip Proof (ODP)

Motor Size Horsepower	Speed (RPM)		
	1,200	1,800	3,600
1	82.5	85.5	77.0
1.5	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7.5	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2
20	92.4	93.0	91.0
25	93.0	93.6	91.7
30	93.6	94.1	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6
75	94.5	95.0	93.6
100	95.0	95.4	93.6

125	95.0	95.4	94.1
150	95.4	95.8	94.1
200	95.4	95.8	95.0

2. Totally Enclosed Fan Cooled (TEFC)

Motor Size Horsepower	Speed (RPM)		
	1,200	1,800	3,600
1	82.5	85.5	77.0
1.5	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5
7.5	91.0	91.7	89.5
10	91.0	91.7	90.2
15	91.7	92.4	91.0
20	91.7	93.0	91.0
25	93.0	93.6	91.7
30	93.0	93.6	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6
75	94.5	95.4	93.6
100	95.0	95.4	94.1
125	95.0	95.4	95.0
150	95.8	95.8	95.0
200	95.8	96.2	95.4

1.26 TESTS

- A. Test all piping and equipment as required by the various Sections of the Specifications.
- B. Tests to be witnessed by and be to the satisfaction of the Architect or his designee, and others having legal jurisdiction.
- C. Pressure tests shall be applied to piping before insulating and before connecting to equipment having pressure ratings lower than the test pressure.
- D. Work shall be tested, repaired, and retested until an approved test is achieved.
- E. Damages caused by testing or failure of a test shall be repaired to the satisfaction of the Architect, at no cost to the Owner.
- F. In general, piping systems shall be tested to 150% of the maximum expected operating or surge pressure, or 125 psi, whichever is greater. Utility connections shall be tested in accordance with the Utility's requirements.
- G. Completed systems shall be tested to demonstrate proper operation, capacity, and acceptable noise and vibration levels. Insofar as possible, systems normally operated during certain seasons of the year shall be tested during that season.

- H. Costs for all testing shall be borne by the appropriate Contractor.

#### 1.27 QUIET OPERATION

- A. Fans and motors shall be isolated from the building structure by approved means. Noise and hum of equipment shall be absorbed or attenuated so as not to be objectionable.
- B. Where noise or vibration levels are considered objectionable by the Architect, they shall be corrected at no additional cost to the Owner.

#### 1.28 USE OF INSTALLATION BY OWNER

- A. Owner shall have the privilege of using any part of the work when sufficiently complete, but such use shall not be considered as an acceptance of the work in lieu of a written certificate from the Architect.

#### 1.29 CLEANUP

- A. Piping, ducts and equipment shall be thoroughly cleaned, inside and out, before being placed into operation.
- B. Any stoppage in a system shall be removed and any work damaged in the course of such removal shall be restored to its original condition at no additional cost to the Owner.
- C. Keep site free from accumulation of waste materials or rubbish. Periodically clean work areas. At conclusion of work remove all tools, construction equipment, surplus materials from the site and leave in clean condition.

#### 1.30 GUARANTEE AND SERVICE

- A. Guarantee all work to be free from defects in workmanship and/or materials and that all apparatus will achieve the capacity and characteristics specified. If during the period of One (1) Year (or other term specified elsewhere) from certificate of completion of the work, defects appear, remedy such defects without cost to the Owner. In default thereof, the Owner may have such corrective work done and charge the cost to the Contractor. Indemnify Owner for property damage which might result from such a defect which made repairs necessary.
- B. Certain equipment will require guarantee periods exceeding one year due to the need for seasonal operation. In such case, the guarantee period shall extend through one, complete, continuous operating season.
- C. Air conditioning compressors shall be furnished with the Manufacturer's Extended Warranty covering five (5) years from date of project acceptance. Deliver warranty certificate to Owner's authorized representative.

#### 1.31 INSURANCE

- A. Fully insure all employees, material and finished work as required by the General

Conditions of the Contract.

1.32 SCAFFOLDING, RIGGING, HOISTING

- A. Unless otherwise indicated, the work of each Section shall include all scaffolding, rigging, hoisting and services necessary to deliver, install, erect in place all items of equipment. Remove such handling materials when no longer needed.

END OF SECTION 15010

## SECTION 15100 - BASIC MATERIALS & METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SCOPE OF WORK

- A. This Section describes various basic materials and equipment for use in the Project's Mechanical Systems.
- B. Refer to the Schedules at the end of this Section for the selection of vibration isolation, piping systems and valves applicable to this Project.
- C. Work included under this Section shall include, but not be limited to: Piping and fittings, ductwork, valves, backflow preventers, hangers, supports, sleeves, fire stopping systems, mechanical identification, seismic bracing, vibration isolation, ductwork access doors, volume dampers, fire dampers, and combination fire/smoke dampers.
- D. Coordination utilizing ductwork erection drawings.

#### 1.3 RELATED WORK

- A. This Section is to be used in conjunction with the provisions of all other Sections of Division 15, especially Section 15010, General Provisions - Mechanical.
- B. Refer also to any applicable portions of Division 16, Electrical Work.

#### 1.4 SUBMITTALS

- A. Provide submittals for review in accordance with the provisions of Section 15010.
- B. Submit manufacturers installation instructions under Section 15010.
- C. Submittals are required for the following:
  - 1. Schedule of valve types proposed for each scheduled service.
  - 2. Schedule of pipe and fitting types proposed for each service scheduled.
  - 3. Schedule of vibration isolation for each unit and service scheduled.

- D. Submit a shop drawing indicating vibration isolator locations, with static and dynamic load on each isolator and description of product data.
- E. Submit shop drawings and samples of duct fittings, including particulars such as gage sizes, welds, sealants, and configurations prior to start of work.

#### 1.5 QUALITY ASSURANCE

- A. All items provided under the provisions of this Section shall be new, of domestic manufacture, and shall be the products of recognized manufacturers of that item.
- B. All items of a similar class shall be the products of the same manufacturer. That is, all valves, all accessory items, etc. shall be from the same source.
- C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- D. Welding Materials and Procedures: Conform to ASME Code and applicable State labor regulations.
- E. Employ licensed welders in accordance with Connecticut Occupational Licensing Act.
- F. Supports for Sprinkler Piping: In conformance with NFPA 13.
- G. Supports for Standpipes: In conformance with NFPA 14.

- H. Maintain ASHRAE criteria for average noise criteria curves for all equipment at full load condition for selection of vibration isolators.
- I. Firestopping shall conform to ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- J. Cleaning of inlet and outlets shall conform with The National Air Duct Cleaners Association's Standard - Mechanical Cleaning of Non-Porous Air Conveyance System Components.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The following describes the requirements and materials for various items included in the Project's Mechanical systems.
- B. It should be noted that this particular Project may not include all of the items listed. Refer to the Valve and Materials Schedules at the end of this Section for those items specific to this Project.

### 2.2 PIPE AND TUBING

Schedule at end of this Section will refer to required types of pipe or tubing by letter designation according to the following list:

- A. Steel, Black & Galvanized; ASTM A-53 or A-120; Plain or threaded ends. Each length mill coated and capped.
- B. Copper Tube; Types K, L, M, and DWV, seamless. Shall be of domestic origin. Contractor shall provide certificate of origin for all copper tube used for potable water system.
- C. Stainless Steel; Type 304/304L, Schedule 5S, ASTM A312, EFW. Full finish annealed pipe with plain ends.
- D. Plastic; Polyvinyl Chloride (PVC), ASTM D1785, Weight as scheduled.
- E. Plastic; Chlorinated Polyvinyl Chloride (CPVC), ASTM D1784, Weight as scheduled.
- F. Cast Iron; Standard or Extra Heavy weight, tarred, plain or bell ends as scheduled. G. Cast Iron; Ductile Iron, cement lined, AWWA/ANSI C151, Class as scheduled.
- H. Ductile iron, cement lined, AWWA C150-81, minimum working pressure 150 psi.
- I. Steel, Black & Galvanized; ASTM A-53 or A-120; Plain or threaded ends. Each length mill coated and capped.

- J. Corrugated Stainless Steel Tubing (CSST), ANSI LC-1 "Standard for Fuel Gas Piping Using Corrugated Stainless Steel Tubing (CSST)", and carrying listing by CSA International, ICC Evaluating Services and IAPMO research & Testing. Materials to be corrugated stainless steel tubing manufactured from ASTM A240 type 304 stainless steel with a minimum nominal wall thickness of 0.010 inches. Tubing jacket to be UV resistant polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density. All mechanical tube fittings are to be manufactured from ASTM B16 type 360 brass whose design incorporates a double wall flare for gas-tight sealing and mechanical capture of the jacket for enhanced tubing protection.

### 2.3 PIPE FITTINGS

Schedule at end of this Section will refer to required types of pipe or tubing fittings by letter designation according to the following list:

- A. Cast Iron Steam Pattern, threaded fittings, weight as scheduled.
- B. Malleable Iron, threaded, ANSI/ASME B16.3, weight as scheduled
- C. Forged Steel, welding ends, FS WW-P-521, for butt welding.
- D. Wrought Copper, solder joint, pressure fittings, ANSI/ASME B16.22.
- E. Wrought Copper and Wrought Copper Alloy, solder joint drainage fittings, ANSI/ASME B16.29.
- F. Mechanical joints and fittings for hard copper tubing systems: Victaulic fittings shall be manufactured from wrought copper ANSI/ASME B16.22 or bronze castings ANSI/ASME B16.18, manufactured to copper tube dimensions, with grooved ends designed to accept Victaulic couplings. (Flaring of tube or fitting ends to IPS dimensions is not allowed).
- G. Stainless steel fittings, precision, cold drawn, austenitic stainless steel, type 304/304L, with elastomer O-ring seals. (UL classified in accordance with ANSI/NSF-61 certified for hot and cold potable water service.)
- H.. Cast Iron Soil Pipe Fittings, for hubless pipe, sanitary service, CISPI #301.
- I. Cast Iron Soil Pipe Fittings, for bell end pipe, with gasketed joints, ASTM C564.
- J. Ductile iron fittings, AWWA C110-87.
- K. Ductile Iron Fittings for Gasketed Joints, ANSI/AWWA C111.
- L. Flanged, Ductile Iron Fittings for mechanical joints on water service piping.
- M. Mechanical joints and fittings for steel piping systems, Victaulic, or engineer approved equal. Fittings shall be manufactured of ductile iron conforming to ASTM A536; wrought steel conforming to ASTM A234; or factory fabricated from carbon steel pipe conforming to ASTM A53; with standard or AGS grooved ends designed to accept Victaulic couplings.

- N. Press fittings for copper and copper alloy piping systems, Viega, or engineered approved equal. Fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing element for press fittings shall be EPDM. Sealing elements shall be factory installed or alternatively supplied by the fitting manufacturer. Press end shall have Smart Connect (SC) feature design, which functions to provide the installer a quick and easy identification of connections which have not been pressed prior to putting the system into operation.

## 2.4 UNIONS AND COUPLINGS

- A. Pipe Size 2 inches and Under: 150 psi malleable iron for threaded ferrous piping; bronze for copper or brass pipe soldered joints, or 300 psi stainless steel threaded type with Vic-Press 304 ends for stainless steel pipe.
- B. Pipe Size Over 2 inches: 150 psi forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; synthetic rubber gaskets for gas service; 1/16 inch thick preformed synthetic rubber bonded to asbestos elsewhere.
- C. Grooved and Shouldered Pipe Ends: Ductile iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion where required; composition sealing gasket, steel bolts, nuts and washers; galvanized couplings for galvanized pipe.

### 1. IPS Steel Piping:

#### a. 2" through 12":

- 1) Rigid Type: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

a) 2" through 8": "Installation Ready" stab-on rigid coupling designed for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Gasket shall be Grade "EHP" EPDM with maximum temperature rating of +250°F (UL listed and ANSI/NSF-61 certified for hot and cold potable water service). Victaulic Style 107 "QuickVic™".

b) 10" and 12": Standard rigid coupling with Grade "E" EPDM gasket with a maximum temperature rating of +230°F (UL listed and ANSI/NSF-61 certified for hot and cold potable water service). Victaulic Style 07.

- 2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration. Victaulic Style 77.

- 3) Flange Adapters: Flat face, for direct connection to ANSI Class 125, 150, or 300 flanged components. Victaulic Style 741 or 743.

#### b. 14" through 24": Victaulic AGS Series with lead-in chamfer on housing key, flat bolt pads, and wide width gasket, Grade "E" EPDM, FlushSeal® design (UL listed and ANSI/NSF-61 certified for hot and cold potable water systems).

- 1) Rigid Type: Provides rigidity and system support and hanging in accordance

with ANSI B31.1 and B31.9. Victaulic Style W07.

- 2) Flexible Type: Allows for linear and angular movement, vibration isolation and stress relief. Victaulic Style W77.
- 3) Flange Adapter: Flat face, ASTM A536 ductile iron, Class 125/150 bolt-hole pattern, AGS grooved end pipe. Victaulic Style W741.

2. Hard Copper Tube:

- a. 2" through 8": "Installation Ready" rigid coupling designed for direct 'stab' installation onto roll grooved copper tube without prior field disassembly and no loose parts. Housings shall be cast with offsetting, angle-pattern, bolt pads coated with copper colored alkyd enamel. Gasket shall be Grade "EHP" EPDM with a maximum temperature rating of +250°F (UL listed and ANSI/NSF-61 certified for hot and cold potable water service), and plated steel bolts and nuts. Victaulic Style 607 "QuickVic™".
- b. Copper flange adapters will be cast of ductile iron coated with copper-colored enamel, flat face, for engaging into roll grooved copper tube and fittings and bolting directly to flanged with ANSI Class 125 and 150 bolt-hole patterns. Victaulic Style 641.

2.5 VALVES

Unless otherwise indicated, use valves suitable for 125 minimum psig WSP and 450 F. Valves for fire protection suitable for 175 psig WOG, UL approved. Grooved end valves shall be suitable for 300 psig CWP, UL approved.

A. Valve Connections:

1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use valves of full pipe line size.
2. Thread pipe sizes up to 2 inches.
3. Flange pipe sizes over 2 inches.
4. Solder end, grooved end, or push-to-connect valves on copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use Vic-Press 304 end valves with stainless steel piping up to 2 inches.

B. Rated Gate, Globe, Check Valves:

1. Gate Valves: Bronze, rising stem, inside screw, solid wedge, solder or screwed ends. Iron body, bronze trim, rising stem, OS&Y, solid wedge, flanged ends.
2. Globe Valves: Bronze, rising stem, inside screw, composite renewable disc, solder or screwed ends. Iron body, rising stem, bronze trim, OS&Y, renewable composition disc, flanged ends.
3. Check Valves:
  - a. Bronze, swing disc, solder or screwed ends. Iron body, bronze trim, spring loaded, renewable composite disc, flanged ends.
  - b. Bronze, lift disc, push-to-connect ends, spring loaded, 301 stainless steel disc. Victaulic PermaLynx™ 510 Series.
  - c. Ductile iron, spring-assisted, aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft, PPS coated or welded-in nickel seat,

grooved ends. Victaulic Series 716 or Series 779 with Venturi taps for flow measurement accuracy.

- d. Ductile iron, spring-actuated, stainless steel dual disc, with stainless steel spring and shaft, EPDM seat, AGS grooved ends. Victaulic Series W715.

C. Ball Valve:

1. Bronze body and brass ball, push-to-connect, solder or screwing rods.
2. Forged brass body, chrome-plated brass ball and brass stem, PTFE seat rings, push-to-connect ends. Victaulic PermaLynx™ 300 Series.
3. Forged brass body, chrome plated brass ball and stem, TFE seats and Vic-Press 304™ ends. Victaulic Series 589.
4. Ductile iron body, chrome plated steel ball and stem, TFE seats and grooved ends. Victaulic Series 726.

D. Butterfly Valves:

1. IPS Size:
  - a. Ductile iron body, offset electroless nickel plated ductile iron disc, offset, providing 360-degree continuous seating, pressure responsive EPDM seat, 416 stainless steel stem and TFE lined fiberglass bearings. Victaulic Vic-300 MasterSeal™.
  - b. PPS coated ductile iron body, offset PPS coated ductile iron disc and seat, disc mounted seal, 17-4PH hardened stainless steel stem and reinforced PTFE bearings. Victaulic Vic®-300 AGS.
2. Hard Copper Tube: Cast bronze body, elastomer encapsulated ductile iron disc, with integrally cast stem, and copper-tube dimensioned grooved ends. Victaulic Series 608.

E. Cocks and Plug Valves:

1. Iron body, brass plugs and washers, air tested, solder or screwed ends. Iron body and plug, pressure lubricated type, flanged ends.
2. Ductile iron body, elastomer encapsulated ductile iron plug, eccentric non-lubricated type with stainless steel backed TFE self-lubricating bearings, and grooved ends. Victaulic Series 377.

F. Drain Valve

1. Bronze or red brass, replaceable disc, hose spout end, chrome plated where installed exposed.
2. Non-freeze type with polished bronze recessed box, hose thread spout, removable key. Length to place seat completely within building.

G. Reduced Pressure Backflow Preventer:

1. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013 (AWWA C506); bronze body, two independently operating, spring loaded check valves. Diaphragm type differential pressure relief valve located between check valves; assembled with two gate valves, strainer, and test cocks. Backflow preventer shall be Model #909 as

manufactured by Watts.

2. Double Check Valve Assembly: ANSI/ASSE 1012 (AWWA C506); bronze body with corrosion resistant internal parts and stainless steel springs, two independently operating check valves. Valve assembly shall be Model #709 as manufactured by Watts.

## 2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gage galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with Schedule 40 steel pipe.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Schedule 40 steel pipe.
- D. Sleeves for Round Ductwork: Form with galvanized steel.
- E. Sleeves for Rectangular Ductwork: Form with galvanized steel.

## 2.7 FIRESTOPPING SYSTEMS

- A. Provide material/system classified by UL to provide firestopping equal to time rating of construction being penetrated.
- B. Firestopping system shall not emit toxic or combustible fumes, and be capable of maintaining an effective barrier against flame, smoke water and toxic gases in compliance with ASTM E-814 under their designation of UL 1479.
- C. Firestopping systems shall be flexible to allow for normal movement of building structure and penetrating items without affecting the adhesion or integrity of the system.
- D. Stuffing and Fire Stopping Insulation: Glass fiber type, non-combustible.
- E. Firestop Sealant: An adhesive, one-part, silicone based, elastomeric sealant.
- F. Intumescent Wrap: An aluminum foil-backed intumescent strip for plastic pipe, insulated pipe or other combustible penetrating items.
- G. Damming Material: Adhesive filling and sealing foam, fire-resistant mineral fiber.

## 2.8 PIPE AND EQUIPMENT SUPPORTS

- A. Hangers for Pipe Sizes ½ to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 5 Inches and Over: Adjustable steel yoke, cast iron roll, double rod hanger.

- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
- E. Wall Support for Pipe Sizes ½ to 2 Inches: Welded steel bracket and wrought steel clamp; adjustable clevis.
- F. Vertical Support: Steel riser clamp, adjusting screws sizes 4 inches and larger.
- G. Floor Support for Pipe Sizes 2-1/2 to 5 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- H. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- I. Copper Pipe Support: Carbon steel clevis, adjustable, copper plated.
- J. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.
- K. Shield for Insulated Piping 2-1/2 Inches and Larger (Except Cold Water Piping): Pipe covering protective saddles.
- L. Shields for Insulated Cold Water Piping 2-1/2 Inches and Larger; Hard block non-conducting saddles in 90 degree segments, 12 inch minimum length, block thickness same as insulation thickness.
- M. Shields for Vertical Copper Pipe Risers: Sheet lead.

## 2.9 INSERTS

- A. Inserts: Malleable iron or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.10 HANGER RODS

- A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

## 2.11 IDENTIFICATION MATERIALS

- A. Unless specified otherwise, identification shall conform with ANSI/ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved white letters on dark contrasting background.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

- D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, performed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.
- E. Plastic Pipe Tape Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## 2.12 SEISMIC BRACING

- A. Bracing shall be fabricated from standard structural or trade sections.
- B. Attachments to masonry walls shall be by means of expansion shields and bolts.
- C. Attachment to building structure shall meet approval of Structural Engineer.

## 2.13 VIBRATION ISOLATION

- A. Type 1: Spring hanger rods based on Mason type PC30N hanger, shall incorporate the following:
  - 1. Vibration hanger shall be closed spring type with neoprene element in series with a steel spring separated from the housing with neoprene stabilizer.
  - 2. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the hole and short circuiting the spring.
  - 3. Springs shall be pre-compressed to the rated deflection to keep piping or equipment at a fixed elevation during installation. The hangers shall have a release mechanism to free the spring after the installation is complete.
  - 4. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
- B. Type 2: Spring isolators based on Mason type SLF isolator, shall incorporate the following:
  - 1. Reserve deflection from loaded to solid height of 50% of rated deflection.
  - 2. Minimum 1/4" thick neoprene acoustical base pad on underside.
  - 3. Spring diameters shall be no less than 0.8 of the compressed height of the spring of the spring at rated load.
  - 4. Non-resonant with equipment forcing frequencies or support structure natural frequency.
- C. Type 3: Spring isolator based on Mason type SLR, shall be the same as Type 2, except:
  - 1. Provide built-in vertical limit stops. Limit stops shall be out of contact during normal operation.
  - 2. Tapped holes in top plate for bolting to equipment.
  - 3. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be equal.
  - 4. Adjustable spring pack with separate neoprene pad isolation.

- D. Type 4: Spring hanger rod isolators based on Mason type HS, shall incorporate the following:
1. Spring element seated on a steel washer within a neoprene cup with a rod isolation bushing.
  2. Steel retainer box encasing the spring and neoprene cup.
- E. Type 5: Elastomer hanger rod isolators based on Mason type HD, shall incorporate the following:
1. Molded unit type neoprene element with projecting bushing lining rod clearance hole.
  2. Neoprene element to be minimum 1-3/4" thick.
  3. Steel retainer box encasing neoprene mounting.
  4. Minimum static deflection of 0.35".
- F. Type 6: Combination spring/elastomer hanger rod isolators based on Mason type DNHS, shall incorporate the following:
1. Spring and neoprene isolator elements in a steel box retainer. Neoprene of double deflection type. Spring seated in a neoprene cup with extended rod bushing.
  2. Characteristics of spring and neoprene as described in Type 2 and Type 5.
- G. Type 7: Elastomer mount isolators based on Mason type ND, shall incorporate the following:
1. Neoprene element, double deflection type.
  2. Maximum static deflection of 0.35".
  3. Threaded insert and hold down holes with cap screws and washer.
- H. Type 8: Pad type elastomer mountings based on Mason type Super W, shall incorporate the following:
1. 3/4" minimum thickness.
  2. Rubber pad, ribbed or waffled design. Use neoprene in oily or exterior locations.
  3. 50 psi maximum loading, 0.10" deflection per pad, 50 durometer.
- I. Type 9: Pad type elastomer mountings based on Mason type WSW, shall incorporate the following:
1. Steel shims cemented between 5/16" thick neoprene pads layered to achieve thickness.
  2. Ribbed or waffled design, 40 durometer.
- J. Type 10: Spring seismic restraint based on Mason type SSLFH, shall incorporate the following:
1. Characteristics of spring and neoprene isolator as described in Type 2.
  2. Snubbing shall take place in all modes with adjustment to limit travel to a maximum of 1/4" before contacting snubbers.
  3. Mountings shall have a minimum rating of 1G as calculated by a registered structural

- engineer.
4. All mountings shall have leveling bolts and be capable of supporting equipment at a fixed elevation during erection.
- K. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.
  - L. Provide color code spring mounts.
  - M. Select springs to operate at 2/3 maximum compression strain, with 1/4 inch ribbed neoprene pads.
  - N. Provide side restraint and/or snubbers in all horizontal directions where required for equipment installation.
  - O. Victaulic Style 75 or 77 flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. A minimum of three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

## 2.14 DUCTWORK

- A. Material:
  1. Ducts: Galvanized steel, lock-forming quality, having zinc coating of 1.25 ounces per square foot for each side.
  2. Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts. Gasketed clamping systems may be used provided they are rated for the pressure level of the system used on.
  3. Sealant: Water resistant, fire resistive, opaque, compatible with mating materials.
  4. Flexible Ductwork: Buckley Flexmaster Aluminum Triple-lock, UL Listed, Class 1 air duct with 1 inch thick fiberglass insulation and polyethylene jacket.
- B. Fabrication:
  1. Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks. Fittings shall conform to the configuration shown on the Drawings.
  2. Construct ductwork to NFPA 90A, NFPA 90B.
  3. Size round ducts installed in place of rectangular ducts from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
  4. Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 18 inches cross break for rigidity. Open corners are not acceptable.
  5. Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
  6. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows used, provide air foil type turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal type with glass fiber inside.
  7. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever

possible. Maximum total divergence upstream of equipment to be 30 degrees and 45 degrees convergence downstream.

8. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate, or sag. Calk duct joints and connections with sealant as ducts are being assembled.
9. Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.
10. Provide necessary baffling in mixed air chambers to insure good mixing of recirculated and outside air streams.
11. Ensure all seams and joints are air tight. Provide gasketed connections between joints or seal with approved duct sealing compound equivalent to EC800. Sealant shall not be of clear, transparent type, but shall have a distinctive color so as to be readily visible.

C. Duct Gages:

1. Low Pressure Ducts: Medium gages for metal. Add cross bracing, angle stiffeners, etc. where recommended by SMACNA.

Maximum Width In Inches	Minimum USS Gage Steel	Minimum US Gage Aluminum
Up to 12	26	24
13 to 30	24	22
31 to 54	22	20
55 to 84	20	18
85 to 120	18	16

2. Medium Pressure Ducts: One gage heavier than for Low Pressure, or as specified in SMACNA and ASHRAE Standards.

2.15 DUCTWORK ACCESSORIES

A. Access Doors

1. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
2. Provide two hinges and two sash locks for sizes up to 18 inch square, two hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inch. Provide an additional hinge for larger sizes.

B. Dampers

1. Fabricate of galvanized steel, minimum 16 gage and provide with quadrants or adjustment rod and lock screw.
2. Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume pro-

portioning. Use of splitter dampers is to be avoided. Use manual volume dampers in both branches wherever possible.

3. Fabricate single blade dampers for duct sizes to 8 x 18 inch.

C. Flexible Connections

1. Fabricate of neoprene coated flameproof fabric approximately 2 inch wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 6 inch intervals.

D. Fire Dampers

1. Fabricate low resistance fusible link fire dampers in accordance with Connecticut Basic Building Code, NFPA-90A and UL approved procedures. Each fire damper shall possess a 1-1/2 hour standard fire rating and shall bear the UL label attesting to this.
2. Fire damper shall meet all UL and NFPA requirements for primary fire dampers, and shall be approved for use where ducts penetrate partitions with resistance ratings of two hours or less, per UL Standard 555.
3. Construction: Frame shall be a 4-8/7" maximum constructed of 20 gauge minimum galvanized steel channel. Blades shall be curtain type constructed of 24 gauge galvanized steel. Provide a 212 F UL listed fusible link. Provide 165 F fusible links where directed.
4. Damper curtain shall be located out of the air stream.

E. Combination Fire Smoke Damper

1. Furnish and install at locations shown on plans, or as described in schedules, round combination fire/smoke dampers. Frames shall be a minimum of 20 gage galvanized steel and the blade shall be two piece of two piece, equivalent to 14 gauge minimum galvanized steel. Bearings shall be stainless steel sleeved turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450 F mechanically fastened and fully encompassing blade edge. Damper must have an integral 20 gauge sleeve and 20 gauge retaining plate for damper mounting.
2. Each combination fire/smoke damper shall be classified for use for fire resistance ratings of less than 3 hours, in accordance with UL standard 555, and shall further be classified by Underwriters Laboratories as a Smoke Damper for use in smoke control systems in accordance with the latest version of UL555S, and bear a UL label attesting to the same. The leakage rating under UL555S shall be leakage Class 1 (8cfm/sq. ft. at 4"w.g.).
3. The dampers and their actuators shall be qualified under UL555S to an elevated temperature of 250 F or 350 F depending upon the actuator. Appropriate electric actuators shall be install by the damper manufacturer at time of damper fabrication. Electric actuators shall be rated for energized hold open position periods of 6 months or more. Damper and actuator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators.
4. Each combination fire/smoke damper shall be equipped with a "controlled closure" quick detect heat-actuated release device to prevent duct and HVAC component damage. Instantaneous damper closure is unacceptable.
5. Each fire/smoke damper shall be Ruskin model FSDR25. Each fire/smoke damper

- shall have an EFL (Electric Fuse Link) device to permit controlled closure through the damper actuator. The EFL shall be 120 VAC and powered from a fused circuit.
6. Each fire/smoke damper shall be operated by the building's fire alarm system and powered by a local 120 volt source, both provided by Division 16. Electrical Drawings for the Duct Smoke Detector Damper Wiring Diagram for additional information.
  7. Each fire/smoke damper shall be the same size as the duct it is connecting to.

### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's printed installation instructions.
- B. Offsetting/Pitching/Drains & Vents

#### 3.2 PIPE INSTALLATION

##### A. Preparation:

1. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
2. Remove scale and dirt, inside and outside, before assembly.
3. Remove welding slag or foreign material from pipe and fitting materials.

##### B. Steel Pipe Connections:

1. Screw joint steel piping up to and including 2 inch. Weld piping 2-1/2 inch and larger, including branch connections.
2. Die cut screwed joints with full cut standard taper pipe threads with teflon tape or other non-toxic joint compound applied to male threads only.
3. Use main sized saddle branch connections, or directly connect branch lines to mains in steel piping if main is one pipe size larger than the branch for up to 6 inch mains and if main is two pipe sizes larger than branch for 8 inch and larger mains. Do not project branch pipes inside the main pipe. Branch nozzles to be contoured to shape of main pipe, then beveled for welding.
4. On 250 psi and higher service, all takeoffs and branches from mains shall be made with standard, forged steel reducing butt welding fittings.
5. Small connections to main piping (up to 1-1/2 inch pipe size) may be made using weldolet, elbolet, sockolet, or thredolet fittings. Bore main full pipe size for branch connections before attachment of welding outlet.
6. Joints for Plain End Pipe: Grooved or Welded.
7. Joints for Threaded End Pipe: Teflon tape or approved pipe lubricant compound.

##### C. Cast Iron Pipe Connections:

1. Joints for Bell and Spigot Pipe: Lead and Oakum or Neoprene gasketing system.
2. Joints for Plain End Pipe: Gasket and clamp, mechanical fastener.
3. Clamp water service pipe at fittings with 3/4 inch rods, anchor and support.
4. Use grooved mechanical couplings and fasteners only in accessible locations; risers, and pipe chases. Concealed locations shall be approved by the engineer.

5. Make connections to equipment and branch mains with unions. (Unions are not required in installations using grooved mechanical couplings. (The couplings shall serve as unions.)
6. Provide non-conducting connections wherever jointing dissimilar metals in open systems.

D. Copper Pipe Connections:

1. Form hot soldered joints in copper, brass, or bronze fittings with non-lead solder. Clean joints prior to fluxing. Use only non-acid fluxes.
2. Make connections to equipment and branch mains with unions. (Unions are not required in installations using grooved mechanical couplings. (The couplings shall serve as unions.)
3. Plastic Pipe connections.
4. Other pipe connections.
5. Press connections: copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

E. Stainless Steel Vic-Press 304™ Pipe Connections:

1. Install Vic-Press 304™ in accordance with the manufacturer's latest installation instructions.
2. Pipe shall be square cut,  $\pm 0.030$ ", properly deburred, and cleaned.
3. Mark pipe ends at the required location, using a gauge supplied by Victaulic, to ensure full insertion into the coupling or fitting during assembly.
4. Use a Victaulic 'PFT' series tool with the proper sized jaw for pressing.

F. Grooved Pipe Connections:

1. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions.
2. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
3. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.
4. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products.
5. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
6. A distributor's representative is not considered qualified to conduct the training.
7. Install the Victaulic AGS piping system in accordance with the latest Victaulic installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow Victaulic guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could

result in joint separation and/or leakage.

G. Vent Pipe in Air Plenum Space:

1. All vent piping routed through an air plenum space shall be CPVC piping.
2. Piping shall meet all the requirements of ASTM D1784 and UL 1887.
3. Piping shall be Blazemaster CPVC or approved equal.

H. Corrugated Stainless Steel Tube (CSST): The tubing, fittings and strike-protection are to be installed per the current version of the manufacturer's design and installation guide and Code requirements. Manufacturer designated training shall be obtained by all installers prior to installation and shall have the manufacturer's certification to perform the installation. The gas piping system shall be pressure tested in accordance with Code, ANSI LC-1 and the current edition of the manufacturer's Design and Installation Guide. Coordinate electrical bonding requirements for the gas piping system with Division 16 in accordance with the National Electric Code, the National Fuel Gas Code and the manufacturer's Design and Installation Instructions.

### 3.3 HANGER INSTALLATION

- A. No chains, wood blocks, wire, or cold bent brackets may be used for support.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment. Provide jam nut to lock adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers to be adjustable or removable without disconnecting of supported pipe.
- J. Provide copper plated hangers and supports for copper piping.

### 3.4 SLEEVE/INSERT INSTALLATION

- A. Set sleeves in position in form work. Provide reinforcing around sleeves as required.
- B. Extend sleeves through floors 2 inches above finished floor level. Calk sleeves full

depth. In dry finished areas set sleeves flush with floor, calk, and provide approved escutcheon plate.

- C. Where piping or ductwork penetrates floor, ceiling or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and sealant. Provide close fitting chrome plated escutcheon covers at both sides of penetration. Sealant and packing shall be of a type which shall maintain the fire resistive rating of the member being penetrated.
- D. Install chrome plated steel escutcheons at finished surfaces.
- E. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- F. Size sleeves for insulated piping and ductwork to allow insulation to pass through sleeve undiminished in thickness. Provide intumescent fire stopping at fire rated walls.

### 3.5 VALVE INSTALLATION

- A. Install gate or butterfly valves at inlet and outlet of each item of equipment, whether shown on Drawings or not.
- B. Install shutoff valves at each division or connection to main and at the base of each riser passing through more than one floor.
- C. Install valves with stems upright to horizontal, not inverted.
- D. Install gate or butterfly for shut-off and isolating service, to isolate equipment, parts of systems, or vertical risers.
- E. Use plug cocks for gas service.
- F. Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- G. Ball valves may be used for shut-off and throttling service in sizes 2" and smaller.
- H. Provide drain valves at main shut-off valves, and low points of piping and apparatus.
- I. Pipe relief from backflow preventer to nearest drain.

### 3.6 IDENTIFICATION INSTALLATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners, or adhesive. Drilled holes for mechanical fasteners, NO holes if adhesive is used.
- C. Metal Tags: Install with corrosive-resistant chain.
- D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.

- E. Plastic Tape Pipe Markers: Install completely around pipe in accordance with manufacturer's instructions.
- F. Equipment: Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices such as in-line pumps, may be identified with metal tags.
- G. Controls: Identify control panels and major control components outside of panels with plastic nameplates.
- H. Valves: Identify valves in main and branch piping with tags.
- I. Piping: Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.
- J. Provide valve chart and schedule in aluminum frame with clear plastic shield. Chart to include valve number, service, size, and purpose of valve. Install where directed.
- K. Submit valve charts and schedules for review prior to installation. Include copies in Maintenance Manuals.

### 3.7 TESTING

- A. Test all piping and equipment as required by the various Sections of the Specifications.
- B. Tests to be witnessed by and be to the satisfaction of the Architect or his designee, and others having legal jurisdiction.
- C. Pressure tests shall be applied to piping before insulating and before connecting to equipment having pressure ratings lower than the test pressure.
- D. Work shall be tested, repaired, and retested until an approved test is achieved.
- E. Damages caused by testing or failure of a test shall be repaired to the satisfaction of the Architect, at no cost to the Owner.
- F. In general, piping systems shall be tested to 150% of the maximum expected operating or surge pressure, or 125 psi, whichever is greater. Utility connections shall be tested in accordance with the Utility's requirements.
- G. Completed systems shall be tested to demonstrate proper operation, capacity, and acceptable noise and vibration levels. Insofar as possible, systems normally operated during certain seasons of the year shall be tested during that season.
- H. Costs for all testing shall be borne by the contractor.

### 3.8 SEISMIC BRACING

- A. Provide lateral bracing in all directions for all equipment, piping, ductwork, etc., sufficient to resist the lateral forces determined under Connecticut Building Code.
- B. SMACNA standard details may be used for bracing of piping and ductwork without calculations. NFPA 13 standard details for seismic bracing of sprinkler piping may be used without calculations. However, other bracing schemes may be used when submitted with calculations.
- C. A separate calculation shall be made for each equipment item.
- D. Provide bracing for all suspended or base mounted equipment, pipes, and ductwork
- E. Attachments to building elements shall only be made at locations having sufficient strength and rigidity to absorb the forces calculated.
- F. For suspended equipment provide bracing such that the effectiveness of the equipment vibration isolators is not reduced.
- G. Vibration isolators, where called for, shall have sufficient lateral stability to resist the forces involved.
- H. Base mounted equipment attached directly to the structure, or on foundation or housekeeping pads, shall be provided with anchor bolts having sufficient strength in shear to absorb the calculated lateral forces in all directions.
- I. Isolated, base mounted equipment shall, in addition to verification of anchor bolt strength, have isolation having lateral stability and snubbing capacity to absorb the calculated lateral forces in all directions.
- J. Where not excluded, provide lateral bracing for piping and ductwork.
- K. Where bracing of piping is required, normal anchors and guides provided to absorb thermal expansion shall be considered as meeting the intent of this Section.
- L. Where required, bracing for piping and ductwork can be made to an intermediate hanger structure located within 12" of the top of the pipe or duct.
- M. Locate and install bracing so that access to the equipment for service, maintenance and repair will not be impeded. Bracing shall be arranged so that there will be no impediment to removal or replacement of the entire unit or piece of equipment.
- N. In Victaulic grooved piping systems, seismic movement of piping systems shall be accommodated by installing swing joints consisting of flexible couplings, pipe nipples and elbows that provide simultaneous movement in all directions, or other seismic movement compensation devices such as loops, offsets, or Style 155 expansion joints to provide flexibility to the system and help reduce pipe stress. Refer to Victaulic design submittal #26.12.

### 3.9 VIBRATION ISOLATION

- A. Install vibration isolators for motor driven equipment.
- B. Set steel bases for one inch clearance between housekeeping pad and base. Adjust equipment level.
- C. Provide spring isolators on piping connected to isolated equipment as follows: Up to 4 inch diameter, first three points of support; 5 to 8 inch diameter, first four points of support; 10 inch diameter and over, first six points of support. Static deflection of first point shall be twice deflection of isolated equipment.
- D. Victaulic Style 75 or 77 flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. A minimum of three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

### 3.10 FIRESTOPPING INSTALLATION

- A. Furnish all materials and labor required for installation of through penetration firestop systems around pipe, duct, cable, conduit, and tubing openings at fire-rated walls, floors, partitions, and floor/ceiling assemblies.
- B. Each penetration shall be reviewed by the Contractor as to it's UL designation and construction conditions and the appropriate firestop system applied to maintain the required rating

### 3.11 DUCTWORK INSTALLATION

- A. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.
- C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- D. At each point where ducts pass through walls or floors, seal joints around duct with non-combustible material. If penetrating fire rated construction, provide sealants to maintain the required ratings.
- E. Construct and install ductwork so as to limit leakage to a maximum of 2% of total air quantity for ductwork.

- F. Cap open ducts during construction to prevent entry of dirt, dust, or debris.
- G. Flexible ductwork is permitted to make the final connection to supply diffusers. Five (5) feet maximum length. Flexible ductwork shall be routed and have smooth curved turns. Kinking shall not be permitted.

### 3.12 DUCTWORK ACCESSORIES

- A. Provide access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Review locations prior to fabrication.
- B. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing.
- C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration.
- D. Fire dampers shall provide a free opening the full size of the duct in which installed.
- E. Install fire dampers in accordance with regulations of NFPA, using hardware, angles, bolts, etc., as required to maintain the intended rating.
- F. Coordinate the installation of fire smoke dampers with Division 16 to ensure component and operating compatibility.

### 3.13 PIPING SCHEDULE

SERVICE	SIZE	MATERIAL	FITTINGS	JOINT
Vent, Exposed	All	Copper, Type "L" **	Wrought **	Soldered
Dom. Hot&Cold	to 2"	Copper, Type "L"	Wrought	Soldered/Press
Dom. Hot&Cold	over 2"	Copper, Type "L"	Wrought	Soldered
Dom. Hot&Cold	All	Stainless Steel 304/304L	Vic-Press	Pressed
Waste & Storm	All	Cast Iron, B&S Hubless C.I., standard*		
Vent	All	Cast Iron, DWV Copper		
Vent, Above Slab (Concealed)	All	40 S, Polyvinyl Chloride(PVC)		
Sprinkler Service	All	40S, Ductile Iron-Class52	C.I.	Thd/Flg/Grvd
Sprinkler	All	40S, Blk. Steel+	C.I.	Thd/Weld
Condensate	All	Type 'L' Copper or 40 S, Polyvinyl Chloride (PVC)	Wrought	Soldered/Press
Refrigerant***	All	Type 'L' Copper	Wrought	Soldered

- \* Schedule 40 PVC may be used above grade and schedule 80 CPVC may be used below grade for waste and storm piping. Proper solvent per ASTM D2661. F628 shall be used for joining.
- \*\* Chrome Plated.
- \*\*\* Refrigerant pipe cleaned and sealed for refrigerant service.
- + Mechanically Joined Schedule 10 Black Steel using grooved end pipe and compatible fittings may be substituted for threaded or welded Steel in ACCESSIBLE locations only.

3.14 VIBRATION ISOLATION SCHEDULE

ISOLATED EQUIPMENT	ISOLATOR TYPE	MINIMUM THICKNESS
Piping - Above Ceilings	4	As Required
Piping - Equip. Rooms	1	As Required
Chillers	9	1-1/4"
Condensers	8	1/2"
Air Handlers and Fans		
Floor Mount at Grade	9	As Required
Floor Mount above Grade	3	As Required
Suspended	6	As Required
Mounted on Steel		
Platform above Ceiling	10	As Required

3.15 VALVE SCHEDULE

APPLICATION	PIPE SIZE	CONNECTION	BODY TYPE	STOCKHAM	SERVICE
Sprink/Standpipe	To 2"	Threaded	Gate	B-132	Shutoff
Sprink/Standpipe	To 2"	Grvd/Thd	Ball	*Series W715	Check/Pump Disch
Sprink/Standpipe	Over 2"	Flanged	Gate	F-667	Shutoff
Sprink/Standpipe	Over 2"	Grooved	Gate	*Series 711	Shutoff
Sprink/Standpipe	Over 2"	Grooved	Butterfly	*Series 705W	Shutoff
Dom. H/C Water	All	Solder	Gate	B-109	Shutoff
Dom. H/C Water	All	Solder	Globe	B-24T	Bypass
Dom. H/C Water	All	Solder	Check	B-321	Check
Dom. H/C Water	To 2"	Push	Check	*510 Series	Check
Dom. H/C Water	All	Solder	Ball	tB-6001	All Uses
Dom. H/C Water	To 2"	Pressed	Ball	*Series 589	Shutoff
Dom. H/C Water	To 2"	Push	Ball	*300 Series	Shutoff
Dom. H/C Water	Over 2"	Grooved	Butterfly	*Series 608	Shutoff/Throttling

t Model Numbers Based on Watts.  
\* Model Numbers Based on Victaulic

END OF SECTION 15100

## SECTION 15200 - INSULATION SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SCOPE OF WORK

- A. This Section describes various insulation materials and accessories used for the Project's Mechanical Systems.
- B. Refer to the Schedules at the end of this Section for the selection of insulation systems applicable to this Project.

#### 1.3 RELATED WORK

- A. This Section is to be used in conjunction with the provisions of all other Sections of Division 15, especially Section 15010, General Provisions - Mechanical.

#### 1.4 SUBMITTALS

- A. Provide submittals for review in accordance with the provisions of Section 15010.
- B. Submit schedule of insulating materials to be utilized.
- C. Submit manufacturer's installation instructions under provisions of Section 15010.
- D. Describe installation methods that will be used to install duct insulation, liners and accessories.

#### 1.5 QUALITY ASSURANCE

- A. All items provided under the provisions of this Section shall be new and shall be the products of recognized manufacturers of that item.
- B. Applicator shall be a Company specializing in insulation applications with a minimum of three years experience.
- C. Material flame spread/fuel contributed/smoke developed rating of 25/50/50 in accordance with NFPA 255. Insulation jacket shall be legibly printed by the manufacturer to show nominal thickness, r-value, type insulation, flame spread and smoke development.

1.6 DELIVERY, STORAGE AND PROTECTION OF MATERIAL

- A. All insulation material and accessories shall be stored in a safe, dry location. No insulation material shall be installed that has become damaged in any way.
- B. If any insulation material has become wet because of job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. Any installed insulation material that has become wet after installation shall be replaced with new insulation.
- C. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The following material describes the requirements and materials for various items included in the Project's Mechanical systems.
- B. It should be noted that this particular Project may not include all of the items listed. Refer to the Schedules at the end of this Section for those items specific to this Project.
- C. Insulation material and accessories shall be products of nationally recognized manufacturers.

### 2.2 TYPE 'A' PIPE INSULATION

- A. Preformed glass fiber insulation jacketed with reinforced all service vapor retarder jacketing; 'k' value of 0.23 at 75 degrees F; operating temperature range is 0 degrees F to 850 degrees F.
- B. Insulation jacketing shall have a factory applied double pressure sensitive adhesive lap system which provides positive closure and vapor sealing of the longitudinal joint. Joints between insulation sections are sealed with butt strips which also have a two component adhesive system. Jacket closure system shall provide an effective vapor seal. Pipe insulation not employing a dual adhesive lap sealing system must have the laps sealed down with a contact adhesive. Stapling and / or taping will not be permitted.
- C. PVC Fitting Covers and Pipe Jacket: High-impact, ultra-violet resistant polyvinyl chloride weatherable covering. White in color, 20 mil thick, PVC jacketing and covers shall be an inherent vapor retarder and will be able to withstand water and low solvency chemical wash-downs. Fittings shall be one piece, pre-molded specifically for each fitting type, including elbows, tees, valves, flanges, reducers, end caps, hubs, traps, mechanical pipe couplings, roof drain sump, etc. Covers and jackets shall be capable of being finished with acrylic latex paint. Product physical properties shall be compliant with ASTM E 84, ASTM D 638, and ASTM D 790. Additionally, within food preparation and service areas, the pipe covering shall comply with USDA requirements.

### 2.3 TYPE 'B' PIPE INSULATION

- A. Preformed flexible elastomeric cellular thermal insulation; 'k' value of 0.27 at 75 0F; operating range of -40 0F to 220 0F.
- B. Adhesive: air-drying contact adhesive to join seams and butt joints.
- C. Insulation tape is made of the same elastomeric cellular material as the insulation. Tape is supplied in 2 inch wide by 1/8 inch thick form.
- D. Protective finish: white water-based latex enamel suitable for both indoor and outdoor application to insulation. Finish shall be exceptionally durable and resistant to weather.

#### 2.4 TYPE 'C' DUCTWORK INSULATION

- A. Flexible glass fiber; ASTM C 553; commercial grade 'k' value of 0.29 at 75 degrees F; 1.0 lb/cu. ft. density; 40 0F to 250 0F temperature range. Insulation is factory applied to reinforced foil kraft scrim (FRK) vapor retarder jacket facing.

#### 2.6 TYPE 'D' DUCTWORK INSULATION

- A. Rigid glass fiber; ASTM C 553, 'k' value of 0.23 at 75 degrees F; 6.0 lb/cu. ft. density; 0 0F to 250 0F temperature range. Insulation is factory applied to reinforced foil kraft scrim (FRK) jacket facing.
- A. Weatherproof and protect duct insulation systems exposed to the outdoors or areas of buildings which have a wet environment.

#### 2.7 ACCESSORY MATERIAL

- A. Accessory materials installed as part of insulation work under this Section shall include but not be limited to closure materials, insulation bands, insulating cement, finishing cement, jacketing materials, support materials, fasteners, and adhesives.
- B. All accessory materials shall be installed in accordance with the Contract Drawings, manufacturer's instructions and/or conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards".

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Ensure that all surfaces over which insulation is to be applied are clean and dry.
- B. Ensure that insulation is clean, dry and in good mechanical condition with vapor or weather barriers intact and undamaged.
- C. Ensure that testing mechanical systems have been completed prior to installing insulation.

#### 3.2 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's printed instructions.
- B. Continue insulation having vapor barrier through penetrations and sleeves undiminished in thickness. Extend insulation without interruption through walls, floors, and similar pipe penetrations, except where otherwise specified. Extend ductwork insulation without interruption through walls and floors, except where interrupted by fire and smoke dampers, and where noted otherwise.
- C. Locate insulation and cover seams in least visible locations.
- D. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. On insulated piping without vapor barrier and piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment connections, but bevel and seal ends of insulation at such locations.
- F. Provide an insert, not less than 6 inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2 inches diameter or larger, to prevent insulation from sagging at point of support. Inserts shall be cork or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used.
- G. Neatly finish insulation at supports, protrusions, and interruptions. Install insulation, covers and accessories so that they have an attractive, neat appearance.
- H. All insulation ends shall be tapered and sealed, regardless of service.

- I. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. All staples used on cooling or dual temperature ductwork insulation shall be coated with suitable sealant (as recommended by the insulation manufacturer) to maintain vapor barrier integrity.
- J. Install insulation and covering so that it has an attractive, neat appearance.
- K. Install insulation materials with smooth and even surfaces. Butt joints firmly together to ensure complete and tight fit over surfaces to be covered.
- L. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by the insulation manufacturer.
- M. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
- N. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
- O. All exhaust piping within building and piping within 12 feet of grade at the building exterior shall be insulated and jacketed. Jacketing located outdoors shall be sealed water-tight. Exhaust piping 12 feet and higher above grade shall not be insulated.

### 3.3 TYPE 'A' PIPE INSULATION

- A. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete a run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.
- B. Butt pipe insulation against hanger inserts. For hot pipes, apply 3" wide vapor barrier tape and band over butt joints. For cold water piping apply wet coat of vapor barrier lap adhesive on butt joints and seal joints with 3" wide vapor barrier tape.
- C. Cover valves, flanges, tees, elbows, reducers, end caps, hubs, traps, mechanical pipe fittings and other similar items with PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

### 3.4 TYPE 'B' PIPE INSULATION

- A. Unslit tubular form can be slipped onto piping before it is connected, or can be slit length wise and applied over piping already connected. Fitting covers are fabricated from miter-cut tubular form. Butt joint and seams are to be joined with insulation manufacturer's supplied adhesive and sealed with the manufacturer's supplied tape. Cover valves, flanges, etc. with oversized insulation.
- B. Provide the insulation manufacturer's protective finish on pipe insulation exposed to the outdoors.
- B. Provide PVC fitting covers/pipe jacketing on insulated piping and fittings exposed within the building. PVC fitting covers and jacketing shall be bonded together with the manufacturer's

recommended adhesive to form a completely sealed covering system.

### 3.5 TYPE 'C' DUCTWORK INSULATION

- A. Duct wrap insulation shall be applied with all joints butted firmly together. All joints in the insulation covering shall be sealed with adhesive. Duct wrap insulation shall be secured to bottom of rectangular or oval ducts over 24 inches wide with mechanical fasteners on 16 inch centers to prevent sagging. All joints and seams and other penetrations shall be closed with 3 inch pressure-sensitive tape matching the facing or a vapor barrier mastic reinforced with 3 inch glass scrim tape.

### 3.6 TYPE 'D' DUCTWORK INSULATION

- A. Rigid insulation shall be secured to ductwork with adhesive or impaled over welded pins and secured with insulation caps and washers matching the color of the vapor barrier facing. All seams, joints and other penetrations shall be firmly butted and sealed with 3 inch pressure-sensitive vapor barrier tape matching the facing or a vapor barrier mastic reinforced with 3 inch glass scrim tape.
- B. Corner angles shall be installed on all external corners of rigid duct insulation before jacketing.

### 3.7 ACCESSORY MATERIALS

- A. All accessory materials shall be installed in accordance with the Contract Documents, the manufacturer's printed installation instructions, and in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards".

### 3.8 PIPE INSULATION SCHEDULE

SERVICE	TYPE	PIPE SIZE	THICKNESS
Domestic Hot Water Mains	A	over 2"	1-1/2"
Domestic Hot Water Runout*	A	to 2"	1/2"
Hot Water Recirculation Mains	A	to 2"	1"
Hot Water Recirculation Mains	A	over 2"	1-1/2"
Domestic Cold Water	A	All	1"
Condensate Drains	B	All	1/2"
PEX Tubing & Fittings	B	to 1-1/4"	1/2"
Horizontal Storm Water	A	All	1/2"
H'cap Lav. & Sinks Supply & Waste	C	All	3/8"
Refrigerant Piping	B	All	1"

\* Runouts not to exceed 12 feet length, over 12 length use thickness for mains.

### 3.9 DUCTWORK INSULATION SCHEDULE

SYSTEM	TYPE	THICKNESS	FINISH
Supply Ducts (concealed)	E	1-1/2"	Foil Scrim
Supply Ducts (exposed)	F	2"	Foil Scrim
Outside Air Ducts (concealed)	E	1-1/2"	Foil Scrim
Outside Air Ducts (exposed)	F	2"	Foil Scrim
Internal Lining +	D	1"	Neoprene
Return/Exhaust Ducts (concealed)	E	1-1/2"	Foil Scrim
Return/Exhaust Ducts (exposed)	F	2"	Foil Scrim
Plenums and Duct Housings	F	2"	Foil Scrim

+ Ductwork with internal lining shall be also insulated with thermal insulation as scheduled.

END OF SECTION 15200



## SECTION 15630 - RESIDENTIAL SPLIT HEAT PUMP SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SYSTEMS DESCRIPTION

- A. The heat pump air conditioning system shall be a Mitsubishi Electric split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
- B. Daiken, Sanyo and LG will be considered.
- C. All systems shall be complete with all components including refrigerant specialties, operating controls, line set cover system at exterior of building and piping/installation accessories.

#### 1.3 RELATED WORK

- A. This Section is to be used in conjunction with the provisions of all other Sections of Division 15, especially Section 15010, General Provisions - Mechanical.
- B. Refer also to any applicable portions of Division 16, Electrical Work.

#### 1.4 SUBMITTALS

- A. Provide submittals for review in accordance with the provisions of Section 15010.
- B. Submit Manufacturer's Installation Instructions under provisions of Section 15010. Include Manufacturer's wiring and piping diagrams prepared for this project.
- C. Submit samples under provisions of Section 15010.

#### 1.5 QUALITY ASSURANCE

- A. All items provided under the provisions of this Section shall be new and shall be the products of recognized manufacturers of that item.
- B. All items of a similar class shall be the products of the same manufacturer. That is, all accessory items, etc. shall be from the same source.
- C. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- D. All wiring shall be in accordance with the National Electric Code (NEC).

- E. The shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210 and bear the ARI label.
- F. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
- G. The outdoor unit will be factory charged for a length of 33 feet of refrigerant with R410A refrigerant.
- H. A dry air holding charge shall be provided in the evaporator.
- I. System efficiency shall meet or exceed 16.0 SEER.

#### 1.6 REGULATORY REQUIREMENTS

- A. Comply with applicable regulations.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Protect equipment from physical damage by storing in protected areas and leaving factory covers in place.
- B. Do not operate systems for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated, and fan has been run under observation.
- C. Units shall be stored and handled in accordance with the manufacturer's recommendations.

#### 1.8 WARRANTY

- A. 3/4 ton to 1 ton nominal capacity units shall have a manufacturer's warranty for a period of five (5) years from date of installation. The units shall have a limited labor warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of US Corporation according to 's Terms and Conditions.
- B. 1-1/4 ton to 2 ton units shall have a manufacturer's warranty for a period of five (5) years from date of installation. The units shall have a limited labor warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of US Corporation according to 's Terms and Conditions.

### PART 2 - PRODUCTS

## 2.1 INDOOR UNIT

- A. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function after power interruption. Indoor unit shall be purged with dry air before shipment from factory

## 2.2 UNIT CABINET

- A. The casing shall have a smooth front, white finish – Munsell 1.0Y 9.2/0.2.
- B. Multi directional drain connection and refrigerant piping, offering three (3) direction pipe alignments for all refrigerant piping and two (2) direction pipe alignments for condensate draining shall be standard.
- C. There shall be a separate, metal installation-plate that secures the indoor unit firmly to the wall. The installation-plate shall be securely attached to the wall using appropriate anchor method. Installing contractor shall determine the best method and be responsible for proper mounting of the installation plate to the wall.

## 2.3 FAN

- A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
- B. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearing.
- C. A manual adjustable guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
- D. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down. Five (5) positions plus Auto and Swing shall be provided, controlled from the remote controller.
- E. The indoor fan shall operate at one of five (5) speeds: Super High, High, Medium, Low, and Quiet plus Auto Fan Mode for models up to 18,000 BTU/h, and four (4) speeds: Powerful, High, Medium and Low plus Auto Fan Mode for the 24,000 BTU/h model. All speeds shall be selected from the remote controller.

## 2.4 FILTER

- A. Return air shall be filtered by means of easily removed, washable, Catechin, Antioxidant Pre-filter and an Anti-allergy enzyme filter – blue, pleated type.

## 2.5 COIL

- A. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.

- B. The tubing shall have inner grooves for high efficiency heat exchange.
- C. All tube joints shall be brazed with phosphor copper or silver alloy.
- D. The coils shall be pressure tested at the factory.
- E. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
- F. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing.

## 2.6 ELECTRICAL:

- A. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The system shall be equipped with A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 gauge AWG connection plus ground.
- C. The indoor unit shall not have any supplemental electrical heat elements.

## 2.7 CONTROL

- A. The unit shall have a wireless hand held remote controller to perform input functions necessary to operate the system.
- B. The wireless hand held controller shall have a Power On/Off switch, Mode Selector – Auto, Cool, Heat, Dry Modes - Temperature Setting, Timer Control with Clock, Fan Speed Select and Vane / Airflow Direction selector. Controller shall have a programmable Smart Set button for pre-selected Temperature, Fan Speed, and Vane position settings.
- C. The indoor unit shall perform Self-diagnostic Function and Check Mode switching.
- D. Temperature changes shall be by 1°F increments with a range of 61 - 88°F (16-31°C).
- E. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.
- F. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
- G. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.
- H. The indoor unit shall have the option of either a wireless or wired wall mounted remote controller to be ordered separately:

## 2.8 WIRED REMOTE CONTROLLER

- A. The Wired Remote Controller shall require a terminal interface for communications. Interface will be mounted at the indoor unit. A two (2) conductor, stranded, 22 AWG twisted pair, jacketed, cable shall connect the wall controller. Connection shall not be polarity sensitive and controller wire shall not exceed thirty-three (33) feet (10m) length.
- B. The wired remote controller shall be approximately 5" x 5" in size and white in color with a light-green LCD display. The controller shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C). The controller shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).
- C. The indoor units shall be capable of working with single-zone or multi-zone outdoor units.

## 2.9 OUTDOOR UNITS

- A. The outdoor units are specifically designed to work with the indoor units. The outdoor units must have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

## 2.10 UNIT CABINET

- A. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.
- B. Cabinet color shall be Munsell 3Y 7.8/1.1.
- C. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.

## 2.11 FAN

- A. The unit shall be furnished with a direct drive propeller type fan.
- B. The outdoor unit fan motor shall be a direct current (DC) motor and have permanently lubricated bearings.
- C. The fan motor shall be mounted for quiet operation.

- D. The fan shall be provided with a raised guard to prevent contact with moving parts.
- E. The outdoor unit shall have horizontal discharge airflow.
- F. Outdoor unit sound level shall not exceed 55 dBA.

#### 2.12 COIL

- A. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
- B. The coil shall be protected with an integral metal guard.
- C. Refrigerant flow from the outdoor unit shall be regulated by means of an electronically controlled, precision, linear expansion valve.
- D. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to twenty five (25) feet of refrigerant piping for capacities up to 18,000 BTU/h, and up to thirty three (33) feet of refrigerant piping for capacities above 18,000 BTU/h.
- E. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
- F. All refrigerant connections between outdoor and indoor units shall be flare type.

#### 2.13 COMPRESSOR

- A. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type manufactured by Mitsubishi Electric Corporation.
- B. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
- C. The outdoor unit shall be equipped with an accumulator.
- D. The compressor will be equipped with internal thermal overload protection.
- E. The outdoor unit must have the ability to operate over the full capacity range with a maximum height difference of 40 feet and have refrigerant tubing length of 65 feet for capacities up to 15,000 BTU/h and a maximum height difference of 50 feet and have refrigerant tubing length of 100 feet for capacities above 15,000 BTU/h between indoor and outdoor units.

- F. There shall be no need for line size changes. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
- G. The compressor shall be mounted so as to avoid the transmission of vibration.

#### 2.14 ELECTRICAL

- A. The outdoor unit electrical power supply shall be 120/240 volts, 1-phase, 60 hertz.
- B. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
- C. The outdoor unit shall be controlled by microprocessors located in the indoor unit and outdoor unit. A 12 to 24 volt DC data stream shall communicate between the units providing all necessary information for full function control.

### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's printed installation instructions.
- B. Protect units with protective covers during balance of construction.

#### 3.2 EXAMINATION

- A. Verify that surfaces are ready to receive work and opening dimensions are as instructed by the manufacturer.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing surfaces.

#### 3.3 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of units.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets and covers, using finish materials furnished by manufacturer.

END OF SECTION 15630

## SECTION 15990 - COMMISSIONING OF SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE OF WORK

- A. Testing, Balancing and Adjusting of Air Systems.
- B. Testing, Balancing and Adjusting Water Systems.
- C. Owner Instructions.
- D. Operation and Maintenance Manuals.
- E. "As Built" Drawings.

#### 1.3 REQUIREMENTS INCLUDED

- A. Provide testing, balancing and adjusting (TBA) services for all operating mechanical systems.
- B. Provide report covering results of TBA procedures.

#### 1.4 RELATED DOCUMENTS

- A. Section 15010 - General Provisions - Mechanical.
- B. All other Sections in Division 15.

#### 1.5 QUALITY ASSURANCE

- A. Work to be performed by testing agency having at least 3 years experience in TBA procedures for equivalent projects.
- B. Air System TBA by personnel certified by Associated Air Balance Council (AABC).
- C. Instrumentation used to have documented calibration.
- D. Operation and Maintenance Manuals and "As-Built Drawings" shall be reviewed by the Engineer prior to turning over to Owner. Refer to Section 15010 - General Provisions-Mechanical.

#### 1.6 PROCEDURES

- A. Comply with procedural standards of AABC.
- B. Two weeks prior to start of TBA procedures submit for approval the following: Copies of written procedures to be used, forms to be used, instrument calibration documents, qualifications of testing personnel and a schedule of hydronic terminal units water flow rates.
- C. Cooperate with installing subcontractor.
- D. Submit final report within one week of completion of TBA procedures.

#### 1.7 CONTRACTOR RESPONSIBILITIES

- A. Prepare system for testing, balancing and adjusting (TBA).
- B. Cooperate with Testing organization to provide access to equipment. Operate system at required times and under conditions required for effective TBA.
- C. Prior to start of TBA work, make sure air systems have all dampers open and water systems have all balancing valves open and all bypass valves closed.
- D. Ensure that all systems have been cleaned and filters serviced and otherwise ready for TBA.
- E. Provide manufacturer's testing and start-up report for each unit.

#### PART 2 - PRODUCTS

- 2.1 None required.

#### PART 3 - EXECUTION

- a. Make any needed changes to motors, pulleys, drives or belts, add any needed dampers as required to achieve the correct system balance. All at no additional cost to the Owner.

#### 3.3 REPORT PREPARATION

- A. Assemble data, perform calculations using flow factors based on installed equipment.
- B. Submit report including copies of findings, TBA Schedules, field data forms used, documentation of instruments, certification procedures used and any further backup material to substantiate results reported.

END OF SECTION 15990

## SECTION 16010 - GENERAL PROVISIONS-ELECTRICAL

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. The following drawings indicate the work required for this Division of Work:

All Drawings associated with this project.

All other contract drawings and specifications associated with the project.

- B. Certain items of work pertaining to the work of this Division are provided under other Divisions of the Specification. These include, but are not limited to the following:

1. Framing of openings in walls, floors, roof.
2. Chases, soffits, furred spaces required to conceal work of this Division.

- C. Materials furnished under other Divisions and installed and/or wired by this Division include, but are not limited to:

1. Mechanical Equipment. (Motor Starters furnished under Division 15)
2. Temperature Controls.

- D. Participate in coordination of Mechanical and Electrical installations. Provide additional coordination drawings, as directed by Architect, in areas of potential interferences.

- E. All work shall comply with applicable codes and regulations, including, but not limited to the following:

1. Connecticut Building, Fire Safety, and Health Codes, as amended, including all codes, standards and regulations referenced therein.
2. Requirements of Local, State, and Federal authorities having jurisdiction over the Work.
3. Current regulations of the Occupational Safety and Health Administration (OSHA).
4. Requirements of affected Public Utility Companies.
5. Special requirements set down by the Owner, the Owner's Insurance Carrier, or other concerned entities.
6. NFPA 70- 2011, National Electrical Code. Contractor shall conform to the latest State of Connecticut approved NFPA 70, codes. Supply, install and wire complete any devices or equipment required by code indicated or excluded.
7. Contractor shall supply temporary power sufficient enough to carry the load of the building(s) to be renovated. Provide temporary lighting and power in conformance to

OSHA regulations.

## 1.2 RELATED DOCUMENTS

- A. Instructions to Bidders, the General Provisions of the Contract, including General Conditions and General Requirements shall apply and be binding to the Contractor and/or Subcontractor who performs this work.
- B. Where items of the General Conditions or Special Conditions are repeated in this Section of the Specifications, it is intended to call particular attention to or to qualify them; it is not intended that any other parts of the General Conditions shall be assumed to be omitted if not repeated herein.

## 1.3 INTENT

- A. Intent of the specifications and drawings is to call for finished work, tested and ready for operation.
- B. Material, fixtures, and equipment mentioned in specifications or shown on drawings shall be furnished new, completely installed adjusted and left in a clean, safe and satisfactory

condition ready for operation. All supplied appliances and connections of every sort necessary shall be furnished and installed to the satisfaction of Architect and Owner.

- C. Apparatus, appliances, material or work not shown on the plans but mentioned in specifications, or vice versa, or any incidental accessories such as electrical disconnect switches, circuit breakers, etc., necessary to make the work complete, serviceable and perfect in all respects and ready for operation, even though not particularly specified, shall be installed without additional expense to the Owner.
- D. Minor details not usually shown or specified, but necessary for proper installation and operation shall be included in the work as though herein specified or shown.
- E. Prior to submission of bids, give written notice to Architect of any materials or apparatus believed to be inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; or any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the cost of all required items has been included and that all systems will function satisfactorily without extra compensation.

#### 1.4 DEFINITIONS

- A. "Architect" means Wiles Architects, Bridgeport, CT 06604.
- B. "Engineer" means Acorn Consulting Engineers, Inc., West Simsbury, CT 06092
- C. "regulating authorities" or "authorities", means all Governmental, Utility, and Insuring Authorities having jurisdiction.
- D. "Subcontractor or Contractor", means specifically the Subcontractor working under his respective Section of Specifications.
- E. "furnish" or "provide" means to supply, erect, install and connect up complete in readiness for regular operation the particular work referred to, unless otherwise specified.
- F. "conduit" includes in addition to pipe, all fittings, connectors, hangers, and other accessories relating to such and the plant and labor necessary to install same.
- G. "concealed" means hidden from sight in chases, furred spaces, hung ceilings, embedded in construction, or buried underground.
- H. "exposed" means not "concealed" as defined above. Trenches, crawl spaces and tunnels shall be considered "Exposed" unless specifically noted otherwise.
- I. "wire" or "wire up" means to properly connect the related item to the appropriate source of power including all needed connectors, circuit breakers, switches and other items necessary for normal operation of the item.
- J. "temperature control" means, in addition to thermostats all heating, ventilating, air conditioning motorized dampers, solenoid valves, electrical air device actuators, relays and other electrical accessories related to HVAC and other mechanical systems.

- K. "concealed" means hidden from sight as in chases, furred spaces, shafts, or above ceilings.

#### 1.5 DRAWINGS

- A. Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement. Deviations from the depicted arrangement shall be approved by the Architect.
- B. Location of all items shown on drawings or called for in specifications, not definitely fixed by dimension, are approximate only. Exact location necessary to secure best conditions and results shall be determined at the project and shall have the approval of the Architect.
- C. Follow the drawings in laying out work. Check drawings of other trades to verify spaces in which work will be installed to insure maximum headroom and space conditions. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation.
- D. Work shown on the drawings is intended to be approximately correct to the scale of the drawings. Figured dimensions and detailed drawings are in all cases to take precedence over them. Typical details shall apply to each and every item of the project where such items are incorporated. Drawings utilize symbols and schematic diagrams to indicate various items of work. These have no dimensional significance, nor do they delineate every item required for the intended installation. Work shall be installed in accordance with the diagrammatic intent of the Electrical drawings, and in conformity with the dimensions indicated on final Architectural and Structural working drawings and on equipment shop drawings.
- E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.
- F. Details appear on the drawings which are specific with the regard to the dimensioning and positioning of the work. These are intended for the purpose of establishing general feasibility. They do not obviate field coordination.
- G. If directed by the Architect or Owner, make reasonable modifications in the layout to prevent conflict with work of other trades or for proper execution of the work.
- H. Abide by and comply with the true intent of the drawings and specifications taken as a whole, to provide a complete job ready for operation. "Drawings and specifications taken as a whole" means all contract plans and specifications -- Architectural, Structural and all Subcontractors' drawings and specifications. Refer to drawings and specifications of other trades to check if equipment or items included under other Sections will require work in order to comply with the statement above "to provide a complete job ready for operation". This work shall be included in the Base Contract. It shall be understood that the indication and/or description of any item, on the drawings or specifications, or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated.
- I. No statement in the specifications or any omission in either plans or specifications should

be misunderstood as relieving the contractor from providing a complete job ready for operation. All existing circuits and devices shall be energized and tested before the completion of the project, contractor shall supply all the required material, labor and equipment necessary for a complete installation. No exclusions from, or limitations in, the language used in drawings or specifications shall be interpreted as meaning that the items or accessories necessary to complete any required system or item of equipment are to be omitted.

- J. Information as to the general construction shall be derived from Structural and Architectural Drawings and Specifications only.
- K. The use of words in the singular shall not be considered as limiting where other indications indicate that more than one item is referred to.

#### 1.6 VISITING THE SITE FOR SURVEYS AND MEASUREMENTS

- A. Before submitting a Bid, visit the site and become thoroughly familiar with all conditions under which the Work will be installed. Contractor will be held responsible for any assumptions, omissions or errors made as a result of failure to become familiar with the site and the Contract Documents.
- B. Base all measurements, both horizontal and vertical, from established benchmarks. Reference all Work from these established lines and levels. Verify all measurements at site and check the correctness of same as related to Work.
- C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or the intent of the Drawings and Specifications, notify the Engineer and do not proceed with the Work until instructions have been received from the Engineer.

#### 1.7 SUBSTITUTIONS

- A. Within sixty (60) days after award of contract, submit, through the General Contractor, to the Architect for review, a list of manufacturers of all materials and equipment proposed for use on the project. Indicate on submittal which items are substituted.
- B. A review, without exception, of this list does not constitute approval, nor does it guarantee acceptance of the shop drawings when submitted.
- C. The contractor's intent to purchase the exact make specified does not relieve him from the responsibility to submit this list. Failure to submit this list will require the contractor to supply the exact item specified as the basis for design.
- D. Submittal of items which differ from those specified or indicated as the basis for design carries the implicit guarantee that the substituted item will provide the intended service and is compatible with other items or systems interfacing with it.
- E. When proposing a substitute item, the contractor is responsible for all costs of accommodating the substitution, including, but not limited to, space and accessibility, modifications required to other systems, structural adequacy and the like.

- F. If substitutions require the Architect or Engineer to prepare sketches or revised drawings in order to become acceptable, the cost of such sketches, drawings, or engineering shall be borne by the contractor.
- G. When substitutions require Engineer or Architect to spend an inordinate time for review or substitutions, the cost of review over four (4) hours will be charged to the contractor who made the submittal.

#### 1.8 MATERIALS AND WORKMANSHIP

- A. All materials and apparatus required for the Work, except as otherwise specified, must be new and of first-class quality and be furnished, delivered, erected, connected and finished in every detail and so selected and arranged as to fit properly into the building spaces. Where no specific kind of quality of material is given, furnish a first- class standard article as accepted by the Engineer.
- B. Furnish the services of an experienced superintendent who is constantly in charge of the installation of the Work, and present on site at all times during the Work. Furnish all skilled Workmen, helpers and labor required to install, unload, transfer, erect, connect up, adjust, start, operate and test each system.
- C. Unless otherwise specifically indicated on the Drawings or in the Specifications, all equipment and materials must be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.
- D. Quality of Work must be consistent with good trade practice and installed in a neat Workmanlike manner. The Engineer reserved the right to reject any Work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. Replacement of said Work, in satisfactory manner, will be at no extra charge to the Owner.

#### 1.9 SHOP DRAWINGS

- A. After acceptance of List of Manufacturers required under paragraph 1.07(A) of this Section, and prior to delivery of materials and equipment to the project site, submit eight (8) copies of shop drawings of each item for review by the Architect.
- B. Each submittal shall contain a complete list of all materials contained within. Include intended use for each item.
- C. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature and complete characteristics of equipment, including, but not limited to, dimensions, capacity, code compliance, motor and drive and testing, construction, electrical characteristics, support, all as required for this project.
- D. Architect may designate submittal of physical samples for review on items where actual color, texture or other characteristics might not be adequately described by a drawing or written material. Upon approval of a sample, each and every item of that sort must be identical to the approved sample.

- E. Samples, drawings, specifications, catalogs, etc., submitted for review shall be labeled indicating specific service for which material or equipment is to be used, Section and Article Number of Specification governing, Subcontractor's name and name of project.
- F. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the Subcontractor from his responsibility of furnishing material or performing work according to Contract Documents.
- G. Failure to submit shop drawings in ample time for checking shall not be cause for an extension of contract time, and no claim by reason of such default will be allowed.
- H. Submittals for all systems which require the interconnection of three or more devices shall include a system block diagram. The diagram shall be of the one line type and with sufficient detail to show interfaces and method of operation.
- I. Material or equipment installed prior to review shall be liable for removal and replacement at no extra charge to the Owner if the material or equipment does not meet the intent of Drawings and Specifications.

#### 1.10 RECORD DRAWINGS

- A. Maintain a record set of Electrical Drawings at the job site on which any changes in location of equipment, devices, panels and major conduits are recorded.
- B. At the end of construction, provide the Owner with a complete set of As-Built Drawings, including all power and lighting plans (indicating as-built circuiting), power and special systems riser diagrams and panel schedules and fire alarm use. Prepare As-Built documentation utilizing the most recent version of AutoCAD. Provide the Owner with a "CD ROM" disk and one set of reproducible mylar documents.
- C. If electronic copies of the contract documents are made available to the Contractor for use in production of As-Built documentation, the Contractor assumes responsibility for completeness and accuracy of the As-Built documents. Translation or manipulation of electronic documents provided to the Contractor is the responsibility of the Contractor.
- D. Exact location of all conduits and utilities under floor slabs shall be indicated and dimensioned on these drawings, as well as the final arrangement of conduits and junction boxes in concealed chases, concealed in walls or above ceilings.

#### 1.11 LAWS, ORDINANCES, CODES, PERMITS AND FEES

- A. Give all necessary notices, obtain all permits and pay all governmental taxes, fees and other costs in connection with the work. File all necessary plans, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction. Obtain all required Certificate of Inspection of the work and deliver to Architect prior to application for final payment.
- B. Materials furnished and work installed shall comply with the rules and recommendations

of the National Board of Fire Underwriters, with all requirements of utility companies, with the Board of Health, with the recommendations of the fire insurance rating organization having jurisdiction, with the local and state building codes, and with the requirements of all governmental departments having jurisdiction. If contract requirements are in excess of applicable codes, rules or regulations, contract provisions shall be given precedence.

- C. Provide utility services as required and as indicated on Drawings and in 1.01(D), above.

#### 1.12 ROYALTIES AND PATENTS

- A. Pay all royalties and defend all suits and claims for infringement of any patent rights and save the Owner harmless on account thereof.
- B. If it is observed that a process or article specified is an infringement of a patent, promptly notify the Architect in writing. If any work is performed knowing it is to be an infringement of a patent, all costs arising therefrom shall be borne by the Contractor.

#### 1.13 STANDARD SPECIFICATIONS

- A. Certain standard and staple materials may be described by reference to standard specifications. The standards referred to are as follows:

ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters Laboratories, Inc.
NFPA	National Fire Protection Association
FM	Factory Mutual Insurance Company
IRI	Industrial Risk Insurers (Formerly FIA)
IES	Illuminating Engineering Society
IEEE	Institute of Electrical and Electronic Engineers

- B. The particular specification will be identified by appropriate prefix and number only, with the latest or legally defined revision being applicable.

#### 1.14 INTERPRETATION OF PLANS AND SPECIFICATIONS

- A. Questions or disagreements arising as to the intent of the specifications or the drawings, or the kind and quality of work required thereby, shall be decided by the Architect whose interpretation thereof shall be final, conclusive and binding on all parties.

#### 1.15 PROCEDURE OF WORK

- A. All work shall proceed in a manner approved by the Owner.

- B. Determination of the required job procedure will be made by the Architect in the best interests of the job and may be adjusted to meet job conditions.

#### 1.16 CHANGES TO WORK

- A. During the progress of the work, the Architect may make any changes, alterations, additions or omissions to work drawn or specified after having agreed on an equitable allowance to be added to or deducted from the contract price. Claims for extra cost to cover extra work will not be allowed unless specifically authorized in writing by the Architect prior to the execution of such additional work.

#### 1.17 COORDINATION OF TRADES

- A. Give full cooperation to other trades and furnish any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

#### 1.18 PROTECTION OF WORK AND PROPERTY

- A. Be responsible for the maintenance and protection of equipment, materials and tools stored or installed on the job site, from loss or damage of all causes, until final acceptance by the Owner.
- B. Be responsible for the protection of finished work of other trades from damage or defacement and remedy any such injury at no additional cost to the Owner.

#### 1.19 CUTTING, PATCHING AND PAINTINGS

- A. Cutting, patching and painting shall be done by the General Contractor unless otherwise noted on plans or specifications.
- B. Cooperate with the General Contractor in making sure that sleeves are set and chases provided for the installation of the work. If failure to do so makes it necessary to cut and patch any part of the completed structure, this shall be done at the expense of the subcontractor having jurisdiction over the work.

#### 1.20 TEMPORARY OPENINGS

- A. Ascertain whether any special temporary openings in the building will be required for the admission of apparatus and notify the Contractor accordingly.
- B. Failure to give sufficient notice to the Contractor in time to arrange for these openings during construction, shall result in this subcontractor's assumption of all costs pertaining to making and repairing any such temporary openings.

#### 1.21 MANUFACTURER'S IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark shall be permanently affixed to all material and equipment furnished under this specification. The nameplate of a subcontractor or distributor will not be acceptable.

## 1.22 MANUFACTURERS IDENTIFICATION

- A. Identify each control and item of equipment with a permanently attached nameplate made of black surface, white core laminated plastic with incised letters, bearing the name of the equipment item and designation of the item taken from the drawings or schedules.
- B. Identify electrical feeders and risers where they enter or leave a junction box or cabinet with fiber tags having the cable designation stamped thereon and tied securely to each cable or by means of printed plastic self-adhering labels attached to the cable sheath.
- C. Subcontractor shall label all cabinet, panels, pull boxes, etc., in the electrical system using the designations shown on the plans and schedules such as -- "PANEL H1", "MDP-1", etc., using incised laminated plastic nameplates securely attached.
- D. Provide typewritten directory cards in all electric panels showing circuit numbers and area or load serviced.
- E. Refer to Section 16195.

## 1.23 INSTRUCTION BOOKS AND OPERATING INSTRUCTIONS

- A. Furnish three (3) sets of operating and maintenance manuals in hard cover covering all electrical systems in the project. Include manufacturer's approved submittal of each item. Submit for review of Architect.
- B. Manuals shall contain, as a minimum, the following:
  - 1. Description of the project and major subsystems.
  - 2. Descriptive text covering the startup, adjustment, trouble-shooting, and safe shutdown for each system.
  - 3. Copies of each typewritten panel directory.
  - 4. Copies of lighting control wiring diagrams and description of operation.
  - 5. A schedule of maintenance based on the manufacturer's recommendations, showing what work is to be performed and at what intervals.
  - 6. Copies of the finally approved submittal for each item, together with the manufacturer's installation, operation, and maintenance instructions and parts lists.
  - 7. List of Firm names, addresses, telephone numbers to be contacted for regular or emergency service, or purchase of parts.
- C. Manuals shall be arranged in one or more three-ring binders, completely indexed as follows:
  - 1. General information; Items 1, 2, 3, & 7 above.

2. Control system information; Item 4.
  3. Approved submittal, maintenance, and parts information; Items 5 & 6.
  4. Each section shall be identified by a permanent index tab.
  5. Each item within a major section shall be separately indexed for quick reference.
- D. Provide adequate written and/or verbal instructions to the Owner's operating personnel and such others as the Owner may designate. As a minimum, contractor shall provide for three (3), eight hour working days of instructions. Individual equipment or system Specifications may require additional or different periods of instruction.

#### 1.24 SLEEVES, INSERTS AND ANCHOR BOLTS

- A. Be responsible for the location and proper position of sleeves and anchor bolts. If failure to do so requires cutting and patching of finished work, it shall be done at the Subcontractor's expense.
- B. Conduits passing through concrete or masonry floors, walls or partitions shall be provided with sleeves having an internal diameter 1/2" larger than the outside of the conduit.
- C. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with wall, floor or ceiling surface. Sleeve through floors shall be packed with a fireproof, resilient material to maintain the fire rating integrity of the assembly and caulked with waterproof compound to the approval of the Architect.
- D. Sleeves through floors of wet areas such as equipment rooms, toilets, etc., shall extend 2" above finished floor surface and be sealed watertight.

#### 1.25 ACCESSIBILITY

- A. Install work so that all parts are readily accessible for inspection, maintenance and repair.
- B. Be fully informed regarding peculiarities and limitations of space available for the installation of materials and apparatus.
- C. See that all equipment items are made easily accessible for adjustment and operation. D.  
  
Where such items must be located over non-access ceilings, in chases or other inaccessible places, access doors and/or panels of a type and size approved by the Architect shall be supplied and delivered to the General Contractor for installation.
- E. Items requiring access are to be grouped to keep size and quantity of access doors to a minimum.
- F. Access doors installed in walls, floors or ceilings shall have the same fire rating as the wall, floor or ceiling.

#### 1.26 ELECTRICAL WORK

- A. Install and wire up complete all electrical switches, starters and unmounted motors and other electrical equipment supplied by other trades.
- B. Furnish separate disconnect switches for all motors controlled by magnetic starters.
- C. Each trade supplying electrically operated equipment for installation and wiring by this Subcontractor is to furnish sufficiently detailed instructions and wiring diagrams for their installation.
- D. Control devices that include mechanical elements such as float switches, alternators, temperature and pressure switches or controls, damper operators or the like, shall be installed by the trade furnishing them, ready for wiring by this Subcontractor, unless otherwise indicated.
- E. Equipment including a number of electrical items in a single enclosure or common base shall be supplied to the job site internally wired as a unit, to numbered terminals, ready for wiring connections.

#### 1.27 ELECTRIC MOTORS

- A. Motors shall conform to all applicable regulations and be suitable for the load, duty, voltage, phase, frequency, service and location intended.

#### 1.28 TEMPORARY POWER

- A. Furnish and install all required temporary electrical services, including lighting and ground-fault circuit-interrupter receptacles as required for construction purposes.
- B. In all of the above cases, furnish the appropriate trades, well in advance of their work schedule, with all information, dimensions, templates, wiring diagrams and devices necessary to coordinate the work.
- C. Be responsible for any additional costs incurred as a result of his failure to furnish information sufficiently in advance to allow for proper coordination.

#### 1.29 TESTS

- A. Test systems and equipment as required by the various Sections of the Specifications.
- B. Tests to be witnessed by and to the satisfaction of the Architect or his representative and such others as may have legal jurisdiction.
- C. Work shall be tested, repaired and retested until an approved test is achieved.
- D. Damages resulting from tests shall be repaired or damaged work replaced to the satisfaction of Architect and Owner.
- E. Testing must be completed successfully prior to concealment of the work.

- F. Completed systems shall be tested for proper operation, capacity and function. Insofar as possible, systems normally operated during certain seasons of the year shall be tested during the appropriate season.
- G. Costs of all tests shall be borne by the appropriate Contractor.

#### 1.30 QUIET OPERATION

- A. All equipment shall be isolated from the building structure by approved means. Noises and hum of equipment shall be absorbed or attenuated so as not to be objectionable.
- B. Where sound or vibration levels are considered objectionable by the Architect, they shall be corrected in a manner approved by the Architect, at no additional cost to the Owner.

#### 1.31 USE OF INSTALLATION BY OWNER

- A. Owner shall have the privilege of using any part of the work when sufficiently complete, but such use shall not be considered as an acceptance of the work in lieu of the written certificate from the Architect.

#### 1.32 CLEANUP

- A. Systems, enclosures, and equipment shall be thoroughly cleaned, inside and out, before being placed into operation.
- B. Keep the site free from accumulation of waste materials or rubbish. At conclusion of the work, remove all surplus materials, tools, construction equipment and rubbish from the site and leave the premises in a clean condition.

#### 1.33 GUARANTEE AND SERVICE

- A. Guarantee that all work will be free from defects in workmanship and/or materials and that all apparatus will achieve the capacities and characteristics specified. If, during the period of one (1) year, or as otherwise indicated, from certificate of completion of the work, defects in material or workmanship appear, remedy such defects without cost to the Owner. In default thereof, the Owner may have such work done and charge the cost to the appropriate Contractor or Subcontractor. Also, indemnify the Owner for any property damage which might result from such a defect which made repairs necessary.
- B. Certain equipment will require guarantee periods exceeding one year due to the need for seasonal operation. In such case, the guarantee will extend through at least one full, continuous season.
- C. Any fault in a system shall be corrected, and any work damaged in the course of this correction shall be repaired, replaced and restored to its original condition at no additional cost to the Owner.

#### 1.34 INSURANCE

- A. Fully insure all employees, material and finished work as required by the General Conditions of the Contract.

1.35 SCAFFOLDING, RIGGING AND HOISTING

- A. Unless otherwise indicated, the work of each Section includes all scaffolding, rigging, hoisting and services necessary for the delivery, erection and installation in place of all equipment and apparatus furnished and the removal of same when no longer required.

1.36 PROGRESS SCHEDULE

- A. Keep informed of progress schedules of all other trades and work in accordance with the project schedule to ensure timely completion of this work.

1.37 WORKMANSHIP

- A. All work shall be performed in a neat and workmanlike manner and shall conform to the best trade practices for such work.

END OF SECTION

## SECTION 16100 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. All applicable provisions of the General Conditions, the Supplementary General Conditions and Division 1 shall apply to all work in this Section.

#### 1.2 SUMMARY

- A. This Section includes the following electrical materials and methods:

1. Supporting devices for electrical components.
2. Concrete equipment bases.
3. Cutting and patching for electrical construction.
4. Touch-up painting.
5. Meter sockets.
6. Seismic Bracing
7. Electrical Devices
8. Cabinets and Enclosures
9. Grounding
10. Coordination Study and Test

#### 1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication and installation of supports and anchorage for electrical items in accordance of the requirements in section 16010.
- D. Coordination Drawings for electrical installation.
  1. Prepare Coordination Drawings according to Division 1 Section "Submittals" to 1/4-inch-equals-1-foot scale for floor plans, 3/8-inch equals 1-foot scale for Mechanical/Electrical rooms or larger, same scale as other trades. Detail major elements, components, and systems of electrical equipment and materials in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Section. Include the following:
    - a. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.

- b. Floor plans, elevations, and details, including the following:
    - 1) Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    - 2) Equipment support details.
    - 3) Exterior wall, roof, and foundation penetrations of cable and raceway; and their relation to other penetrations and installations.
    - 4) Fire-rated interior and floor penetrations by electrical installations.
    - 5) Sizes and locations of required concrete pads and bases.
  - c. Reflected ceiling plans to coordinate and integrate installing air outlets and inlets, light fixtures, alarm and communication systems components, sprinklers, and other ceiling-mounted items.
- E. Samples of color, lettering style, and other graphic representation required for each identification product for Project.
  - F. Short circuit analysis, coordination study and test.

#### 1.4 QUALITY ASSURANCE

- A. Comply with latest NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - 1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

#### 1.5 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.
- E. Coordinate connecting electrical service to components finished under other Sections. F.  
  
Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- G. Coordinate requirements for access panels and doors where electrical items requiring

access are concealed by finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors".

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
  - 1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
  - 2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.
- B. Steel channel supports have 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
  - 1. Fittings and accessories mate and match with channels and are from the same manufacturer.
- C. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets. Spring steel clamps or "click"-type hangers are not allowed.
- D. Sheet-Metal Sleeves: 0.276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.
- I. Powder-Driven Threaded Studs: Heat-treated steel.

### 2.2 SEISMIC BRACING

- A. Bracing shall be fabricated from standard structural or trade sections.
- B. Attachments to masonry walls shall be by means of expansion shields and bolts.

- C. Attachment to building structure shall meet approval of Structural Engineer.

### 2.3 CONCRETE EQUIPMENT BASES

- A. Forms and Reinforcing Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete".

### 2.4 GROUND FAULT INTERRUPTER RECEPTACLES

- A. Duplex, 20A, 125 volt AC, specification grade Ivory, ANSI C73.12, NEMA 5-20K, Hubbell #GF5362-I.
- B. Face Plates: Nylon, Ivory, Hubbell #PJ-26 or satin stainless steel 302/304.

- C. Face Plates: (Wet or Damp Locations) Gray cast aluminum, vertical, standard box mounting, gasketed, Hubbell #

## 2.9 OUTLET BOXES

- A. Outlet boxes and covers shall be pressed steel, except as noted, and protected against corrosion with zinc applied by the electric galvanizing, hot dipping or sheradizing process.
- B. Outlet boxes shall be of sizes and type to accommodate:
  - 1. Structural conditions.
  - 2. Size and number of raceways and conductors or cable entering.
  - 3. Device or fixture for which required.
- C. Outside lighting outlets shall have galvanized or cadmium plated cast iron boxes with gaskets, drilled and tapped to take fixture specified for these locations.
- D. Floor boxes where shown on plans shall be adjustable, watertight, cast iron, with brass cover and flange to match floor finish. Box shall be drilled and tapped to accommodate entering conduits and furnished with power or low tension pedestal head as indicated. Furnish in Steel City, National or equal.
- E. Cast Boxes: Cast fer alloy, deep type, gasketed cover, threaded hubs.

## 2.10 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet Metal Boxes larger than 12 Inches in any Dimension to be hinged enclosure. Cast.
- C. Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

## 2.11 BOXES AND FITTINGS

- A. Outlet boxes and fittings shall be installed at each outlet switch or junction point of conduit.
- B. Outlet boxes shall be as manufactured by Steel City, National or Raco.

## 2.12 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250; Type (1) (3R) (4) steel.
- B. Finish: Manufacturer's standard enamel finish.
- C. Covers: Continuous hinge, held closed by flush latch operable by key.
- D. Panel for Mounting Terminal Blocks or Electrical Components: 14 gage steel, white enamel finish.

## 2.13 CABINETS

- A. Cabinet Boxes: Galvanized Steel with removable endwalls. Provide 3/4 inch thick plywood backboard painted matte white, for mounting terminal blocks.
- B. Cabinet Fronts: Steel, flush surface type with concealed hinge and flush lock keyed to match branch circuit panelboard; finish in gray baked enamel.

## 2.14 TERMINAL BLOCKS AND ACCESSORIES

- A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.
- B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

## 2.15 FABRICATION

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs on enclosures.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

## 2.16 ELECTRICAL IDENTIFICATION

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Tape Labels: Embossed adhesive tape will not be permitted for any application.
- C. Wire and Cable Marker: Cloth markers, split sleeve or tubing type.

## 2.17 TOUCH-UP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Non equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION REQUIREMENTS

- D. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- E. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.
- F. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- G. Give right of way to raceways and piping systems installed at a required slope.

### 3.2 ELECTRICAL SUPPORTING METHODS

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Conform to manufacturer's recommendations for selecting supports.
- D. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200 lb-minimum design load.

### 3.3 SEISMIC BRACING

- A. Provide lateral bracing in all directions for all conduit and equipment, sufficient to resist the lateral forces determined under Connecticut Building Code, Section 1610.6.4 (BOCA 1996 as amended).
- B. Bracing calculations shall be based on Seismic Hazard Group I.
- C. A separate calculation shall be made for each equipment item.
- D. Provide bracing for all suspended or base mounted conduit and equipment except as

excluded in Table 1610.6.4(1) of the Code.

- E. Attachments to building elements shall only be made at locations having sufficient strength and rigidity to absorb the forces calculated.
- F. For suspended equipment provide bracing such that the effectiveness of the equipment vibration isolators is not reduced.
- G. Vibration isolators, where called for, shall have sufficient lateral stability to resist the forces involved.
- H. Base mounted equipment attached directly to the structure, or on foundation or housekeeping pads, shall be provided with anchor bolts having sufficient strength in shear to absorb the calculated lateral forces in all directions.
- I. Isolated, base mounted equipment shall, in addition to verification of anchor bolt strength, have isolation having lateral stability and snubbing capacity to absorb the calculated lateral forces in all directions.
- J. Locate and install bracing so that access to the equipment for service, maintenance and repair will not be impeded. Bracing shall be arranged so that there will be no impediment to removal or replacement of the entire unit or piece of equipment

### 3.4 CONCRETE BASES

- A. Unless otherwise specifically noted, the Contractor shall furnish all necessary supports, pads, bases and piers required for all equipment furnished under the Division.
- B. Concrete pads are per the Division 3 Specification for switchboards, generators, motor control centers and other freestanding equipment. All pads extend six (6") inches beyond machine base in all directions with top edge chamfered. Insert steel dowel rods into floors to seismically anchor pads. Submit shop drawings of all foundations and pads to the Engineer for review before they are constructed. Field coordinate all required dimensional and necessary loading information.
- C. Construction of foundations, supports, pads, bases and piers where mounted on the floor is of the same finish quality as the adjacent and surrounding flooring material.
- D. Securely attach all equipment, unless otherwise shown, to the building structure in an acceptable manner. Attachments are of a strong and durable nature; replace any attachments that are insufficient, in the opinion of the Engineer, as directed without additional expense to the Owner.

### 3.5 INSTALLATION

- A. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including, screws and

- bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- C. Install devices to securely and permanently fasten and support electrical components.
  - D. Raceway Supports: Comply with NFPA 70 and the following requirements:
    - 1. Conform to manufacturer's recommendation for selecting and installing supports.
    - 2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
    - 3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
    - 4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
    - 5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
    - 6. Hanger Rods: 1/4-inch diameter or larger threaded steel, except as otherwise indicated.
    - 7. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.
  - E. Provide, set in place and be held responsible for the location of all sleeves, inserts and anchor bolts required for the Work. In the event that failure to do so requires cutting and patching of finished work, it shall be done at the Contractor's expense.
  - F. Provide all conduits passing through floors, walls or partitions with sleeves having an internal diameter of one (1") inch larger than the outside diameter of the conduit or insulation enclosing the conduit.
  - G. Solidly fill with mineral fiber or other acceptable fire-stopping material all penetrations through fire-rated walls, ceilings and all floors except slab on grade) in which conduits, cables or busways pass.
  - H. Refer to Division 7 Specification for additional and more specific fire-stopping information.
  - I. Submit fire-stopping systems as a shop drawing.
  - J. Seal with a UL approved fire-stop fitting classified to an hourly rating equivalent to the fire rating of the wall, ceiling or floor all penetrations through fire-rated walls, ceiling or floors in which cables or conduits pass.
  - K. Install seal fittings on conduits and cables, as required by the NEC, which are in or pass through hazardous areas.
  - L. Use sealing bushings on conduit and cable ends to effectively prevent the intrusion of water, a damp or corrosive atmosphere, hot or cold air, or dust.

- M. Use thruwall and floor seals to provide a positive means of sealing pipes or conduits which pass through the concrete foundation of a structure below grade or below ground water level. Also use seals at entry points through concrete walls or floors which must be sealed.

### 3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.
- C. Contractor is responsible for carrying out the requirements of this section at no additional costs to Owner. Costs of defective, conflicting, ill-timed work, or unnecessary cutting, coring, patching, and repairing are the sole responsibility of the Contractor.
- D. Provide cutting and patching per Division 1 requirements. Furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of Work.
- E. Furnish, locate and set inserts and/or sleeves as required before the floors and walls are built. The Contractor is responsible for the cost of drilling, cutting and patching as required for conduits, etc., where sleeves and inserts were not installed or correctly located. Provide all drilling required for the installation of hangers.
- F. Use extreme caution when installing all holes cut through concrete slabs to avoid cutting or damaging structural members. Cuts no structural members or structural slabs/floors without the written acceptance of the Engineer. Cut structural steel members in a manner directly by the Engineer.

### 3.7 LOCATION OF OUTLETS

- A. Coordinate work with other trades so that exact roughing locations are available for all devices and equipment.
- B. Locations shown on drawings are subject to modification due to conditions arising during construction. Such changes shall be executed as part of the work of this Section. Verify locations shown on drawings with Architect and/or Owner, correcting discrepancies as they arise, all at no additional cost to the Owner.
- C. Outlets in equipment spaces shall be roughed after final location of piping and equipment has been established.
- D. Dimensions scaled from Electrical or Mechanical Drawings shall not be relied on in locating outlets. Use only Architectural Drawings for the determination of measurement of work in the field.

### 3.8 DEVICE INSTALLATION

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Install wall dimmers 48 inches above floor. Separate adjacent dimmers as instructed by manufacturer to prevent a requirement for derating of dimmers. Do not use common neutrals.
- C. Install convenience receptacles 18 inches above floor, 6 inches above counters grounding pole on bottom.
- D. Install specific-use receptacles at heights shown on Contract Drawings.
- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- F. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- H. Install devices and wall plates flush and level.
- I. Verify all mounting heights with architectural drawings.
- J. Coordinate device locations with architectural details.

### 3.9 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of boxes and outlets prior to rough-in.
- C. Locate and install boxes to allow access.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Locate boxes in masonry walls to require minimum cutting. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.
- H. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush

ceiling outlet boxes.

- I. Align wall-mounted outlet boxes for switches, and similar devices.
- J. Boxes shall set plumb and true in building surface and furnished with suitable plaster rings where so required.

### 3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.

### 3.11 CABINET INSTALLATION

- A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures. Install trim plumb.

### 3.12 POWER SYSTEM GROUNDING

- A. Main Electrical Room Grounding Grid: Exoterically weld cable connections and connections to ground rods. From two points on ground grid, provide one No. 350 KCMIL insulated ground conductor in one inch conduit to main ground bus.
- B. Main Distribution System: From ground bus, provide one No. 350 KCMIL insulated (bare) ground conductor in one inch conduit to ground bus within switchgear, to neutral of switchgear, and to non-current carrying parts.
- C. Circuit Grounding: Install grounding bushings, grounding studs, and grounding jumpers at distribution centers pullboxes motor control centers panelboards.
- D. Bonding Jumpers: Provide green insulation, sized correlated with over-current device protecting the wire, attach to grounding bushings on conduit, to lugs on boxes and other enclosures. Connection to neutral only at service neutral bar make separate lug.
- E. Bonding Wire: Install bonding wire when using flexible conduit connected at each end to a grounding bushing.
- F. Busduct Grounding: Ground busduct enclosure to main distribution center ground.
- G. Post Light Grounding: Provide direct-bury ground conductor with green insulation to lighting standards. Connect to corrosion-resistant ground stud or ground clamp to feed-in point ground.

### 3.14 ELECTRICAL IDENTIFICATION INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

### 3.15 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

### 3.16 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards and Motor Control Centers: 1/4 inch; identify equipment designation. 1/8 inch; identify voltage rating and source.
- C. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 1/8 inch; identify circuit and load served, including location.
- D. Individual Circuit Breakers, Enclosed Switches, and Motor Starters: 1/8 inch; identify load served.
- E. Transformers: 1/4 inch; identify equipment designation. 1/8 inch; identify primary and secondary voltages, primary source, and secondary load and location.
- F. Devices, provide 1/8 inch; on receptacles with circuit and panel number.

### 3.20 GROUNDING TEST

- A. Measure ground grid resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with Code requirements.

END OF SECTION

## SECTION 16111 - CONDUIT

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. All applicable provisions of the General Conditions, the Supplementary General Conditions and Division 1 shall apply to all work of this Section.

#### 1.2 WORK INCLUDED

- A. Rigid metal conduit and fittings.
- B. Intermediate metal conduit (IMC) and fittings.
- C. Electric metallic tube (EMT) and fittings.
- D. Liquidtight flexible metal conduit and fittings.
- E. Surface metal raceways.

#### 1.3 RELATED WORK

- A. Section 16010 - General Provisions-Electrical.
- B. All other Sections of Division 16.

#### 1.4 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated.
- C. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- D. FS WW-C-563 - Electrical Metallic Tubing.
- E. FS WW-C-566 - Specification for Flexible Metal Conduit.
- F. FS WW-C-581 - Specification for Galvanized Rigid Conduit.

### PART 2 - PRODUCTS

#### 2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.2 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; use fittings and conduit bodies specified above for rigid steel conduit.

2.3 ELECTRICAL METALLIC TUBING (EMT)

- A. Electrical Metallic Tubing.
- B. Fittings and Conduit Bodies: Material to Match.

2.4 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

- A. Conduit: Flexible metal conduit with PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.5 SURFACE METAL RACEWAYS

- A. As manufactured by Wiremold, Inc., type and size as indicated on Drawings.

2.6 CONDUIT SUPPORTS

- A. Conduit Clamps, Straps, and Supports: Steel or malleable iron. Refer to Section 16100.

2.7 APPROVED MANUFACTURERS

- A. Rigid steel threaded conduit shall be as manufactured by one of the following:
  - 1. Wheatland Tube Company.
  - 2. Youngstown Sheet and Tube Company.
  - 3. Republic Steel Corporation.
  - 4. Triangle.
- B. Electrical metallic tubing shall be steel, electrically welded and galvanized, and shall be as manufactured by one of the following:
  - 1. Youngstown Sheet and Tube Company.
  - 2. Republic Steel Corporation.
  - 3. Wheatland Tube Company.
- C. Couplings and box connectors shall be concrete-tight, set screw type as manufactured by one of the following:
  - 1. Raco, Inc.
  - 2. Appleton electric Company.
  - 3. Efcor Div.

- D. Furnish and install where indicated on drawings steel surface metal raceways and wireways as manufactured by:
  - 1. Wiremold Company.
  - 2. Siemens.
  - 3. Columbia Metal Products.
- E. Flexible steel conduit shall have an integral bond wire for grounding and shall be as manufactured by Sealtite, American Flexible Conduit Company, or Triangle/pwc. Liquid-tight flexible conduit shall be used where flexibility and protection from liquids, vapors, or solids is needed.
- F. Aluminum conduit and fittings will not be allowed unless specifically noted on drawings.

### PART 3 - EXECUTION

#### 3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for conductor type and number installed, 3/4 inch minimum size.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route exposed conduit and conduit above accessible ceilings, parallel and perpendicular to walls and adjacent piping.
- D. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- E. Arrange conduit supports to prevent distortion or alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- H. Support conduit per Article 314 of the National Electrical Code, 2011, (NFPA-70-2011).
- I. All conduits and cable assemblies are to be concealed unless otherwise noted.

#### 3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

- C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of four 90-degree bends between boxes.
- E. Use conduit fittings to make sharp changes in direction, as around beams.
- F. Use hydraulic bender or factory elbows for bends in conduit larger than 2 inch size.
- G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point, all underground conduits shall be water tight to prevent the entrance of subsurface water into the building.
- H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.
- J. Install expansion joints where conduit crosses building expansion joints.
- K. Where conduit penetrates fire-rated walls and floors, provide mechanical firestop fittings with UL listed fire rating equal to wall or floor rating.

### 3.3 CONTINUITY

- A. Complete raceway systems shall become metallically continuous and shall be thoroughly grounded in accordance with requirements of the National Electrical Code, 2011 and its latest revisions.

### 3.4 CONDUIT/RACEWAY SCHEDULE

- A. Wet Interior Locations: Rigid steel.
- B. Dry Concealed Locations: EMT.
- C. Dry Exposed Locations: Rigid steel or IMT, surface metal raceways.
- D. Connections to Transformers and Machinery: 24" Minimum length Sealtite Flexible Conduit.
- E. Below Grade, Below or In Slabs: Rigid steel.

### 3.5 PVC CONDUITS

- A. Where indicated on Drawings, raceways may be Schedule 40 or Schedule 80 PVC, complete with compatible fittings.
- B. All PVC conduit runs must be electrically continuous using a separate grounding conductor in addition to the conductors specified for the run.

END OF SECTION

## SECTION 16120 - WIRE AND CABLE

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. All applicable provisions of the General Conditions, the Supplementary General Conditions and Division 1 shall apply to all work of this Section.

#### 1.2 WORK INCLUDED

- A. Building wire.
- B. Cable.
- C. Wiring connections and terminations.

#### 1.3 RELATED WORK

- A. Section 16010 - General Provisions-Electrical.
- B. All other Sections of Division 16.

#### 1.4 REFERENCES

- A. NEMA WC 3 - Rubber-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- B. NEMA WC 5 - Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- C. NFPA 70 - 2011 -National Electrical Code.

#### 1.5 SUBMITTALS

- A. Submit product data for Wire and Cable under provisions of Section 16010.

### PART 2 - PRODUCTS

#### 2.1 BUILDING WIRE

- A. Thermoplastic - insulated Building Wire: NEMA WC 5.
- B. Rubber-insulated Building Wire: NEMA WC 3.
- C. Feeders and Branch Circuits Larger Than 6 AWG; Copper, stranded conductor, 600 volt insulation, THW, THHN/THWN.

- D. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THW OR THHN/THWN, 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid conductor.
- E. Control Circuits: Copper, stranded conductor 600 volt insulation, THW.
- F. Wire sizes #6 and larger shall be stranded. All sizes called for in the specifications or on the plans are American Wire Gauge sizes. Conductors shall be copper, unless noted differently.
- G. All wire shall be factory color-coded with a separate color for phase, switch and neutral used consistently throughout. The neutral wire of all branch circuits shall be white. Green shall be used for equipment grounding conductors. Feeders shall be phase color coded at all access points.
- H. The use of MC or SER cable for panel feeders is acceptable where concealed. Exposed feeders shall be run in EMT or RGC.
- I. The use of MC cable and NM cable is acceptable as required by code or as unless otherwise noted elsewhere. Where MC cable is permitted under this specification, its use shall be governed by Article 334 of the National Electric Code and approved by authorities having jurisdiction.
- J. Cables are required to be installed per NEC. All installation shall be coordinated with construction types and NEC requirements. Coordinate types of construction with Architectural plans and specifications. Install cables in conduit where required by NEC.
- K. Provide plenum rated cable where required. Coordinate with Div. 15.
- L. All wiring for branch circuits and grounding shall be provided and installed per NEC requirements. Any discrepancies to said requirements on drawings shall be verified during bid process with Engineer.
- M. Provide health care wiring as required per section 517 of the NEC.

## 2.2 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 90 degree C. individual conductors twisted together, and covered with an overall PVC jacket.
- B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 90 degree C, individual conductors twisted together, and covered with a PVC jacket; UL listed.
- C. Section A & B above shall be installed in E.M.T.

## PART 3 - EXECUTION

### 3.1 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.
- C. Place an equal number of conductors for each phase of a circuit in same raceway or cable.
- D. Splice only in junction or outlet boxes.
- E. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- F. Make Conductor lengths for parallel circuits equal.
- G. All wires and cables shall be continuous from origin to destination without running splices. At the end of these wires and cables, a sufficient slack shall be left as may be required for making proper connections.
- H. No grease or other component which contains acids shall be used in pulling wires and cables.
- I. Where solid conductors are to be connected directly to the devices without the use of lugs, such as occurs at lighting switches and plug receptacles, the wire shall be formed into a loop to fit around the screw.

### 3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricate for pulling 4 AWG and larger wires.
- B. Install wire in raceway after all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.

### 3.3 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Support cables above accessible ceilings do not rest on ceiling tiles. Use spring metal clips or cable ties to support cables from structure. Include bridle rings or drive rings.
- C. Use suitable cable fittings and connectors.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and

taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

- E. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Terminate spare conductors with electrical tape.

#### 3.4 FIELD QUALITY CONTROL

- A. Inspect wire and cable for physical damage and proper connection.
- B. Torque test conductor connections and terminations to manufacturer's recommended values.
- C. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- D. Conduits must be swabbed out and made thoroughly dry before pulling wire and cable.

END OF SECTION

## SECTION 16450 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. All applicable provisions of the General Conditions, the Supplementary General Conditions and Division 1 shall apply to all work of this Section.

#### 1.2 SUMMARY

- A. This section includes grounding of electrical and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
  - 1. Ground rods.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors, Cables, Connectors, and Rods:

- a. Erico Inc.; Electrical Products Group
- b. Ideal Industries, Inc.
- c. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- d. Raco, Inc.; Division of Hubbell
- e. Thomas & Betts, Electrical
- f. Burndy Electrical.

## 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Isolated Ground Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  1. Solid Conductors: ASTM B3.
  2. Assembly of Stranded Conductors: ASTM B8.
  3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  1. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor, unless indicated on drawing otherwise.
  2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1 5/8 inches wide and 1/16 inch thick (or as shown on the drawings).
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators with pre-drilled and tapped holes in NEMA configuration.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combination of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.

1. Size: 3/4 by 120 inches.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. In raceways, use insulated equipment grounding connectors.
- B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps with at least two bolts.
- C. Ground Rod Clamps at Test Wells: Use bolted pressure clamps.
- D. Grounding Bus: Install in electrical, telephone, CATV and data equipment rooms, and closets, and elsewhere as indicated.
  1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
  2. Length: 24 inches, unless noted otherwise.
- F. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

#### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with 2011 NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-24-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- E. CSST gas piping systems shall be bonded to the electrical service grounding electrode system at the point where the gas service enters the building. The bonding jumper shall not be smaller than 6 AWG copper wire. Coordinate with Div. 15.

### 3.3 COUNTERPOISE

- A. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 500 MCM AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches below grade and 24 inches from building foundation.

### 3.4 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Install one test well for each service at the ground rod electrically closet to the service entrance. Set top of well flush with finished grade or floor.

### 3.5 CONNECTIONS

- A. General: Make connection so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections have dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors make bolted-and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk

insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

- B. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
  - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
  - c. Equipment Rated More Than 1000 kVA: 3 ohms.
  - d. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

## SECTION 16491 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. All applicable provisions of the General Conditions, the Supplementary General Conditions and Division 1 shall apply to all work in this Section.

#### 1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
  - 1. Service disconnecting means
  - 2. Feeder and branch circuit protection
  - 3. Motor and equipment disconnecting means

#### 1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interruptor
- B. RMS: Root mean square
- C. SPDT: Single pole, double throw

#### 1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' data on features, performance, electrical characteristics, ratings and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
  - 1. Dimensioned plans, elevations, sections and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Current and voltage ratings.
    - c. Short-circuit current rating
    - d. Features, characteristics, ratings and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in

Division 16100. Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual tests of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be operational after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" article.
- E. Manufacturers Field Service Report.
- F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 section "Closeout Procedures," include the following:
1. Routine maintenance requirements for components.
  2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
  3. Time-current curves, including selectable ranges for each type of circuit breaker.
- 1.5 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - B. Comply with NEMA AB 1 and NEMA KS 1.
  - C. Comply with NFPA 70.
- 1.6 COORDINATION
- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment and adjacent surfaces. Maintain required work-space clearances and required clearances for equipment access doors and panels

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fusible Switches:
    - a. Eaton Corp.; Cutler-Hammer Products
    - b. General Electric Co.; Electrical Distribution and Control Division
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.
  2. Molded-Case Circuit Breakers
    - a. Eaton Corp.; Cutler-Hammer Products
    - b. General Electric Co.; Electrical Distribution and Control Division
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.
- 2.2 ENCLOSED SWITCHES
- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
  - B. Enclosed, Fusible Switch, 800 amps and smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.
- 2.3 ENCLOSED CIRCUIT BREAKERS
- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
    1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low level overloads, and instantaneous magnetic trip element for short circuits.. Adjustable magnetic trip setting for circuit-breaker frame sizes of 250 amps and larger.
    2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field-adjustable trip setting.
    3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
      - a. Instantaneous trip
      - b. Long- and short-time pickup levels
      - c. Long- and short-time, time adjustments
      - d. Ground-fault pickup level with time delay
  - B. Molded-Case Circuit Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
    1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
    2. Application Listing: Appropriate for application; type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
    3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

4. Shunt Trip: 120 volt trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
5. Under-Voltage Trip: Set to operate at 35 to 75 percent of rated voltage with field adjustable 0.1 to 0.6 second time delay.

## 2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  1. Outdoor Locations: NEMA 250, Type 3R
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel
  3. Wet or Damp Indoor Locations: NEMA 250, Type 4

## 2.5 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in division 16100.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install switches and circuit breakers according to manufacturer's written instructions.
- D. Provide circuit breaker type switches for all equipment for proper means of disconnect per the NEC.
- E. Install switches and circuit breakers level, and plumb, within sight of and no more than 20 feet from equipment being served.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16100.
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
  - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Infrared Scanning: After substantial completion, but not more than 60 days after final acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
  - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches and circuit breakers checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Set field-adjusted switches and circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

**A. Add Alternate No. 1 – AIR TRANSFER FAN ARRANGEMENT**

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- 1. Base Bid: Base bid shall not include any air transfer fan arrangement in walls.
- 2. Add Alternate: shall include air transfer fan arrangement in wall between the Bedroom and living room as indicated.
- 3. Add Alternate shall be indicated a separate stipulated sum amount to be added to the Base Bid upon the approval of the Owner.

**A. No. <Insert number>; <Insert title of alternate>.**

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- 1. Base Bid: <Insert brief description of base bid requirement> [as indicated on Sheet <Insert title of sheet>] [and] [as specified in Division <Insert MF04 Division number> Section "<Insert MF04 Section title>."]

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**B. Alternate: <Insert brief description of alternate requirement> [as indicated on Sheet <Insert title of sheet>] [and] [as specified in Division <Insert MF04 Division number> Section "<Insert MF04 Section title>."] **Add Alternate No. 2 – UNITS 55 THRU 64 INCLUSIVE HEAT PUMPS****

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- 1. Base Bid: Heat Pump Systems for units 1 thru 54 and units 65 thru 158 inclusive.
- 2. Add Alternate: Heat Pump Systems for units 55 thru 64 inclusive.
- 3. Add Alternate shall be indicated a separate stipulated sum amount to be added to the Base Bid upon the approval of the Owner.

2.

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END OF SECTION 012300

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SP-1

**Southwest**  
**APPROVED CONTRACTORS, LLC**  
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**Stern Village Energy Improvements**

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Professional Seal

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No.	Description	Date
1	Contract Setup	12/14/11
2	Site Visit	12/14/11
3	Site Visit	12/14/11
4	Site Visit	12/14/11
5	Site Visit	12/14/11
6	Site Visit	12/14/11
7	Site Visit	12/14/11
8	Site Visit	12/14/11
9	Site Visit	12/14/11
10	Site Visit	12/14/11
11	Site Visit	12/14/11
12	Site Visit	12/14/11
13	Site Visit	12/14/11
14	Site Visit	12/14/11
15	Site Visit	12/14/11
16	Site Visit	12/14/11
17	Site Visit	12/14/11
18	Site Visit	12/14/11
19	Site Visit	12/14/11
20	Site Visit	12/14/11

**Site Plan**

Project Name: \_\_\_\_\_  
 Client: \_\_\_\_\_  
 Date: \_\_\_\_\_

**SP-1**



Existing Site Heat Pumps