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ELECTRICAL SPECIFICATIONS

SECTION H
EMERGENCY GENERATOR SYSTEM

1.01 GENERAL:

A. Requirements contained in this Specification shall apply to and govern the work under this Section.

1.02 WORK INCLUDED:

A. Provide labor and material necessary to install a standby natural gas engine-generator set of the latest commercial type and design as specified herein.

1.03 SUBMITTALS:

A. The Contractor shall furnish information showing manufacturers' model number, dimensions, and weights for the engine, generator, and major auxiliary equipment.

1.04 MANUFACTURERS:

A. The following manufacturers meeting these specifications are acceptable:

1. Onan
2. Caterpillar
3. Detroit Diesel
4. Kohler

1.05 SUBSTITUTIONS:

A. Proposed deviations from the specifications shall be treated as follows:

1. Request for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be by addenda only.
2. Under no circumstances will assemblers of units be acceptable. To qualify as a manufacturer, the engine or alternator must be the item manufactured and the completed engine generator set supplied by that manufacturer's authorized dealer only.
3. The Contractor shall submit copies of pertinent drawings and schematic diagrams for approval and shall include the following:
   a. Engine generator set including plans and elevations or riser views clearly indicating entrance points for each of the interconnections required.
   b. Engine generator/exciter control cubicle.
   c. Fuel consumption rate curves at various loads, ventilation and combustion CFM requirements.
   d. Exhaust mufflers and vibration isolators.
   e. Battery Charger, battery, and battery racks.
   f. Automatic load transfer switch.
   g. Actual electrical diagrams including schematic diagrams and interconnection wiring diagrams for all equipment to be provided.
   h. Legends for all devices on all diagrams.
   i. Sequence of operation explanations for all portions of all schematic wiring diagrams.
4. The specified standby KW shall be for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.
5. These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.

1.06 MATERIALS:

A. Engine: The engine shall be 1800 RPM, water-cooled in line or Vee type four-stroke cycle compression ignition natural gas. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, gas regulators, engine driven water pump, and unit mounted instruments, water temperature gauge, lubrication oil pressure gauge, and battery charging ammeter.

1. Governor – An electronic governor shall maintain frequency regulation not to exceed 3% (1.8 hertz) from no load to full rated load.
2. Mounting– The units shall be mounted on a structural steel sub-base and shall be provided with suitable spring-type isolators.
3. Safety Devices– Safety shut-off for high water temperature, low oil pressure, over-speed, and engine over-crank shall be provided.
4. Guards– Guards shall be provided over all exposed moving parts as required by OSHA.

B. Generator:

1. The generator shall be rated for continuous stand-by service at (See drawings for size) at 0.8 power factor, 120/208 volts, three phase, four wire, 60 hertz, 1800 RPM.
2. The generator shall be a three phase, 60 hertz, single bearing, rotating field, synchronous type built to NEMA standards. A voltage regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be + - 2% from no load to full rated load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustments shall be a minimum of + - 5%. Generator and exciter shall be inherently capable of parallel operation with other power sources of equivalent electrical characteristics, and stator shall include a twelve lead, re-connectable buss bar system for easy load connection.

C. Cooling System:

1. Radiator - A radiator with blower type fan shall be sized to maintain safe operation 110 degrees F ambient temperature. Air flow restriction from the radiator shall not exceed 0.5" HO.
2. The engine cooling system shall be pre-treated by the system supplier for the inhibition of internal corrosion, and freezing.

D. Fuel System: (See mechanical plans for piping of natural gas)

E. Weather Proof Housing and Exhaust Muffler;

1. Housing shall consist of a weather proof enclosure to completely enclose the engine generator and accessories. Housing shall protect the engine generator from the environment, yet be conductive to easy maintenance. Housing shall have removable swing out doors on each side and lockable rear door for access to meters and controls. Side doors shall have a means to pad lock. Construction of housing shall be of a minimum 14 gauge sheet steel and painted manufacturers standard color.
2. Exhaust muffler shall be mounted on top of housing. The exhaust muffler shall be a critical grade muffler. Muffler shall be factory installed so that its weight is not supported by the engine. A flexible exhaust fitting shall be supplied and installed between the muffler and exhaust manifold. All accessories shall be factory installed. This includes flanges, muffler, tail pipe and rain cap.

F. Automatic Starting System:

1. Starting Motor - A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
2. Automatic Control - fully automatic generator set start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, over speed, over crank. Controls shall include a 30 second single cranking cycle limit with lockout.
3. Jacket Water Heater - A unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 70 degrees F. the heater shall be 120 volt, single phase, 60 hertz. Provide pressure switch actuated by oil pressure to shut down heater when oil pressure reaches running pressure.
4. Battery Charging Alternator - A belt driven battery charging alternator rated 24 volts, 35 amp DC shall be provided with transistorized voltage regulator.
5. Batteries - A lead - acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 220 amp-hours. Necessary cables and clamps shall be provided.
6. Battery Racks - Battery racks shall be provided for each battery and shall conform to NEC 480 - 7 (a) (1). They shall be constructed of metal and so treated as to be resistant to deteriorating action by battery electrolyte. Further, construction shall be such that nonconducting insulation material directly supports the cells.
7. Battery Charger - A current limiting battery charger shall be furnished to automatically recharge batteries. Chargers shall float at 2.17 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC volt-meter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 6 amperes.

G. Generator Control Panel:

1. Type - A generator mounted NEMA 3R type vibration isolated 14 gauge steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:
   a. Frequency meter, 3 inch, dial type.
   b. Voltmeter, 3 inch, 2% accuracy.
   c. Ammeter, 3 inch, 2 % accuracy.
   d. Ammeter - Voltmeter phase selector switch.
   e. Automatic starting controls as specified.
   f. Voltage level adjustment rheostat.
   g. Dry contacts for remote alarm wired to terminal strips.
   h. Individual fault indicator lights for low oil pressure, high water temperature, over speed, and over crank.
   i. Three position function switch marked, RUN-STOP and REMOTE.
   j. Running time meter, oil pressure, battery charging ammeter, and water temperature gauges.

H. Main Line Circuit Breakers:

1. Type A main line, molded case circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions.
2. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories National Electric Manufacturer's Association, and National Electrical Code.

I. Automatic Load Transfer Switch(es):

1. The amperage rating of each automatic load transfer switch shall be as shown on riser diagram.
2. Each automatic transfer switch shall be mechanically held on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure. The switches shall be double throw with the main contacts rigidly and mechanically interlocked to insure only two possible positions: Normal or Emergency. A manual operator must be provided to enable manual operation.
3. Rating and Performance: The automatic load transfer control shall be rated for continuous duty when enclosed in a non-ventilated NEMA 3R enclosure. It shall be rated for all classes of load including inductive and non-inductive at 600 volts and tungsten lamp load at 250 volts. The transfer switch portion of the control shall be designed, built, and tested to close on an inrush current up to and including twenty (20) times the continuous rating of the switch without welding or excessive burning of the contacts. The transfer switch shall be capable of switching load up to and including fifteen (15) times the continuous rating of the switch and capable of enduring six thousand (6000) cycles of operation, at rated current, at a rate of six (6) cycles per minute, without failure. One cycle shall consist of one complete opening and closure of both sets of contacts Onan inrush current of ten (10) times the continuous rating of the switch.
4. Each transfer switch shall be listed under U.L. 1008, and approved by Canadian Standards Association. Switches utilizing reversing contactor mechanisms as a means to transfer load are disallowed and will not be considered.
5. Accessories to transfer switches; All automatic load transfer switches shall include the following accessories:
   a. Engine starting contacts to provide for generator starting from each unit independent of the other.
   b. Full phase protection. Three phase relays shall be field adjustable, close differential type with 92-95% pickup and 82-85% drop out. Relays are to be connected across live lines.
   c. Test switch, to simulate a power outage.
   d. Adjustable time delay on engine starting to over-ride momentary outages and nuisance voltage dips.
   e. Adjustable time delay on transfer of load to emergency source. Adjustable time delay to open transfer switch contact to allow motor loads to decay.
   f. Adjustable time delay on retransfer to load to normal with 5 minute cool-down timer wherein the generator set runs unloaded after transfer to line.
   g. Plant exerciser to start and run the generator set with or without load each 168 hours for a 30 minute interval. Selector switch will be provided for with load or without load testing.
   h. One auxiliary contact closed on emergency and one auxiliary contact open on emergency.
   i. Pilot lights to indicate the normal and emergency position of the transfer switch.
   j. Isolated (ungrounded neutral bar).
   k. Disconnect plug.

J. Annunciator Panel: A flush recessed panel shall be provided for remote mounting in the Administrative Area or as shown on the drawings to give audible and visual warning of fault or alarm conditions in the generator set. Wiring and conduit shall be as required by the system manufacturer. The panel shall conform with the requirements of the National Electrical Code, Section 700-12, and the National Fire Protection Associates publication, NFPA No. 110-3-5.5.1, Level One. Leak detection status shall be indicated on the annunciator.

K. Transient voltage surge protection shall be provided protecting all low voltage circuits serving the transfer switch and the annunciator. EDCO or equal.

L. Temporary Docking Station:

1. Manufacturers:
   a. Subject to compliance with requirements, provide products by one of the following:
      i. Trystar
      ii. Other brands considered by Prior Approval
2. Enclosure:
   a. NEMA 3R or better, Rain-Tight Aluminum enclosure.
   b. Pad lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
   c. NEMA 3R rating integrity shall be maintained while the temporary cabling is connected during use.
   d. Front and Sides shall be accessible for maintenance.
   e. Top, Sides and Bottom shall be accessible for Permanent Cabling.
   f. Pain After Fabrication Power Coat finish, manufacturer standard color.
3. Phase, Neutral and Ground Busbar
   a. Material: Silver-plated Copper
   b. Equipment Ground Bus, Bonded to enclosure
   c. Isolated Ground Bus, Insulated from box
   d. Ground Bus, minimum 50% of phase size / rating.
   e. Neutral Bus rated a minimum of 100% of the phase bus rating, or as directed on drawings / riser.
4. Temporary Connectors
   a. Camlock style connectors, 16 series model and color coded according to system voltage and requirements.
   b. Camlock connections shall be Bus Bar Style, Cabling or Double Set Screw connections are not acceptable
   c. Camlock connections shall be fully protected against accidental contact while not in use.
5. Permanent Connections shall be factory installed broad range set-screw mechanical type lugs, located behind a physical separation barrier.
6. Integrated Transfer Switch Configuration:
   a. Docking station shall integral Rotary Transfer Switch, Manually Operated.
   b. Switch shall have three positions – Utility / Permanent Line, Off, and Temporary Line.
   c. Switch mechanism and actuator shall be located behind pad lockable door to prevent tampering by unauthorized personnel.
7. All equipment designed and intended for 600 volt class rated, with operating characteristics and configuration for 208 / 120 Volt, 3 – Phase, 4 – Wire, 60 Hz systems at the ampacity noted on drawings.
8. Provide complete with factory installed Phase Rotation Monitoring and Alarm Device and connections.
9. Remote Annunciator, provide a separate remote annunciator panel, or integrate remote alarm annunciation into generator remote panel where provided and where possible for connection. If generator annunciator does not have sufficient functionality a separate panel is required.
10. Provide with integral 7 mode surge protective device, rated for minimum 120,000 surge current amps per phase.
11. PROVIDE HOUSEKEEPING PAD MINIMUM 10" THICK, WITH THE TOP AT A MINIMUM 6 INCHES ABOVE GRADE, AND THAT EXTENDS AT LEAST 6 INCHES HORIZONTALLY BEYOND THE EDGE OF THE DOCKING STATION ON ALL SIDES. COORDINATE CONCRETE AND REINFORCING REQUIREMENTS WITH ARCHITECTURAL, STRUCTURAL AND CIVIL SPECIFICATIONS.

1.07 MANUFACTURING:

A. The engine, including engine block, oil plan, and cylinder heads, generator and all major items of auxiliary equipment shall be manufactured in the U. S. by manufacturers currently engaged in the production of such equipment.

B. The unit shall be shipped to the job site by the manufacturer's authorized dealer having a parts and service facility within a 75 mile radius of the job site. In addition, and in order not to penalize the owner for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than eighty percent (80%) of all engine replacement parts in his stock at all times. Certified proof of this requirement shall be available from the dealer and a personal inspection of the dealer's facilities shall be made by the designing engineer or his appointed representative to substantiate claims made by the generator set supplier.

1.08 TESTING:

A. Prior to acceptance of the installation, equipment shall be tested to show it is free of any defects and will start automatically and be subjected to full load test through the use of existing loads and, dry type load banks supplied for this purpose at the job site by the generator set supplier.

B. Load bank testing shall be done in the presence of the Owner's engineer or his appointed representative only after the unit is permanently installed in accordance with the plans and specifications. If testing is completed without benefit of Engineers presence, testing shall be done again in his presence. Testing shall be for a period of four (4) hours under full load.

C. Contractor shall supply all fuel necessary for load bank testing and shall before final acceptance of generator unit top off tank leaving it full.

1.09 CERTIFICATE TEST REPORTS, MANUALS AND INSTRUCTIONS:

A. Prior to the final inspection, deliver 4 copies of the following items to the Engineer:

1. A certificate by the manufacturer of the engine-generator set that the auxiliary electrical power system has been properly installed, adjusted and tested.
2. Certified copies of all of the factory and construction site test data sheets and reports for the engine-generator set and major auxiliaries.
3. Complete operating and maintenance manuals for the engine-generator set and auxiliaries including wiring diagrams, technical data sheets and information for ordering replaceable parts:
   a. Include complete interconnection diagrams which indicate all components of the system.
   b. Include complete diagrams of the internal wiring for each of the items of equipment.
   c. The diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

B. Laminate or mount under plexiglas a set of operating instructions for the system and install it under a neat frame, adjacent to transfer switch.

C. Furnish the services of a competent, factory-trained engineer or technician for instructing operating and maintenance personnel on the proper operation and maintenance of the system at the time of testing.

1.10 SYSTEM SERVICE CONTRACT:

A. The supplier of the standby power system shall provide a copy of and make available to the owner his standard service contract which, at the owner's option, may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specification sheets, wiring or outline drawings, etc. Submitted for approval to the designing engineer. The contract shall be for the complete power system.

1.11 WARRANTY:

A. The complete standby electrical system furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But, in no event shall it be for a period of less than five (5) years or 3000 hours from date of final testing and acceptance of the system and shall include labor, parts and travel time for necessary repairs at the job site. Warranty information shall be submitted along with construction site test data sheets. This information shall list starting and ending dates and who is to be contacted for warranty service.

END OF SECTION H

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