

16620 STANDBY EMERGENCY ELECTRICAL GENERATOR (CNG/LPG)

SPECIFIER:

CSI MasterFormat 2004 number: 26 32 13

PART 1 GENERAL

1.1 WORK INCLUDED

A/E shall use this Section for non-EHPA school Facilities. A/E shall provide emergency generator information according to the project's design requirements.

- A. Provide a standby electric generating system which is rated for continuous standby service at ____ KW, ____ KVA at 0.8 power factor, 277/480 volts at 60 Hertz. The system includes but is not limited to the following:
 - 1. A compressed natural gas (CNG) or liquefied petroleum gas (LPG) engine-driven electric plant, to provide emergency electric power.
 - 2. Engine mounted start stop control systems.
 - 3. An automatic load transfer control to provide automatic starting and stopping of the plant and switching of the load.
 - 4. Generator main disconnects.
 - 5. Mounted accessories as specified.
 - 6. Remote annunciator panel.
 - 7. Pressurized fuel tank for LPG or CNG.

- B. The system shall be built, tested and shipped by the manufacturer of the generator set so there is one source of supply and responsibility. The performance of the emergency electric plant shall be certified by an OSHA approved Nationally Recognized Testing Laboratory (NRTL), including the plant's full power rating stability, voltage and frequency regulations. All components shall be of American manufacture.

- C. Related Sections:
 - 1. 03300 - Concrete.
 - 2. Division 15 - Mechanical.
 - 3. 15890 - Ductwork.
 - 4. 16250 - Automatic Transfer Switch.
 - 5. 16475 - Overcurrent Protective Devices.

1.2 SUBMITTALS

- A. Submit for review, the following product data materials:
 - 1. Generator Set: Generator, battery charger, batteries, engine governor, exhaust silencer, vibration isolators, remote annunciator panel, voltage regulator, jacket water heater, filters, fuel tank and accessories, remote shunt-trips.

2. Transfer Switches and Control Panel.
3. Mounted Accessories as specified herein.
4. The following Engine-Generator data in tabular form:
 - a. Make of engine.
 - b. Number of cylinders.
 - c. Bore, inches.
 - d. Stroke, inches.
 - e. Piston displacement, cubic inches.
 - f. Piston speed, feet per minute, at rated rpm.
 - g. Bmep @ rated kW output.
 - h. Make and type of generator.
 - i. Generator electrical rating, kVA and kW @ 0.8 pf lagging.
 - j. Number and type of bearings.
 - k. Exciter type.
 - l. Generator insulation class and temperature rise.
 - m. Combustion air requirements.
 - n. Exhaust flow and maximum allowable backpressure.
 - o. Radiator (CFM) air requirements at maximum rated ambient air temperature. static pressure and allowable external static pressure drop.
 - p. Radiated heat.
 - q. Maximum brake hp @ rated rpm.
 - r. Engine manufacturer certified engine bhp curve and certified engine-generator set fuel consumption curve.
 - s. Lubrication requirements and recommended products.
 - t. Fuel requirements including fuel line sizes and recommended products.
 - u. Shipping and net weight of engine-generator package.
 - v. Type of fuel injector system.
 - w. Harmonic analysis.
 - x. Certified engine HP curves.
 - y. Exhaust pipe size.
 - z. Available short-circuit.
5. Disconnect switches.
6. NFPA 110 Level 1 Factory generator set Test Report.
7. Provide operating and maintenance manuals, complete with replacement parts data, in printed and electronic media format (CD).
8. Submit sample of written warranty for review and approval. Failure to comply with this mandatory requirement is considered sufficient reason to reject all submittal data.
9. Contract Closeout Submittal: Furnish M-DCPS the manufacturer's certification and warranty assuring each item of equipment is complete and in good condition, free from damage, properly installed, connected, adjusted, and tested as to full power rating, stability, voltage and frequency regulation.

1.3 QUALITY ASSURANCE

- A. Qualifications: Single source generator supplier and installer, acceptable to the standby emergency generator manufacturer, capable of providing, but not limited to, the following services:

1. Generator and electrical apparatus pertinent to the generator including the automatic transfer switches.
 2. Complete fuel tank system.
 3. Annunciator Panel.
 4. Sheet metal shrouding.
 5. Plumbing pertinent to the fuel system and generator.
 6. Exhaust system and piping.
 7. Insulation of exhaust system.
 8. Control wiring between generator and transfer switch, water heater, battery charging, and annunciator panel wiring.
 9. Required warranty.
 10. Other work required for a complete and operable system.
- B. Generator set, transfer switch, and all accessories shall be delivered to the job site by the manufacturer's local authorized dealer who will supervise its installation and testing.
1. In order to qualify as local authorized distributor, that dealer must be authorized to perform warranty service on the complete system including engine, generator, controls, and automatic transfer switch, and must provide written proof of such authorization upon request.
 2. Authorized dealer must maintain a 24-hour emergency parts and service facility within a 2-hour response range of the job site and have a minimum of five years continuous experience in Southeastern Florida.
- C. M-DCPS will not accept 2 or more subcontractors to provide the Standby Emergency Generator work.
- D. Performance Requirements: Materials shall be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL).

1.4 WARRANTY

- A. Manufacturer of the standby emergency generator system shall provide a 5 years warranty against all defects in materials and labor from date of substantial completion. The date of equipment delivery shall not be used to supersede this requirement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Emergency Generator System:
1. Caterpillar.
 2. Cummins-ONAN.
 3. Kohler.

2.2 GENERATOR

- A. Permanent magnet generator (PMG) exciter.
- B. Class H insulation limited to Class "F" (130 degree C) rise.

- C. Pitch: 2/3 pitch to minimize 3rd harmonics from the generator produced fundamental waveforms.
- D. Provide an internally mounted 120-volt AC (alternating current) single-phase alternator anti-condensation space heater to minimize condensation while the generator is not running. The heater shall be electrically connected to the generator enclosure mounted AC service junction box and shall be interface wired to the AC panel by the electrical contractor.
- E. Provide, install and wire 3-phase fused NRTL listed lightning arrestor and NRTL listed surge capacitor inside the generator housing.

2.3 ENGINE

A/E shall provide emergency generator system information according to project design requirements.

- A. The engine shall be turbocharged, four cycle, water cooled with unit-mounted radiator, air discharge duct adapter, fan and water pump, LPG or CNG fueled and meet EPA regulation.
 - 1. Provide _____cylinders and a minimum rating of _____BHP at the operating speed of 1800 RPM developed.
 - 2. Supply full pressure lubrication by a gear oil pump.
 - 3. Provide oil filters with replaceable elements, oil coolers, fuel pumps and jacket water heater (120 or 208 volt AC single-phase) connected to a heater contactor controlled by the heater's thermostat; to be wired by the electrical contractor.
- B. Govern engine speed by a isochronous governor to maintain alternator frequency within 3 Hertz from no load to full load alternator output. Ensure the engines have a 24-volt, DC, battery charging alternator with transistorized voltage regulator.

2.4 ENGINE INSTRUMENTS

- A. The engine instruments panels shall contain an oil pressure gauge, water temperature gauge and battery charge rate ammeter.

2.5 ENGINE CONTROLS

- A. Provide complete engine start control, which operates on closing contact, and stop control, which operates on opening contact. Provide a cranking limiter to open the starting circuit in approximately 45 seconds if the plant has not started within that time.
- B. Electric plants' control shall include a 3-position selector switch with the following positions: RUN STOP, REMOTE, high water temperature, low oil pressure, and overspeed shutdown.
- C. Provide individual signal lights and alarm terminal to indicate when any safety device has operated.

- D. Provide two remote emergency stop switches. Depict switches locations on drawings, requirements as per NEC.

2.6 ALTERNATOR

- A. The alternator shall be brushless, 4 pole revolving field type with rotating rectifier exciter and solid-state voltage regulators. Directly connect the stators to the engine fly wheel housing, and the rotors driven through a semi-flexible driving flange to ensure permanent alignment.
- B. Voltage regulation shall be within plus 2 percent of rated voltage, from no load to full load. The instantaneous voltage dip shall be less than 12 percent of rated voltage when full load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within three seconds.
- C. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage.
- D. Include a Rheostat that provides a minimum of plus or minus 5 percent voltage adjustment from rated value. Ensure temperature rise is within rating as defined by NEMS MG1 22.40.

2.7 ALTERNATOR INSTRUMENTS PANELS

- A. The alternator instrument panel shall be wired, tested and shock mounted on the electric plant by the manufacturer of the emergency generator. It shall contain at least the following equipment:
 - 1. Oil pressure gauge.
 - 2. Water temperature gauge.
 - 3. Battery charge rate ammeter gage.
 - 4. Lapsed time meter.
 - 5. AC voltmeter: Dual Range, indicates all voltages.
 - 6. AC ammeter: Dual Range, indicates current in each phase.
 - 7. Frequency meter.
 - 8. Run off auto switch.
 - 9. Phase selector switch.
 - 10. Voltage adjusting rheostat.
 - 11. Remote start-stop terminals.
 - 12. Battery charging alternator on engine with voltage regulator.
 - 13. Manual reset button.
 - 14. Overload field circuit breaker with manual reset.
 - 15. Emergency latch relay and alarm terminal.
 - 16. Cranking limiter and light.
 - 17. One fault light for safety shutdown.
 - 18. Automatic overspeed shutdown.
 - 19. High engine temperature shutdown.
 - 20. Low oil pressure shutdown.
 - 21. Panel lights with on-off switch.
 - 22. Engine water jacket heater.
 - 23. Meter Switch.
 - 24. Voltmeter/Ammeter phase selector with off position.

2.8 ELECTRIC PLANT MOUNTING

- A. Provide the electric plant on a welded steel base, suitable for mounting to any level surface. Provide unit with four quad spring vibration isolators. Mount the entire package on a 6-inch high concrete pad that extends 4 inches all around from the generator steel base.

2.9 GENERATOR TERMINAL BOX

- A. Generator phase and neutral loads shall be brought into an oversize terminal box and terminated at copper bus bar extensions, where external connections can be made to generator feeder disconnect.
- B. Provide a ground bar in the box, bonded to the box, for termination of grounding conductors.
- C. Ground fault CT's shall be provided in the terminal box by the generator supplier. Ground fault relays shall be alarm only.

2.10 GENERATOR MAIN DISCONNECT

- A. Provide a solid-state main circuit breaker with long-time pickup and delay, short-time pickup and delay, and instantaneous. Provide 24 volt D.C. shunt-trip for remote trip.

2.11 FUEL SYSTEM

- A. Provide two equal-size LPG fuel tanks, or direct connection from the existing CNG site-available gas line, capable of supplying enough fuel to operate generator at full rated load for 8 continuous hours. Fuel tank manufacturer shall be registered with Florida Department of Environmental Protection (FDEP) and have current valid equipment list number (EQ#). If permitted by Code and AHJ, fuel tanks shall be buried and provided proper underground protection.

2.12 ACCESSORIES

- A. Provide all accessories needed for the proper operation of the plant. Include critical location exhaust silencers with inlet, flexible exhaust connections, starting batteries, battery cables, battery racks and detailed operation and maintenance manuals with parts list.
- B. Supply the fuel engine driven unit with at least the following specific accessories:
 - 1. Separate gas tank, and fuel lines:
 - a. Power available green pilot light indicator.
 - b. Fuel strainer.
 - c. Solenoid valve.
 - d. External threaded vent connection.
 - 2. Silencer and Flexible Exhaust Connector:

- a. Provide a Maxim M-41 critical type exhaust silencer with side inlet as manufactured by Riley Beard, Inc., or A/E approved equal by Nelson. Silencer size shall be as required to be equal to exhaust pipe size.
- b. Exhaust Muffler shall be all-welded design, constructed of sheet and plate steel.
- c. Provide a flexible connector, minimum 36 inches long, same size as exhaust pipe, compatible with engine manifold flange for exhaust pipe system, to be installed by mechanical contractor.
- d. Insulate the muffler and exhaust pipe with 1-1/2 inch thickness of Kaylo Block 1800 degree F insulation, as manufactured by Owens-Corning Fiberglass. Secure the 1-1/2 inch Kaylo block to the metal lath with 14 gauge galvanized wire ties, 16 inches on center. Stretch smoothly a 1 inch 20 gauge galvanized hex, mesh and secure over the insulation. Apply a minimum of 1/4-inch thick wet coat of fibrous (non-asbestos) cement over the insulation to a smooth and even finish. After the cement has dried, cover the insulation with 8 ounces canvas applied with adhesive.

3. Batteries and Charger:

- a. Provide batteries for engine starting. Batteries shall be mounted in a suitable acid-resistant rack not made with wood products.
- b. Provide an automatic battery charger with voltmeter and ammeter, for 120 volt, 1 phase input and 24 volt D.C. output. 10 amp output minimum. Meeting NFPA 110 alarm requirements. An alarm for Battery Charger failure, Low battery charge rate, High battery charge rate shall be supplied.
- c. Provide Heavy duty battery cables.

4. Remote Annunciator Panel:

- a. Provide a remote annunciator panel in compliance with NFPA-110 Level 1 at the Main Administration Office, as indicated on Contract Drawings.

2.13 CONTROL PANEL

- A. Loss of normal power (as defined in transfer switch specification), at transfer switch automatically causes the generator system to start, accelerate to rated speed and build up to rated voltage.
- B. If the generator fails after 3 attempts, the failure light is lit and an alarm sounded on the control panel and remote annunciator panel.
- C. After normal power has been restored to transfer switch and after the time delay on retransfer, the transfer switch returns to normal power and all controls reset for next operation. After an adjustable time delay, the unit shuts down automatically.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install standby emergency generator according to the manufacturer's recommendations and according to the requirements of NFPA 70 - National Electrical Code - (NEC).

- B. The Installer shall be responsible for coordinating all trades to ensure the proper functioning of the entire systems including but not limited to fuel supply, exhaust equipment and air transfer system. This coordination shall include furnishing all required information to other subcontractors regarding fuel, exhaust and cooling system dimensions, pipe and duct sizes, etc. The Installer shall furnish a dimensioned plan layout indicating all generator dimensions, roughing dimensions, piping layout, duct layout, tank locations and elevations and all required electrical wiring and interconnections. These areas include but are not limited to the following:
 - 1. Fuel System including main fuel storage tank, (day tanks), and piping, as specified.
 - 2. Remote Annunciator Panel.
 - 3. Cooling air intake and exhaust louvers.
 - 4. Sheet metal ductwork interconnection between radiator and exhaust air louvers.
 - 5. Installation of mufflers and exhaust pipes.
 - 6. Insulation of mufflers and exhaust pipes.
- C. Emergency generator controls shall be readily accessible as defined by NEC.
- D. Provide the generator with a time elapsed meter and automatic programmer.

3.2 TESTS AND START-UP

A. Tests:

- 1. The emergency generator system shall receive the manufacturer's standard testing.
- 2. Before acceptance of the installation, the equipment shall be tested to show it will start automatically, subjected to full load test, shut down and reset as required in these Specifications.
- 3. The entire emergency power system will be started up and certified in writing by the manufacturer of the generator system. Test the system per NFPA 110 under full load with a dry resistive load bank at the jobsite, for a minimum of four hours, including minimum of three (3) hours at 100% and 1 hour at 110%.
- 4. Test shall be performed in the presence of the A/E, M-DCPS Project Manager, and representative from M-DCPS Facilities Maintenance Operations.
- 5. Before acceptance, any defects that become evident during this test shall be corrected at no additional cost to M-DCPS.
- 6. Provide cold start test and record time required to come to a voltage and frequency stable condition.

B. Start-up and Instructions:

- 1. On completion of the installation, perform the initial start-up by a factory-trained and certified representative of the generator system manufacturer.
- 2. At the time of start-up, operating instructions and maintenance procedures shall be thoroughly explained to M-DCPS's operating personnel.
- 3. Two hard-copies and two DVD copies of all operating and maintenance instruction books shall be supplied to M-DCPS for the emergency generator system and auxiliary equipment.
- 4. One set of special tools, operating software, connection cables and any other equipment necessary to diagnose and repair the generator system shall be supplied to M-DCPS.

3.3 RELATED WORK BY OTHERS

- A. All exhaust system piping, insulation and connections from the engine to the muffler, and from the muffler to the exterior of the building including the thimble, shall be provided complete under Division 15. The muffler shall be provided by the emergency generator /engine supplier.

END OF SECTION