

SECTION 16231 - EMERGENCY GENERATOR

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. The Vendor shall provide and install two engine driven generator sets that have been prototype tested, factory built, production tested, and site tested, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. All equipment shall be new and of current production by an international firm which manufactures the generator and controls. The Contractor shall provide all required fluids for the generator, including a full tank of diesel fuel after acceptance of the generator and all testing is complete.

1.2 GENERAL REQUIREMENTS:

- A. The generator sets will be of the latest commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm which manufactures the generators 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.

1.3 SUBMITTAL:

- A. The submittal shall include 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.

1.4 TESTING:

- A. To assure 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 these separate tests: final production tests and site tests.

B. Production Tests

1. Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
2. Verify the single-step load pickup maximum in KW that can be placed on the unit
3. Transient and steady—state governing.
4. Safety shutdown device testing.
5. Voltage regulation.
6. Rated Power @ 0.8 PF
7. Maximum Power.
8. Certified test record will be sent prior to shipment for review by the Owner and Engineer.

B. SITE TESTS

1. Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.
2. Lubricating oil and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected. The Vendor shall provide and install all required lubricating oil and antifreeze for the initial set-up of the generator.
3. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
4. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the enclosure, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency and phase rotation.

5. Automatic start-up by means of 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 voltage, amperes, and frequency shall be monitored throughout the test.
6. The Contractor/Vendor shall provide a four (4) hour full load (100% rating of the generators) bank test of each generator and provide the Owner with written certification that the generator meets all required requirements and is 100% ready for use on this project. This test shall be performed on site once the generator and associated equipment is fully installed.

1.5 WARRANTY & MAINTENANCE:

- A. A two year warranty for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- B. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified.

PART 2 – PRODUCTS

2.1 PRODUCTS:

- A. The generator set shall be manufactured by Caterpillar Diesel Engine Generator Set with sound attenuated enclosure and sub-base fuel tank or prior approved equal by MTU Onsite Energy, Kohler or Generac. One generator shall be rated 2,500 KW / 3,125 KVA, standby, 0.8 power factor, 480Y/277Volt, three phase, 4 wire and shall have an output circuit breaker, rated 4000 Amp, 3 pole, 100% rated. The second generator shall be rated 275 KW / 344 KVA, standby, 0.8 power factor, 480Y/277Volt, three phase, 4 wire and shall have an output circuit breaker, rated 500 Amp, 3 pole, 80% rated. The generator sets shall be capable of this full rating while operating in the conditions normal for Griffin, Georgia.

- B. The generator sets shall be capable of starting all rated loads in one block step as per NFPA 110 with a maximum voltage dip of 20% as allowed by the National Electrical Code. Provide a complete sizing report at the Shop Drawing Phase of the project for each generator indicating the maximum voltage dip is 20% or less for the single block load.
- C. Vibration isolators shall be provided between the engine-generator and heavy-duty steel base and between the steel base and the sub-base fuel tank.

2.2 ENGINE:

- A. The engine shall run at a governed speed of 1800 rpm. The engine shall be equipped with the following:
 - 1. An electronic isochronous governor capable of +/- 0.25% steady-state frequency regulation.
 - 2. 24 Volt positive engagement solenoid shift-starting motor.
 - 3. 45 Ampere minimum automatic battery charging alternator with solid-state voltage regulation.
 - 4. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 - 5. Dry-type replaceable air cleaner elements for normal applications.
- B. The engine shall be for operation on diesel fuel. The 2500 KW unit shall be supplied with a minimum of 4,000 gallon double wall, UL Listed integral fuel tank base; high and low fuel solenoid level switches and low level alarm and rupture basin leak detection alarm. The 275 KW unit shall be supplied with a minimum of 800 gallon double wall, UL Listed integral fuel tank base; high and low fuel solenoid level switches and low level alarm and rupture basin leak detection alarm.
- C. The engine shall be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H₂O static pressure on the fan in an ambient temperature up to 122°F/50°C and maintain this rating when installed in the sound enclosure. Provide with radiator duct flange.
- D. Engine shall be certified for complaint with EPA Certified for Stationary Emergency Application, EPS Tier 2 emissions level. Emergency Standby Compliant Tier 2.

2.3 GENERATOR:

- A. The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed 2/3 pitch stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22) for Class H and be tropicalized. Temperature rise of the rotor and stator shall be limited, shall be Class F temperature rise. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 1% at any constant load from 0% to 100% of rating.
- B. The generator set shall meet the transient response requirements of ISO 8528-5.
- C. The alternator excitation shall be of a permanent magnet exciter design.
- D. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

2.4 CONTROLLER:

A. Standards

- 1. The generator must meet NFPA-110 Level 1 requirements (current version) and must have an integral alarm horn as required by NFPA. Controller shall be CAT EMCP 4.2 Genset Controller or prior approved equal.
- 2. Provide and install in the generator controller a Modbus Communications Card (CCM Card) such that the generator will communicate with the Owners metering system.

B. Applicability

- 1. For standardization purposes, the control described herein must be available on generator sets 20 kW and larger.
- 2. The control must be usable on 24-volt starting systems.
- 3. Environment
 - a. -40°C to +70°C operating temperature range
 - b. 5-95% humidity, non-condensing

C. Hardware Requirements

1. The control shall have a run-off/reset-auto three-position selector switch.
2. Seven indicating lights:
 - a. Switch Position
 - b. Common alarm
 - c. Common Shutdown
 - d. System Ready
 - e. Speed Signal
 - f. Emergency Stop
3. Lighted display with two lines of 20 alphanumeric characters for messages. Panel lights must be supplied as standard.
4. Four position snap action sealed keypad for menu selection and data entry.
5. An audible alarm must be supplied in the control unit.

D. Control Functional Requirements

1. Field programmable time delay for engine start. Adjustment range, 0-15 in 1 second increments.
2. Field programmable time delay engine cool down. Adjustment range, 0-99 minutes in 1-minute increments.
3. Output for overcurrent if the generator reaches a user programmable percentage of its KW rating. Load shed must also be enabled if the generator output frequency falls below 59 Hz (60 Hz system).
4. Programmable cyclic cranking that allows up to six crank cycles and up to 45 seconds of crank time per crank cycle.

E. Generator System Monitoring Requirements

1. All monitored functions must be viewable on the digital display.
2. The following generator functions must be monitored:
 - a. all output voltages - line to line, and line to neutral, 1.0% accuracy
 - b. all phase currents and average current, 1.0% accuracy
 - c. output frequency, 1.0 accuracy
 - d. KW for total and per phase
 - e. KVA for total and per phase
 - f. KVAR for total and per phase
 - g. Power factor, overall and per phase

h. KWH and KVARH

3. Engine parameters listed below shall be monitored:
 - a. coolant temperature
 - b. oil pressure
 - c. battery voltage
 - d. RPM
 - e. Engine hours of use
 - f. Crank attempt counter
 - g. Start counter

4. The control must be capable of detecting the following conditions, indicate if the condition will shutdown the generator or provide a warning, and annunciate the situation, using words and phrases, on the digital display. The following will cause a system shutdown:
 - a. emergency stop
 - b. loss of speed signal
 - c. high engine temperature
 - d. low oil pressure
 - e. overcrank
 - f. under speed / over speed

5. The following will cause a warning but leave the generator running:
 - a. battery charger failure
 - b. customer programmed digital auxiliary input
 - c. customer programmed analog auxiliary input
 - d. power system supplying load
 - e. high battery voltage
 - f. high coolant temperature
 - g. loss of AC sensing
 - h. low battery voltage
 - i. low coolant temperature
 - j. low fuel level or pressure
 - k. low oil pressure
 - l. overcurrent
 - m. speed sensor fault
 - n. weak battery

6. The following must be programmable from the controller keypad:
 - a. Time delay settings:
 - b. generator run time (0 to 72 hours) - exercise
 - c. load shed
 - d. engine start
 - e. engine cool down
 - f. overvoltage and undervoltage delays

- g. crank on and crank pause time
- h. idle time
- i. Trip point settings:
- j. high battery voltage
- k. low battery voltage
- l. overspeed
- m. underfrequency
- n. overfrequency
- o. overvoltage
- p. undervoltage
- q. load shed

2.5 ACCESSORIES:

A. Output Circuit Breakers:

1. The 2500 KW unit shall have a 4000 Amp, 3 pole, 100% rated output circuit breaker, molded case type, generator mounted. The generator output leads entering the line side of the circuit breaker shall be solder tinned as to prevent flyers, corrosion and improve conductivity between the alternator leads and the circuit breaker.
2. The 275 KW unit shall have a 500 Amp, 3 pole, 80% rated output circuit breaker, molded case type, generator mounted. The generator output leads entering the line side of the circuit breaker shall be solder tinned as to prevent flyers, corrosion and improve conductivity between the alternator leads and the circuit breaker.

B. Generator Sound Attenuated Enclosure

1. The enclosure must be weatherproof / sound attenuated type (73 dBA at 23 feet minimum at full load). In addition the enclosure must meet applicable National Electrical Code (NEC) and National Fire Protection Association (NFPA) codes relating to clearances of all items included with the Generator Set. Radiator temperature rating is to be maintained at 122 degree F / 50 degree C.
2. The performance of the enclosure must be in accordance with the Generator Set's specific requirements for cooling and combustion airflow. Clearances must be adequate for maintenance personnel and/or doors must be located such that service personnel have adequate access.

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3. Lifting provisions must be provided in the base that enables the complete Gen-set with the enclosure to be lifted without damage.

4. Exhaust silencer shall be a Critical Grade Silencer mounted inside the enclosure for the sound attenuated units.
- C. Engine block heater. 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. Heater shall be rated for operation at 208 volt, single phase.
- D. Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
- E. The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB (A).
- F. Each generator unit will be provided with an automatic float battery charger system, 10 Amp including alarms. Provide quantity as required for each generator. The battery charger shall be rated to operate at 120 volt, single phase.
- G. The 2500 KW generator shall be provided with a manufacturer provided and installed 100 Amp, 120/208 volt, single phase, 3 wire auxiliary power panel with all required branch breakers and 100 Amp, 2 pole main breaker. Mount inside the generator enclosure to provide power for all accessories required by these specifications, including the engine block heater, battery chargers, lighting, etc. All accessories shall be prewired to this panel as required. All wiring shall be in accordance with the National Electrical Code, NFPA 70 - 2014 edition.
- H. The 275 KW generator shall be provided with a junction box inside the enclosure for connections of the heater circuit, battery charger circuit and accessory circuits as required. If required provide disconnect switches for all accessories at the junction box. All accessories shall be prewired to this junction box as required. All wiring shall be in accordance with the National Electrical Code, NFPA 70 - 2014 edition.

END OF SECTION 16231