

SPECIFICATIONS & BID DOCUMENTS FOR NEW GENERATOR



New Generator
Department of Public Works
Trumbull, CT
DeCarlo & Doll Inc.
October 28, 2014

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SECTION 001 – INSTRUCTIONS TO BIDDERS

TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC TRANFER SWITCH AND GAS GENERATOR
ALTERNATE

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

GENERAL INSTRUCTIONS TO BIDDERS

The Town of Trumbull, Connecticut (hereinafter referred to as "Town"), through the Office of the Town Purchasing Agent, will accept sealed bids from qualified firms (here-in-after referred to as bidder, contractor, proposer) for an **EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH**, to be located at the Town's Highway Department, 366 Church Hill Road, Trumbull, CT 06611, in accordance with the attached specifications and scope of work.

1. PREPARATION OF BIDS

Bids shall be submitted by using the enclosed BID PROPOSAL FORM that accompanies this request. Submit one (1) ORIGINAL and one (1) EXACT COPY. Bidders should submit bids in a clear, concise and legible manner to permit proper evaluation of responsive bids. Bidders may also submit under separate cover with their proposal, any samples of reports and documents that are necessary to meet the requirements (deliverables) of this request should a purchase order be awarded.

2. BID SUBMISSION

Bids are to be submitted in DUPLICATE in a sealed envelope and addressed as follows:

BID NUMBER: 6088, DUE: NOVEMBER 19, 2014
Purchasing Agent
Town of Trumbull
5866 Main Street
Trumbull, CT 06611

Please be advised that the person signing the formal proposal must be so authorized by your organization to contractually bind your firm with regard to prices and related contractual obligations for the delivery period as is specified.

3. BID TIME

- a) Bids shall be received at the office of the Purchasing Agent, Town Hall, prior to the advertised hour of opening, at which time all proposals will be publicly opened and read aloud. Any bid received after the due date and time noted above shall not be accepted or opened.
- b) A bidder may withdraw a proposal at any time prior to the above scheduled date and time. Any bid received after the above scheduled date and time shall not be considered or opened.

4. TOWN OPTIONS

- a) The Town reserves the right to reject any and all bids and does not bind itself to accept the lowest bid or any proposal. The Town reserves the right to ask for new bids in whole or in part, or to reject any or all bids, or any part thereof, and to waive any requirements, irregularities, technical defects or service therein when it is deemed to be in the best interest of the Town and/or of the Public Works Department.
- b) If a bid proposal does not meet or better the required specifications, requirements, and scope of work requested on all points that must be outlined in a letter attached to the bid proposal otherwise it will be presumed that the bid as proposed is in accordance with the required specifications.

5. TAXES

All purchases made by the Town and/or Public Works Department, and associated with the award of this requirement shall be tax exempt. Any taxes must not be included in bid prices. A Tax Exemption Certificate shall be furnished upon request.

6. INQUIRIES AND SITE VISITS

All inquiries regarding this request shall be answered up to the close of business on November 7, 2014 after which time no additional questions will be accepted. To ensure consistent interpretation of certain items, answers to questions the Town deems to be in the interest of all bidders will be made available in writing or by Fax as appropriate to all bidders. Inquiries of a technical nature may be directed to **Emanuel Machado, DeCarlo & Doll, Inc. 89 Colony Street, Meriden CT 06451, 203-379-0467 ext 267, machadoe@decarloanddoll.com**. Other questions may be directed to the Kevin Bova, Purchasing Agent (203.452.5042). Additionally, after proposals are received, the Town reserves the right to communicate with any or all of the bidders to clarify the provisions of Proposals. The Town further reserves the right to request additional information from any bidder at any time after proposals are opened. **AN OPTIONAL SITE VISIT TO THE TOWN'S HIGHWAY DEPT, 366 CHURCH HILL ROAD, TRUMBULL, CT 06611 will be conducted NOVEMBER 5, at 3:00 PM** to verify all field conditions prior to submitting a bid.

7. AWARD AND AUTHORITY

The Town Purchasing Agent will issue notification of award in writing after consultation with and approval from the Public Works Department.

8. PRICING

- a) Bidders are requested to quote as a complete generator assembly.
- b) All prices quoted are to be firm for a period of at least 180 days following bid opening.
- c) Special Consideration will be given to responses with extended firm price dates. The Town is always interested in any and all cost reduction opportunities.

9. ASSIGNMENT OF RIGHTS, TITLES, AND INTERESTS

Any assignment or subcontracting by a bidder, vendor, or contractor for work to be performed, or goods and/or services to be provided, in whole or in part, and any other interest in conjunction with Town procurement shall not be permitted without the express written consent of the Town of Trumbull.

10. HOLD HARMLESS CLAUSE

Bidder agrees to indemnify, hold harmless and defend the Town and Public Works Department from and against any and all liability for loss, damage or expense which the Town may suffer or for which the Town may be held liable by reason of injury, including death, to any person or damage to any property arising out of or in any manner connected with the operations to be performed under an agreement with the Town, whether or not due in whole or in part of any act, omission or negligence of the Town or any of his representatives or employees.

11. WORK REGULATIONS AND STANDARDS

All work activities performed in association with this request must be performed and completed for the Town and Public Works Department in accordance with current Federal State and Local regulations. All services performed shall also conform to the latest OSHA standards and/or regulations.

12. INSURANCE

The successful bidder shall provide the Town Purchasing Agent with a Certificate of Insurance before work commences. The Town and the Public Works Department shall be named as an additional insured with an Insurance Company licensed to write such insurance in Connecticut, against the following risks and in not less than the following amounts:

- Worker's Compensation
- Contractor's Public Liability and Property Damage
- Automobile Insurance

General Liability -

Bodily Injury Liability	Each Person \$1,000,000	Each Occurrence \$1,000,000	Aggregate \$1,000,000
Property Damage Liability	Each Person \$1,000,000	Each Occurrence \$1,000,000	Aggregate \$1,000,000
Personal Injury Liability		Each Occurrence \$1,000,000	Aggregate \$1,000,000

Comprehensive Automobile Liability

Bodily Injury	Each Person \$1,000,000	Each Occurrence \$1,000,000	Aggregate \$1,000,000
Property Damage		Each Occurrence \$1,000,000	Aggregate \$1,000,000

Such policies shall provide that no coverage shall be changed or cancelled unless thirty- (30) day's prior notice of such change or cancellation shall be made to the owner. Such notice shall be made by registered mail; postage prepaid, to the Purchasing Agent, Town of Trumbull, Town Hall, Trumbull, Connecticut 06611. In the event of cancellation, the contractor shall cease all operations on or before the effective date of said cancellation and he shall not commence work again until he has obtained replacement insurance and has delivered a Certificate of Insurance to the office of the Town's Purchasing Department.

13. PROPOSAL AND PAYMENT BONDS

- a) A Bid Bond payable to the Town must accompany each Proposal for ten (10%) percent of the total amount of the Proposal. As soon as the Proposal prices have been compared, the Town will return the bonds of all except the three lowest responsible Proposals. When the Agreement is executed, the bonds of the two remaining unsuccessful Bidders will be returned. The Bid Bond of the successful Bidder will be retained until the Payment Bond have been executed and approved, after which it will be returned. A certified check may be used in lieu of a Bid Bond.
- b) The party to whom the contract is awarded will be required to execute the Agreement and obtain the Payment Bond within ten (10) calendar days from the date when Notice of Award is delivered to the Proposer. The Notice of Award shall be accompanied by the necessary Agreement and Bond forms. In case of failure of the Proposer to execute the Agreement, the Town may, at his option, consider the Proposer in default, in which case the Bid Bond accompanying the proposal shall become the property of the Town.
- c) The Town, upon receipt of acceptable Payment Bond and Agreement signed by the Contractor, shall sign the Agreement and return to the Contractor an executed duplicate of the Agreement within a reasonable period of time. The returned executed Agreement by the Town to the Contractor shall be accompanied with a Notice to Proceed.

14. LIQUIDATED DAMAGES:

- a) Non-compliance with the scheduled completion date of the Contract shall result in engineering charges as follows:
 - The Contractor shall pay liquidated damages of \$250.00 per working day for each day after the agreed Contract delivery date.

15. LOWEST RESPONSIBLE PROPOSAL

- b) The Town along with the Public Works Department shall determine the "lowest responsible qualified proposer" on the basis of the Proposer submitting the lowest "Total Proposal", responsiveness of his Technical Proposal; and demonstrating a history of the ability and integrity necessary to perform the required work; and certifying that it shall perform the work in accordance with the specifications.
- c) Proposals will be compared on the basis of the "Total Proposal" of the items listed in the Proposal and on basis of the Proposer's experience and competence.
- d) If the Lowest Total Proposal exceeds the amount of funds available for the project, the Town along with the Public Works Department reserves the right to increase or decrease any class, item or part of the work. After determining the "lowest responsible qualified proposer", the Town will issue a Notice of Award to the successful Proposer.
- e) In the event that the lowest responsible qualified proposer fails to execute the Contract and/or fails to provide the required documents within the time period prescribed, the Town and Public Works Department, at its option, may consider the lowest responsible qualified proposer to be in default, in which case the Bid Guarantee shall become the property of the Town.

16. DELIVERY TIME IS OF THE ESSENCE.

Special consideration may be given to bidders that provide an expedited delivery.

17. CONFLICT OF INTEREST

No purchase shall be made from nor shall services (other than services as an officer, agent, or employee of the Town or Public Works Department) be secured from any officer or employee of the Town or Public Works Department, or from any partnership or corporation in which such officer or employee is a partner or officer, or holds a substantial interest, unless such relationship and the fact that such purchase is contemplated shall be made known in writing to the agency making such purchase, and notice thereof posted, for at least five (5) days before such purchase be made, in the office of the agency making such purchase and in a public place in the Trumbull Town Hall.

17. WARRANTY

Selected bidder agrees to warranty all work completed for this requirement for a period of at least twenty-four (24) months starting upon final acceptance.

18. STATEMENT OF QUALIFICATIONS AND REFERENCES

Bidders shall complete and submit the "Statement of Qualifications" section of this request along with the References form. The Town and Public Works Department may make such investigations as necessary and it deems appropriate to determine the qualifications of the proposer to perform the work required. If the Town is not satisfied that the proposer is properly qualified, the Town along with the Public Works Department reserves the right to reject the proposal of said proposer.

19. SPECIFICATIONS

- a) Should any Bidder find discrepancies in the Specifications, or be in doubt as to the exact meaning, DeCarlo & Doll at once. DeCarlo & Doll, Inc. may then, at their option, issue Addenda clarifying same. DeCarlo & Doll, Inc. shall not be responsible for oral instructions or misinterpretations of specifications.
- b) The Town reserves the right to issue Addenda at any time prior to the Bid Opening. All such Addenda become, upon issuance part of the Specification. Each Bidder shall cover such Addenda in the proposal and shall acknowledge receipt of same on the blank provided therefore.
- c) The Town reserves the right to require any or all Bidders to submit statements as to previous experience in performing comparable work; and as to financial and technical organizations and resources available for this work. The mere opening and reading aloud of a bid shall not constitute or imply the Town's acceptance of the suitability of a Bidder or the bid, nor shall possession of Drawings or Specifications constitute an invitation to bid. The competency and responsibility of Bidders as well as the number of working days required for completion will be considered in making an award.

20. ADDENDUMS

It is the responsibility of the bidder to verify prior to final submittal of a bid or bid if any addenda to this request have been issued. Any addenda to this request shall be posted on the Town of Trumbull website www.trumbull-ct.gov under the Purchasing Department's section. Bidders may also call the Purchasing Department directly 203.452.5042 for inquiries regarding addenda.

21. MISCELLANEOUS

- a) All Contractors shall develop a complete and thorough schedule which demonstrates that the Contractor will be able to complete the project in a timely fashion.

END OF SECTION 001

SECTION 002 – BID FORMS

**TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH**

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

STATEMENT OF QUALIFICATIONS

Submitted by:
Name of Organization _____
Name of Individual _____
Title _____
Address _____
Telephone _____ Fax: _____ Cell: _____

Schedule A: Prior Similar Projects (Add Additional Pages as Needed)

Project	Owner	Design Professional	Contract Price	Amount Completed	Date of Delivery / Installation

Schedule B: Current Similar Projects (Add Additional Pages as Needed)

Project	Owner	Design Professional	Contract Price	Amount Completed	Date of Delivery / Installation

TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

REFERENCES
(To be submitted with proposal – attach additional pages as necessary)

List references for similar services provided for at least five (5) clients in the past five (5) years (attach any other client references if desired). **PLEASE NOTE IT IS THE TOWN'S INTENT TO COMMUNICATE WITH THE REFERENCES LISTED HEREIN.**

CLIENT 1:

Organization Name: _____
Contact Name: _____ Phone: _____
Service Dates: _____
Project(s): _____

CLIENT 2:

Organization Name: _____
Contact Name: _____ Phone: _____
Service Dates: _____
Project(s): _____

CLIENT 3:

Organization Name: _____
Contact Name: _____ Phone: _____
Service Dates: _____
Project(s): _____

CLIENT 4:

Organization Name: _____
Contact Name: _____ Phone: _____
Service Dates: _____
Project(s): _____

NEW GENERATOR
DEPARTMENT OF PUBLIC WORKS
TRUMBULL, CT
D&D Project No. 51855.00

CLIENT 5:

Organization Name: _____

Contact Name: _____ Phone: _____

Service Dates: _____

Project(s): _____

**TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH**

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

PROPOSAL

Proposal of _____ (hereinafter called "Proposer, Bidder"), organized and existing under the laws of the State of Connecticut, doing business Town of Trumbull, Connecticut (hereinafter called the Town).

In compliance with the Advertisement for Proposals, Proposer hereby proposes for the PURCHASE OF AN EMERGENCY GENERATOR FOR THE DEPARTMENT OF PUBLIC WORKS project, in the Town of Trumbull, Connecticut together with all related incidental and appurtenant work as described in the specifications or outlined and/or shown on the exhibits. The work is to be done in strict accordance with the Specifications, within the time set forth therein, and at the prices stated on the Proposal Schedule.

By submission of this Proposal, the Proposer certifies, that this Proposal has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Proposal with any other Proposer or with any competitor.

Proposer hereby agrees to commence work under this contract on or before a date to be specified in the "Notice to Proceed", and to fully complete the Project within one hundred and twenty (120) consecutive calendar days thereafter.

Proposer further agrees to pay as liquidated damages, the sum of (\$250.00) two hundred and fifty dollars for each consecutive calendar day thereafter till completion of the full contract. Proposer further agrees that he will provide and sustain the required Bonds and Insurance Policies as required.

Proposer understands that the Town reserves the right to reject any or all proposals and to waive any informality in the bidding.

Proposer agrees that this proposal shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving proposals.

Upon receipt of written notice of the acceptance of this proposal, proposer shall execute the formal contract attached within five (5) days and deliver a Surety Bond or Bonds as required in the General Conditions. The Bid Security attached in the sum of _____ Dollars (\$) is to become the property of the Town in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Town caused thereby.

Company Name

By (Signature)

Address

Print Name

Title

Date

Telephone/Fax

TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

PROPOSAL (Continued)

The undersigned hereby declares that in regard to all conditions affecting the work to be done and the labor and materials required, this proposal is based on his investigations and findings, and the Town of Trumbull and Department of Public Works and their officers, agents and employees shall not in any manner be held responsible for the accuracy of, or be bound by any estimates, borings, water or underground conditions relative to the proposed work, indicated in this or in the other contract documents; that no warranty or representation has been made by the Town of Trumbull and Department of Public Works or their officers, agents and employees as to subsurface soil or rock conditions, ground water, or other underground and similar conditions; nor has any representation or warranty been so made that the estimated quantities to be used for comparison of proposals will even approximate the actual quantities or materials and work which the Contractor may be required to furnish or perform.

1. OFFER

Pursuant to and in compliance with the Invitation to Bid relating thereto, the Undersigned has thoroughly reviewed all specifications, requirements, scope of work, standards, and general instructions of Bid Number 6088 together with any addenda issued and received prior to closing time for receipt of Bids and agrees to provide all materials, all labor and all else whatsoever necessary to erect and properly finish all work in accordance with said documents for the above mentioned projects to the satisfaction of the Trumbull and Department of Public Works for the stipulated sum of:

Base Bid (in words) _____

Base Bid (in figures) \$ _____

ALTERNATE – Gas Generator (in words) _____

ALTERNATE – Gas Generator (in figures) \$ _____

Enclosed herewith is the Bid Guaranty (10% of Base Bid minimum), in the form of: () Bid Bond () Certified Check

2. ACCEPTANCE

- This offer shall be open to acceptance for ninety (180) days from the Bid opening date.
- If this Bid is accepted by the Owner within the time period stated above, Undersigned will:
- Execute this Agreement within ten days of receipt of acceptance of this Bid.
- Furnish the required bond (s) within ten days of receipt of acceptance of this Bid.
- Commence work within seven days after written Notice to Proceed or Contract signing.
- If this Bid is accepted within the time stated, and the Undersigned fails to provide the required Bond(s), the Town of Trumbull may charge against the Undersigned the difference between the amount of this bid and the amount for which the contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the bid guaranty.
- In the event this Bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If this Bid is accepted, the Undersigned will complete all the work per the contract documents and shall receive satisfactory inspection by the appropriate municipal and state entities within **120 calendar days** from Notice to Proceed. Is it additionally understood that liquidated damages, in the amount of **\$250 per calendar day**, will be assessed for failure to complete the project within the above time period.

TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

PROPOSAL (Continued)

4. CHANGES TO THE WORK

Equitable adjustments for Changes in the Work will be net cost plus a percentage feed in accordance with the General Conditions.

5. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted therein have been considered and all costs thereto are included in the Base Bid.

Addenda # _____, _____, _____, _____, _____

6. BID FORM SIGNATURE (S)

The Corporate Seal

(Bidder - print the full name of Proprietorship, Partnership, or Corporation)

Was hereunto affixed in the presence of:

(Authorized signing officer)

(Title)

(Seal)

(Authorized signing officer)

(Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

TOWN OF TRUMBULL, CONNECTICUT
REQUEST FOR QUOTATION
EMERGENCY STANDBY POWER SYSTEMS GENERATOR SET & AUTOMATIC SWITCH

BID NUMBER: 6088 DUE: NOVEMBER 19, 2014 @ 2:00PM

PROPOSAL (Continued)

BIDDER SHALL STATE THE NAMES OF ALL OF ALL PROPOSED SUBCONTRACTORS.

PROPOSED SUBCONTRACTORS

If none, write "None" _____.

*Description of Work _____

Proposed Subcontractor Name _____

Address _____

*Description of Work _____

Proposed Subcontractor Name _____

Address _____

*Description of Work _____

Proposed Subcontractor Name _____

Address _____

*Description of Work _____

Proposed Subcontractor Name _____

Address _____

***Insert description of work and subcontractors' names as may be required.**

This is to certify that the names of the above mentioned subcontractors are submitted with full knowledge and consent of the respective parties.

The Bidder warrants that none of the proposed subcontractors have any conflict of interest as respects this contract.

Bidder _____
(Fill in Name)

By _____
(Signature and Title)

END OF SECTION 002

SECTION 004 – DIESEL GENERATOR SPECIFICATIONS

1. SCOPE OF WORK

- 1.1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the specifications herein.
- 1.2. Any and all exceptions to the published specifications shall be subject to the approval of the engineer.
- 1.3. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed at a future date per specifications herein.
- 1.4. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
- 1.5. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.

2. GENERAL REQUIREMENTS

- 2.1. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete future installation as shown on the specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
- 2.2. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, transfer switches, and switchgear, and assembles the generator sets as a complete and coordinated system. There will be one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

3. SUBMITTAL

- 3.1. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

4. CODES AND STANDARDS
 - 4.1. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
 - 4.2. The generator set shall conform to the requirements of the following codes and standards:
 - 4.2.1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 4.2.2. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
 - 4.2.3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 4.2.4. IEC8528 part 4, Control Systems for Generator Sets.
 - 4.2.5. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
 - 4.2.6. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 4.2.7. NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - 4.2.8. NFPA 99, Essential Electrical Systems for Health Care Facilities.
 - 4.2.9. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

5. TESTING

5.1. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

5.2. **Design Prototype Tests.** Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:

5.2.1. Maximum power (kW).

5.2.2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.

5.2.3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.

5.2.4. Governor speed regulation under steady-state and transient conditions.

5.2.5. Voltage regulation and generator transient response.

5.2.6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.

5.2.7. Three-phase short circuit tests.

5.2.8. Alternator cooling air flow.

5.2.9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.

5.2.10. Endurance testing.

5.3. **Final Production Tests.** Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

5.3.1. Single-step load pickup

5.3.2. Safety shutdown device testing

5.3.3. Rated Power @ 0.8 PF

5.3.4. Maximum power

5.3.5. Upon request, a witness test, or a certified test record sent prior to shipment.

5.4. **Site Tests.** The manufacturer's distribution representative shall perform an installation check, startup, and building load test once generator is delivered and completely installed. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

5.4.1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

5.4.2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.

5.4.3. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.

5.4.4. Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

6. WARRANTY AND MAINTENANCE

6.1. The generator set shall include a five year comprehensive warranty to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of startup. Optional warranties shall be available upon request.

- 6.2. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and function tests performed on all systems.

7. EQUIPMENT

- 7.1. The generator set shall be a Kohler model 230REOZJE OR or equal (to be approved by DeCarlo & Doll Inc.) with a 4UA13 alternator. It shall provide 230kW/287.5 kVA when operating at 120/208 volts, 60 Hz, .8 power factor. The generator set shall be capable of a Standby 130°C rating while operating in an ambient condition of less than or equal to 77° F and a maximum elevation of 3300 feet above sea level.
- 7.2. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 736 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.
- 7.3. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

8. ENGINE

- 8.1. The minimum 548-cubic-inch displacement engine shall deliver a minimum of 346 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
- 8.1.1. Electronic isochronous governor capable of 0.25% steady-state frequency regulation.
- 8.1.2. 24-volt positive-engagement solenoid shift-starting motor.
- 8.1.3. 45-ampere automatic battery charging alternator with a solid-state voltage regulation.
- 8.1.4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

- 8.1.5. Dry-type replaceable air cleaner elements for normal applications.
- 8.1.6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.

8.2. The turbocharged, intercooled engine shall be fueled by diesel.

8.3. The engine shall have a minimum of 6 cylinders and be liquid-cooled by Unit Mounted Radiator 122°F/50°C.

8.4. The engine shall be EPA certified from the factory.

9. ALTERNATOR

- 9.1. The alternator shall be salient-pole, brushless, 2/3-pitch, 12 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within $\pm 2.0\%$ at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
- 9.2. The alternator shall have a single maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
- 9.3. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

10. CONTROLLER

10.1. **Decision Maker® 3000 Generator Set Controller**

10.1.1. The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware and software. .

10.1.2. The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.

10.2. **Controller Buttons, Display and Components**

The generator set controller shall include the following features and functions:

10.2.1. Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:

Run Mode: When in the run mode the generator set shall start as directed by the operator.

Off/Reset Mode: When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.

Auto Mode: When in Auto the mode the generator set shall be ready to accept a signal from a remote device.

10.2.2. Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.

10.2.3. Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.

- 10.2.4. Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 characters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running the display shall scroll all important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
- 10.2.5. Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
- 10.2.6. Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
- 10.2.7. Alarm Silence/Lamp Test Button. When this button is depressed it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
- 10.2.8. USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
- 10.2.9. Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2 wire star for transfer switch and auxiliary shutdown.
- 10.2.10. The controller shall have auto resettable circuit protection integral on the circuit board.

10.3. System Controller Monitoring and Status Features and Functions

The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:

- 10.3.1. Overview menu
 - 1. Active shutdowns and warnings shall be displayed if present and without the need of operator interface.
 - 2. Engine runtime with total hours
 - 3. Average line to line voltage
 - 4. Coolant temperature
 - 5. Fuel level or pressure
 - 6. Oil pressure
 - 7. Battery voltage
 - 8. Software version
 - 9. Frequency
 - 10. Average current

- 10.3.2. Engine metering menu
 - 1. Engine speed
 - 2. Oil pressure
 - 3. Coolant temperature
 - 4. Battery voltage

- 10.3.3. Generator metering menu
 - 1. Total power in VA
 - 2. Total power in W
 - 3. Rated power % used
 - 4. Voltage L-L and L-N for all phases
 - 5. Current L1, L2, L3
 - 6. Frequency

- 10.3.4. Generator set information
 - 1. Generator set model number
 - 2. Generator set serial number
 - 3. Controller set number

- 10.3.5. Generator set run time
 - 1. Engine run time total hours
 - 2. Engine loaded total hours
 - 3. Number of engine starts
 - 4. Total energy in kW

- 10.3.6. Generator set system
 - 1. System voltage
 - 2. System frequency 50/60Hz
 - 3. System phase, single/three phase
 - 4. Power rating kW
 - 5. Amperage rating
 - 6. Power type standby/prime
 - 7. Measurement units, metric/English units adjustable
 - 8. Alarm silence, always or auto only

- 10.3.7. Generator set calibration, the following are adjustable at the controller
 - 1. Voltage L-L and L-N all phases
 - 2. Current L1, L2, L3
 - 3. Reset all calibrations

- 10.3.8. Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller
 - 1. Voltage Adjustable +/- 10%

- 10.3.9. Digital and Analog Inputs and outputs
 - 1. Displays settings and status

- 10.3.10. Event Log
 - 1. Stores event history, up to 1000 events

10.4. **Controller Engine control features and functions**

- 10.4.1. Automatic restart - the controller has automatic restart feature which initiates the start routine and re-crank after a failed start attempt.

- 10.4.2. Cyclic cranking - the controller shall have programmable cyclic cranking

- 10.4.3. Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.

- 10.4.4. The control system shall include time delays for engine start and cool down.

- 10.4.5. The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.

- 10.4.6. The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring.

10.5. Controller Alternator control features and functions

- 10.5.1. Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.
- 10.5.2. AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
- 10.5.3. Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
- 10.5.4. Power metering. The controller digitally displays power metering of kW and kVA.

10.6. Other control features and functions

- 10.6.1. Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
- 10.6.2. Historical data logging. The controller total number of generator set successful start shall be recorded and displayed.
- 10.6.3. Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.

10.7. Generator Set Warning, Shutdown Alarm and Status

The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:

10.7.1. Engine functions

1. Critical high fuel level (alarm)
2. ECM communication loss (shutdown)
3. ECM diagnostics (alarm & shutdown)
4. Engine overspeed (shutdown)
5. Engine start aid active
6. Engine under speed (shutdown)
7. Fuel tank leak (alarm & shutdown)
8. High DC battery voltage (alarm)
9. High coolant temperature (alarm & shutdown)
10. High fuel level (alarm)
11. Low DC battery voltage (alarm)
12. Low coolant level (shutdown)
13. Low coolant temperature (alarm)
14. Low cranking voltage (alarm)
15. Low engine oil level (alarm & shutdown)
16. Low fuel level (alarm & shutdown)
17. Low fuel pressure (alarm)
18. Low oil pressure (alarm & shutdown)
19. No coolant temperature signal (shutdown)
20. No oil pressure signal (shutdown)
21. Overcrank (shutdown)
22. Speed sensor fault (alarm)

10.7.2. Generator functions

1. AC sensing loss over & under current (alarm & shutdown)
2. Alternator protection (shutdown)
3. Ground fault input (alarm)
4. kW overload (shutdown)
5. Locked rotor (shutdown)
6. Over-frequency (shutdown)
7. Over AC voltage (shutdown)
8. Under-frequency (shutdown)
9. Under AC voltage (shutdown)
10. Emergency stop (shutdown)

- 10.7.3. Other General functions
1. Battery charger fault (alarm)
 2. Common fault (shutdown)
 3. Common warning (alarm)
 4. Master switch not in auto (alarm)
 5. Generator running
 6. Input/Output fault (alarm)

- 10.7.4. The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements which include several of the above along with; EPS supplying load, Master switch no in auto and contacts for local and remote common alarm.

10.8. Generator Remote Monitoring and other devices

- 10.8.1. Remote annunciator. Shall provide a minimum of 20 light remote annunciator panel for monitoring generator set conditions conveniently by facility personnel. The annunciator shall provide audible and visual alarms that meet NFPA 110 level 1 system requirements. The device shall have warnings for high/low battery voltage, battery charger failure and spare alarms for user defined inputs. The device shall have an area to identify the system device. Lamp test and alarm silence buttons will be provided. Alarm horn shall work in accordance with NFPA 110. The device shall also have the capability of annunciating Transfer Switch functions and have a key switch for testing of the automatic transfer switch. The annunciator shall also have a USB port for the upgrading of software, firmware and for allowing service personnel to change device parameters.
- 10.8.2. Inputs and Outputs. The controller shall have relay outputs and digital and analog inputs standard on the board. Also provide additional inputs and outputs via remote board that connects to the genset controller and provides optional connections for customer devices.

11. ACCESSORIES

- 11.1. **Air Restriction Indicator.** The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.
- 11.2. **Battery Charger.** A 10-ampere automatic float to equalize battery charger with the following features:
1. 12 or 24 VDC output
 2. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations
 3. Ammeter and voltmeter with 5% full-scale accuracy
 4. LED lamp for power indication
 5. Current limited during engine cranking, short circuit, and reverse polarity conditions
 6. Temperature compensated for ambient temperatures for -40°C to 60°C
 7. UL Listed
- 11.3. **Battery Rack and Cables.** Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- 11.4. **Critical Silencer.** The engine exhaust silencer shall be temperature and rust resistant, and rated for critical applications. The silencer will reduce total engine exhaust noise by 25-35 db(A).
- 11.5. **Circuit Breaker.** The generator shall come with a primary, factory installed, 100% rated line circuit breaker of 800 amperes that is UL2200 listed. Line circuit breakers shall be sized for the rated ampacity of the genset. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections. When GFI breakers are required, additional neutrals shall be factory installed.
- 11.6. **Remote Annunciator Panel.** The remote annunciator shall meet NFPA 110, Level 1 requirements and enable remote viewing of the generator status. The panel shall be connected to the generator controller via either network communication wires or via hard wired connections. Options shall be available to provide ATS source availability, contactor position, and loaded or unloaded test for up to four transfer switches. The panel shall have the capability to be either flush- mounted or surface-mounted. The annunciator shall meet UL508 requirements.
- 11.8. **Run Relay.** The run relay shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The relay provides three sets of dry contacts for energizing or deenergizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

- 11.9. **Standard Air Cleaner.** The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.
- 11.10. **2 Input/5 Output Module.** The 2 Input/5 Output Module kit provides two additional analog inputs and 5 additional dry contact outputs. The analog inputs can be used for analog or digital input functions. They can be set up for 0-5VDC, ± 3 VDC resistive or relay contact sensor devices. The dry contact outputs are arranged as two 120VAC or 28VDC, 10A form C contacts and three 28VDC, 2A form C contacts. Input and output functions are user defined using Site Tech software.
- 11.11. **Block Heater.** The block heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.

12. DOUBLE WALL SECONDARY CONTAINMENT SUB BASE FUEL TANK

- 12.1. A subbase fuel tank used in conjunction with a diesel powered generator set of 230kW will contain State Tank 944 gallons of fuel to support the generator set for a period of 59 hours at 100% of rated load and 67 hours at 75% of rated load.
- 12.2. The subbase fuel system is listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
- 12.3. The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
- 12.4. **Primary Tank.** It will be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.

Steel Channel Support System. Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.

Exterior Finish. The exterior coating has been tested to withstand continuous salt spray testing at 100 percent exposure for 244 hours to a 5 percent salt solution at 92-97° F. The coating has been subjected to full exposure humidity testing to 100 percent humidity at 100° F for 24 hours. Tests are to be conducted in accordance with The American Standard Testing Methods Society.

- 12.5. **Venting.** Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
- 12.6. **Emergency Venting.** The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is sized to accommodate the total venting capacity of both normal and emergency vents.
- 12.7. **Fuel Fill.** There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.
- 12.8. **Fuel Level.** A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed vacuum tested dial shall be provided to eliminate fogging.
- 12.9. **Low Fuel Level Switch.** Consists of a 30 watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

13. SOUND ENCLOSURE

- 13.1. The enclosure shall be constructed from high strength, low alloy steel, aluminum or galvanized steel.
- 13.2. The enclosure shall be finish coated with powder baked paint for superior finish, durability and appearance. Enclosures will be finished in the manufacturer's standard color.
- 13.3. The enclosure shall allow the generator set to operate at full load in an ambient of 40°C - 45°C with no additional derating of the electrical output.
- 13.4. The enclosure shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.
- 13.5. Doors shall be equipped with lockable latches. Locks must be keyed alike.

- 13.6. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.
- 13.7. The complete exhaust system shall be internal to the enclosure.
- 13.8. All acoustical insulation shall be fixed to the mounting surface with pressure sensitive adhesive or mechanically fastened. In addition, all acoustical insulation mounted on a horizontal plane shall be mechanically fastened. The acoustical insulation shall be flame retardant.
- 13.9. The enclosure shall include an exhaust scoop to direct the cooling air in a vertical direction.

END OF SECTION 003

SECTION 004 – AUTOMATIC TRANSFER SWITCH SPECIFICATIONS

1. SCOPE OF WORK

- 1.1. Furnish and install an automatic transfer switches system(s) with 3-Pole/4-Wire, Solid Neutral (T), 800 Amps, 208 Volt-60Hz (C). Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

2. CODES AND STANDARDS

The automatic transfer switches and controls shall conform to the requirements of:

- 2.1. UL 1008 - Standard for Transfer Switch Equipment
- 2.2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
- 2.3. NFPA 70 - National Electrical Code
- 2.4. NFPA 99 - Essential Electrical Systems for Health Care Facilities
- 2.5. NFPA 110 - Emergency and Standby Power Systems
- 2.6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- 2.7. NEMA Standard ICS 10-2005, Electromechanical AC Transfer Switch Equipment
- 2.8. EN61000-4-4 Fast Transient Immunity Severity Level 4
- 2.9. EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)
- 2.10. IEEE 472 (ANSI C37.90A) Ring Wave Test
- 2.11. IEC Specifications for EMI/EMC Immunity (CISPR 11, IEC 1000-4-2, IEC 1000-4-3, IEC 1000-4-4, IEC 1000-4-5, IEC 1000-4-6, IEC 1000-4-8, IEC 1000-4-11)
- 2.12. CSA C22.2 No. 178 certification

3. ACCEPTABLE MANUFACTURERS

- 3.1. Automatic transfer switches shall be Kohler Standard Specific Breaker - Standard Transition (KSS)/KSSACTA0800S. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid date. Alternate bids shall include a line-by-line clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.

4. MECHANICALLY HELD TRANSFER SWITCH

- 4.1. The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Main operators shall include overcurrent disconnect devices; linear motors or gears shall not be acceptable.
- 4.2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
- 4.3. The switch shall be positively locked and unaffected by momentarily outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- 4.4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
- 4.5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 800 amperes and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- 4.6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.
- 4.7. For two and three pole switches, where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
- 4.8. For four pole switches with a switching neutral, where neutral conductors must be switched as shown on the plans, the contactor shall be provided with fully rated switched neutral transfer contacts. Overlapping neutral contacts may be used as an alternative.

5. ENCLOSURE

- 5.1. The ATS shall be furnished in a NEMA 1 (A) enclosure.
- 5.2. All standard door mounted switches and indicating LEDs shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall be capable of having a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

6. CONTROLLER DISPLAY AND KEYBOARD

- 6.1. A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and control through the communications interface port or USB. The following parameters shall only be adjustable via a password protected programming on the controller:
 - Nominal line voltage and frequency
 - Single or three phase sensing
 - Operating parameter protection
 - Transfer operating mode configuration (Standard transition, Programmed transition or Closed transition)

7. VOLTAGE FREQUENCY AND SENSING

- 7.1. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored. Voltage on both normal and emergency sources and frequency on the emergency sources shall be adjustable with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Dropout/Trip	Pickup/Reset
Under voltage	75 to 98%	85 to 100%
Over voltage	106 to 135%	95 to 100% of trip
Under frequency	95 to 99%	80 to 95%
Over frequency	101 to 115%	105 to 120%
Voltage unbalance	5 to 20%	3 to 18%

- 7.2. Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 70°C .
- 7.3. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.

- 7.4. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.
- 7.5. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
- 7.6. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
- 7.7. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

8. TIME DELAYS

- 8.1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.
- 8.2. A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- 8.3. A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

- 8.4. A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect and reconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal.

The controller shall also include the following built-in time delays for the following operations:

1. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source.
 2. 10 seconds to 15 minute time delay for a failure to synchronize on an in-phase operation.
- 8.5. All time delays shall be adjustable in 1 second increments.
- 8.6. All time delays shall be adjustable by using the display and keypad, with a remote device connected to the communications interface port or USB.
- 8.7. Each time delay shall be identified and a dynamic countdown shall be shown on the display. Active time delays can be viewed with a remote device connected to the communications interface port or USB.

9. ADDITIONAL FEATURES

- 9.1. The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.
- 9.2. The display shall provide for the test functions, allowed through password security. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.
- 9.3. A contact closure shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

- 9.4. Auxiliary contacts shall be provided consisting of a minimum of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.
- 9.5. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- 9.6. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.
- 9.7. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
- 9.8. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
- 9.9. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad, communications interface port or USB. A "not-in-auto" LED shall indicate anytime the controller is inhibiting transfer from occurring.
- 9.10. An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled from the user interface, communications interface port or USB.
- 9.11. A time based load control feature shall be available to allow the prioritized addition and removal of loads based during transfer. This feature may be enabled for either or both sources. The user shall be able to control up to nine loads with independent timing sequences for pre and post transfer delays in either direction of transfer.

- 9.12. The controller shall provide 2 inputs for external controls that can be programmed from the following values:

-Common fault -Remote test
-Inhibit transfer -Low battery voltage
-Peak shave -Time delay bypass

Load shed forced to OFF position (Programmed transition only)

The controller shall provide two from "C" contact outputs rated for up to 12A @ 240VAC or 2A @ 480VAC that can be programmed from the following values:

-Aux switch open	-Transfer switch aux contact fault
-Alarm silenced	-Alarm active
-I/O communication loss	-Contactor position
-Exercise active	-Test mode active
-Fail to transfer	-Fail to acquire standby source
-Source available	-Phase rotation error
-Not in automatic mode	-Common alarm
-In phase monitor sync	-Load bank control active
-Load control active	-Maintenance mode active
-Non-emergency transfer	-Fail to open/close
-Loss of phase	-Over/under voltage
-Over/under frequency	-Voltage unbalance
-Start signal	-Peak shave active
-Preferred source supplying load	-Standby source supplying load

The controller shall be capable of expanding the number of inputs and outputs with additional modules.

- Optional input/output modules shall be furnished with mount on the inside of the enclosure to facilitate ease of connections.

- 9.13. *Engine Exerciser* - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on the calendar mode. For each routine, the user shall be able to:

1. Enable or disable the routine
2. Enable or disable transfer of the load during routine.
3. Set the start time,
time of day,
time of week,
week of month (1st, 2nd, 3rd, 4th, alternate or every)
4. Set the duration of the run.
5. At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be display when the exercise is active. It shall be possible of ending the exercise event with a single button push.

- 9.14. *Date and time* - The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
- 9.15. Systems Status - The controller shall have a default display the following on:
1. System status
 2. Date, time and type of the next exercise event
 3. Average voltage of the preferred and standby sources
- Scrolling through the displays shall indicate the following:
1. Line of line and lone to neutral voltages for both sources
 2. Frequency of each source
 3. Load current for each phase
 4. Single or three phase operation
 5. Type of transition
 6. Preferred source
 7. Commit or no commit modes of operation
 8. Source/source mode
 9. In phase monitor enable/disable
 10. Phase rotation
 11. Date and time
- 9.16. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.
- 9.17. *Self Diagnostics* - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- 9.18. *Communications Interface* - The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration). This module shall allow for seamless integration of existing or new communication transfer devices and generators.
- 9.19. The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.
- 9.20. The controller shall contain a USB port for use with a software diagnostic application available to factory authorized personnel for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The application can also adjust parameters on the controller.

9.21. *Data Logging* - The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be accessible via the communications interface port or USB.

1. Event Logging
Data, date and time indication port or USB
2. Statistical Data
Total number of transfers*
Total number of fail to transfers*
Total number of transfers due to preferred source failure*
Total number of minutes of operation*
Total number of minutes in the standby source*
Total number of minutes not in the preferred source*
Normal to emergency transfer time
Emergency to normal transfer time
System start date
Last maintenance date

*The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.

9.22. *External DC Power Supply* - An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

10. TEST AND CERTIFICATIONS

10.1. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

10.2. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

11. SERVICE REPRESENTATION

- 11.1. The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
- 11.2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

END OF SECTION 004

SECTION 005 – GAS GENERATOR SPECIFICATIONS - ALTERNATE

1. SCOPE OF WORK

- 1.1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the specifications herein.
- 1.2. Any and all exceptions to the published specifications shall be subject to the approval of the engineer.
- 1.3. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed at a future date per specifications herein.
- 1.4. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
- 1.5. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.

2. GENERAL REQUIREMENTS

- 2.1. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete future installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
- 2.2. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, transfer switches, and switchgear, and assembles the generator sets as a complete and coordinated system. There will be one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

3. SUBMITTAL

- 3.1. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring

diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

4. CODES AND STANDARDS

- 4.1. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
- 4.2. The generator set shall conform to the requirements of the following codes and standards:
 - 4.2.1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 4.2.2. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
 - 4.2.3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 4.2.4. IEC8528 part 4, Control Systems for Generator Sets.
 - 4.2.5. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
 - 4.2.6. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 4.2.7. NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - 4.2.8. NFPA 99, Essential Electrical Systems for Health Care Facilities.
 - 4.2.9. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

5. TESTING

- 5.1. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
- 5.2. **Design Prototype Tests.** Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
- 5.2.1. Maximum power (kW).
 - 5.2.2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 - 5.2.3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
 - 5.2.4. Governor speed regulation under steady-state and transient conditions.
 - 5.2.5. Voltage regulation and generator transient response.
 - 5.2.6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - 5.2.7. Three-phase short circuit tests.
 - 5.2.8. Alternator cooling air flow.
 - 5.2.9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
 - 5.2.10. Endurance testing.

- 5.3. **Final Production Tests.** Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
- 5.3.1. Single-step load pickup
 - 5.3.2. Safety shutdown device testing
 - 5.3.3. Rated Power @ 0.8 PF
 - 5.3.4. Maximum power
 - 5.3.5. Upon request, a witness test, or a certified test record sent prior to shipment.
- 5.4. **Site Tests.** The manufacturer's distribution representative shall perform an installation check, startup and building load test, once generator is delivered and completely installed. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
- 5.4.1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - 5.4.2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
 - 5.4.3. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
 - 5.4.4. Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

6. WARRANTY AND MAINTENANCE

- 6.1. The generator set shall include a five year comprehensive warranty to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of startup. Optional warranties shall be available upon request.
- 6.2. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and function tests performed on all systems.

7. EQUIPMENT

- 7.1. The generator set shall be a Kohler model 200REZXB (or equal to be approved by DeCarlo & Doll Inc.) with a 4UA13 alternator. It shall provide 200kW/250.0 kVA when operating at 120/208 volts, 60 Hz, .8 power factor. The generator set shall be capable of a Standby 130°C rating while operating in an ambient condition of less than or equal to 77° F and a maximum elevation of 1200 feet above sea level.
- 7.2. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 736 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.
- 7.3. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

8. ENGINE

- 8.1. The minimum 674-cubic-inch displacement engine shall deliver a minimum of 302 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
 - 8.1.1. Electronic isochronous governor capable of 0.5% steady-state frequency regulation.
 - 8.1.2. 24-volt positive-engagement solenoid shift-starting motor.

- 8.1.3. 45-ampere automatic battery charging alternator with a solid-state voltage regulation.
- 8.1.4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
- 8.1.5. Dry-type replaceable air cleaner elements for normal applications.
- 8.1.6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.
- 8.2. The turbocharged, aftercooled engine shall be fueled by natural gas.
- 8.3. The engine shall have a minimum of 6 cylinders and be liquid-cooled by Unit Mounted Radiator 122°F/50°C.
- 8.4. The engine shall be EPA certified from the factory, and shall not require a site performance test.
- 8.5. Natural Gas fuel supply pressure, measured at the generator set fuel inlet downstream of any fuel system equipment accessories shall be within the operating range of 1.74-2.74 kPa (7.0-11.0 in. H₂O).

9. ALTERNATOR

- 9.1. The alternator shall be salient-pole, brushless, 2/3-pitch, 12 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within $\pm 2.0\%$ at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
- 9.2. The alternator shall have a single maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

- 9.3. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

10. CONTROLLER

10.1. **Decision Maker® 3000 Generator Set Controller**

- 10.1.1. The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware and software. .
- 10.1.2. The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.

10.2. **Controller Buttons, Display and Components**

The generator set controller shall include the following features and functions:

- 10.2.1. Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:
- | | |
|-----------------|---|
| Run Mode: | When in the run mode the generator set shall start as directed by the operator. |
| Off/Reset Mode: | When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown. |
| Auto Mode: | When in Auto the mode the generator set shall be ready to accept a signal from a remote device. |
- 10.2.2. Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
- 10.2.3. Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.

- 10.2.4. Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 characters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running the display shall scroll all important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
- 10.2.5. Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
- 10.2.6. Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
- 10.2.7. Alarm Silence/Lamp Test Button. When this button is depressed it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
- 10.2.8. USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
- 10.2.9. Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2 wire star for transfer switch and auxiliary shutdown.
- 10.2.10. The controller shall have auto resettable circuit protection integral on the circuit board.

10.3. System Controller Monitoring and Status Features and Functions

The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:

10.3.1. Overview menu

1. Active shutdowns and warnings shall be displayed if present and without the need of operator interface.
2. Engine runtime with total hours
3. Average line to line voltage
4. Coolant temperature
5. Fuel level or pressure
6. Oil pressure
7. Battery voltage
8. Software version
9. Frequency
10. Average current

10.3.2. Engine metering menu

1. Engine speed
2. Oil pressure
3. Coolant temperature
4. Battery voltage

10.3.3. Generator metering menu

1. Total power in VA
2. Total power in W
3. Rated power % used
4. Voltage L-L and L-N for all phases
5. Current L1, L2, L3
6. Frequency

10.3.4. Generator set information

1. Generator set model number
2. Generator set serial number
3. Controller set number

10.3.5. Generator set run time

1. Engine run time total hours
2. Engine loaded total hours
3. Number of engine starts
4. Total energy in kW

- 10.3.6. Generator set system
 - 1. System voltage
 - 2. System frequency 50/60Hz
 - 3. System phase, single/three phase
 - 4. Power rating kW
 - 5. Amperage rating
 - 6. Power type standby/prime
 - 7. Measurement units, metric/English units adjustable
 - 8. Alarm silence, always or auto only

- 10.3.7. Generator set calibration, the following are adjustable at the controller
 - 1. Voltage L-L and L-N all phases
 - 2. Current L1, L2, L3
 - 3. Reset all calibrations

- 10.3.8. Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller
 - 1. Voltage Adjustable +/- 10%

- 10.3.9. Digital and Analog Inputs and outputs
 - 1. Displays settings and status

- 10.3.10. Event Log
 - 1. Stores event history, up to 1000 events

10.4. **Controller Engine control features and functions**

- 10.4.1. Automatic restart - the controller has automatic restart feature which initiates the start routine and re-crank after a failed start attempt.

- 10.4.2. Cyclic cranking - the controller shall have programmable cyclic cranking

- 10.4.3. Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.

- 10.4.4. The control system shall include time delays for engine start and cool down.

- 10.4.5. The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.

- 10.4.6. The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring.

10.5. Controller Alternator control features and functions

- 10.5.1. Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.
- 10.5.2. AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
- 10.5.3. Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
- 10.5.4. Power metering. The controller digitally displays power metering of kW and kVA.

10.6. Other control features and functions

- 10.6.1. Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
- 10.6.2. Historical data logging. The controller total number of generator set successful start shall be recorded and displayed.
- 10.6.3. Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.

10.7. Generator Set Warning, Shutdown Alarm and Status

The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:

10.7.1. Engine functions

1. Critical high fuel level (alarm)
2. ECM communication loss (shutdown)
3. ECM diagnostics (alarm & shutdown)
4. Engine overspeed (shutdown)
5. Engine start aid active
6. Engine under speed (shutdown)
7. Fuel tank leak (alarm & shutdown)
8. High DC battery voltage (alarm)
9. High coolant temperature (alarm & shutdown)
10. High fuel level (alarm)
11. Low DC battery voltage (alarm)
12. Low coolant level (shutdown)
13. Low coolant temperature (alarm)
14. Low cranking voltage (alarm)
15. Low engine oil level (alarm & shutdown)
16. Low fuel level (alarm & shutdown)
17. Low fuel pressure (alarm)
18. Low oil pressure (alarm & shutdown)
19. No coolant temperature signal (shutdown)
20. No oil pressure signal (shutdown)
21. Overcrank (shutdown)
22. Speed sensor fault (alarm)

10.7.2. Generator functions

1. AC sensing loss over & under current (alarm & shutdown)
2. Alternator protection (shutdown)
3. Ground fault input (alarm)
4. kW overload (shutdown)
5. Locked rotor (shutdown)
6. Over-frequency (shutdown)
7. Over AC voltage (shutdown)
8. Under-frequency (shutdown)
9. Under AC voltage (shutdown)
10. Emergency stop (shutdown)

- 10.7.3. Other General functions
1. Battery charger fault (alarm)
 2. Common fault (shutdown)
 3. Common warning (alarm)
 4. Master switch not in auto (alarm)
 5. Generator running
 6. Input/Output fault (alarm)

10.7.4. The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements which include several of the above along with; EPS supplying load, Master switch no in auto and contacts for local and remote common alarm.

10.8. Generator Remote Monitoring and other devices

10.8.1. Remote annunciator. Shall provide a minimum of 20 light remote annunciator panel for monitoring generator set conditions conveniently by facility personnel. The annunciator shall provide audible and visual alarms that meet NFPA 110 level 1 system requirements. The device shall have warnings for high/low battery voltage, battery charger failure and spare alarms for user defined inputs. The device shall have an area to identify the system device. Lamp test and alarm silence buttons will be provided. Alarm horn shall work in accordance with NFPA 110. The device shall also have the capability of annunciating Transfer Switch functions and have a key switch for testing of the automatic transfer switch. The annunciator shall also have a USB port for the upgrading of software, firmware and for allowing service personnel to change device parameters.

10.8.2. Inputs and Outputs. The controller shall have relay outputs and digital and analog inputs standard on the board. Also provide additional inputs and outputs via remote board that connects to the genset controller and provides optional connections for customer devices.

11. ACCESSORIES

- 11.1. **Air Restriction Indicator.** The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.
- 11.2. **Battery Charger.** A 10-ampere automatic float to equalize battery charger with the following features:
1. 12 or 24 VDC output
 2. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations
 3. Ammeter and voltmeter with 5% full-scale accuracy

4. LED lamp for power indication
 5. Current limited during engine cranking, short circuit, and reverse polarity conditions
 6. Temperature compensated for ambient temperatures for -40°C to 60°C
 7. UL Listed
- 11.3. **Battery Rack and Cables.** Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- 11.4. **Critical Silencer.** The engine exhaust silencer shall be temperature and rust resistant, and rated for critical applications. The silencer will reduce total engine exhaust noise by 25-35 db(A).
- 11.5. **Circuit Breaker.** The generator shall come with a primary, factory installed, 100% rated line circuit breaker of 800 amperes that is UL2200 listed. Line circuit breakers shall be sized for the rated ampacity of the genset. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections. When GFI breakers are required, additional neutrals shall be factory installed.
- 11.6. **Remote Annunciator Panel.** The remote annunciator shall meet NFPA 110, Level 1 requirements and enable remote viewing of the generator status. The panel shall be connected to the generator controller via either network communication wires or via hard wired connections. Options shall be available to provide ATS source availability, contactor position, and loaded or unloaded test for up to four transfer switches. The panel shall have the capability to be either flush-mounted or surface-mounted. The annunciator shall meet UL508 requirements.
- 11.8. **RS232 Communications.** Communications & Personal Computer Software
1. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT.
 2. Both RS-232 and RS-485 communication formats shall be available.
 3. A variety of connections shall be available based on requirements:
 - A single connection to a PC. A cable length of up to 1220 m (4000 ft) must be supported.
 - Multiple devices at a single location connected to a PC.
 - A single connection from a device to a PC over phone lines.
 - Multiple devices to a PC over phone lines.
 4. When equipped with communications modules, transfer switches and power monitors along with generator set controllers must be able to be connected to the same communication network with no additional interfaces being required.
 5. The capability to connect up to 128 devices (generator set controls and transfer switches) on a single network must be supported.

6. Cabling is to be device to device in a daisy chain fashion with no limitation on device locations within the network.
7. The network must be self- powered. No power wiring between devices is allowed.
8. A single software package with the following capabilities is required:
 - Any combination of transfer switches and generator set controls.
 - Up to 128 devices at a single site must be supported.
 - The same software package must support communications over phone lines. The software shall allow communications with up to 128 sites (phone numbers) including phone number fields large enough for International communication.
 - Access to individual devices by the software shall be protected by password.
 - To support future expansion, it must be possible to add devices (ATS and generator set controllers), up to 128 and sites up to 128, with the installed software. Changing to a different software package is not acceptable.
 - All displays, data inquires, and program functions allowed on the controllers, both generator set and ATS, shall also be available through the software.
 - A single software screen must be capable of displaying data from multiple devices simultaneously.
 - It shall be possible to reset shutdown faults, and restart the generator set using the software.
 - If a transfer switch is used, it must be possible to start the generator set and transfer the loads to the generator.

- 11.9. **Run Relay.** The run relay shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The relay provides three sets of dry contacts for energizing or deenergizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

- 11.10. **Safeguard Breaker.** A resettable line current breaker with inverse-time shall be furnished to protect the generator from damage due to its own high current capability. This breaker shall have a time delay up to 10 seconds to allow selective tripping of downstream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed.

- 11.11. **Standard Air Cleaner.** The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.

- 11.12. **Block Heater.** The block heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.

12. SOUND ENCLOSURE

- 12.1. The enclosure shall be constructed from high strength, low alloy steel, aluminum or galvanized steel.
- 12.2. The enclosure shall be finish coated with powder baked paint for superior finish, durability and appearance. Enclosures will be finished in the manufacturer's standard color.
- 12.3. The enclosure shall allow the generator set to operate at full load in an ambient of 40°C - 45°C with no additional derating of the electrical output.
- 12.4. The enclosure shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.
- 12.5. Doors shall be equipped with lockable latches. Locks must be keyed alike.
- 12.6. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.
- 12.7. The complete exhaust system shall be internal to the enclosure.
- 12.8. All acoustical insulation shall be fixed to the mounting surface with pressure sensitive adhesive or mechanically fastened. In addition, all acoustical insulation mounted on a horizontal plane shall be mechanically fastened. The acoustical insulation shall be flame retardant.
- 12.9. The enclosure shall include an exhaust scoop to direct the cooling air in a vertical direction.

END OF SECTION 005