

SECTION 26 32 15
ENGINE GENERATOR FIELD STARTUP REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Scope of Work
 - 2. Materials and Equipment
 - 3. Installation
 - 4. Testing
- B. Scope of Work
 - 1. Provide factory startup at the site by the local authorized dealer for the generator, enclosure, particle filter, fuel tank including mechanical inspection, electrical installation inspection, factory documented startup, and support for site Acceptance testing (Level 4) and Integration Systems Testing (Level 5), per startup schedule.
 - 2. Provide a separate cost for a load bank for 100% load testing for level 4. Allow 2 days for testing at Level 4 per generator
 - 3. Assume 2 days testing at Level 5 per generator.
 - 4. These hours are over and above the time needed to connect the generator systems.
 - 5. Load bank cables will be connected by the electrical Installer. The electrical Installer will provide a single point of contact to work with the generator vendor's local distributor on the startup.
 - 6. Fuel for testing is provided by Owner.
 - 7. Comply with requirements for seismic, wind, snow, ice and flood as indicated in Section 26 00 10: 1.5 Regulatory Requirements
 - 8. For remote batteries wire the temperature compensated feature of the battery charger. Provide wiring and sensor as required.

1.2 RELATED WORK

- A. Section 26 00 10 – Basic electrical requirements, is an integral part of this section. Requirements and work indicated in 26 00 10 are not repeated in this Section.
- B. Section 26 08 00 – Electrical General Commissioning Requirements. Provide Installer's and Manufacturer's support as required to coordinate with the Commissioning Agent and support all commissioning efforts and paperwork, acceptance and integrated testing.
- C. Section 26 32 12p Packaged Engine Generator - PBB - Purchase
- D. Section 26 32 13i – Engine Generators – Install
- E. Section 26 32 13p Engine Generator - TKD – Purchase
- F. Section 26 32 14p Engine Generator Set Enclosure - TKD - Purchase

1.3 COORDINATION

- A. Coordinate work under provisions indicated in Section 26 00 10.

1.4 QUALIFICATIONS/QUALITY ASSURANCE

- A. Conform to requirements indicated in Section 26 00 10.

- B. Work shall be performed by an authorized dealer for the engine generator manufacturer.

1.5 REGULATORY REQUIREMENTS AND STANDARDS

- A. Conform to requirements indicated in Section 26 00 09p.
- B. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NFPA 70 pertaining to construction and installation of engine-generator systems.
- C. NFPA Compliance: Comply with applicable requirements of NFPA 30 "Flammable and Combustible Liquids Code", NFPA 37, "Installation and Use of Stationary Combustion Engines and Gas Turbines," and NFPA 110 "Standard for Emergency and Standby Power Systems" for a level 1 system. NFPA 20 "Fire Pumps".
- D. UL Compliance: Comply with applicable requirements of the Underwriter's Laboratories including UL2200 – "Stationary Engine Generator Assemblies". UL 142 "Steel Above Ground Tanks". UL 2085 "Protected Above Ground Tanks for flammable and combustible liquids with secondary containment".
- E. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators," and MG 2, "Safety and Use of Electric Motors and Generators."
- F. IEEE Compliance: Comply with applicable portions of IEEE Std 446, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."
- G. Insurance Underwriters Compliance: Comply with applicable requirements of the Owner's insurance underwriter Factory Mutual.
- H. Environmental Compliance: Comply with all federal and local applicable noise, hazardous materials, and emissions control standards and any authorities having jurisdiction. Packaged Generator set shall be certified and in compliance with emissions regulations.

1.6 SUBMITTALS

- A. Submit as required here in and under Section 26 00 09p.
- B. General Submittals: Manufacturer shall, upon receipt of an order, proceed immediately with submittal requirements described below to meet proposed shipment date of the equipment package to the site. Submit one fully detailed, organized and marked up electronic PDF copy and three hard copies in three ring binders of the following:
 - 1. Bill of Material - Itemized bill of materials for the major and minor systems and sub-systems.
 - 2. Manufacturer's model numbers, brochures and system descriptions, including catalog cuts and/or data sheets describing the proposed equipment. Identify all options provided.
- C. Submit oil analysis report.

1.7 EXTRA MATERIALS

- A. Furnish under provisions indicated in Section 26 00 09p
- B. Provide the following additional materials:
 - 1. One spare set of consumables such as fuses, filters, etc.
 - 2. One spare set of air, fuel and oil filters in addition to those to be installed after acceptance and integrated systems testing.

PART 2 - PRODUCTS

2.1 STARTING BATTERIES

- A. Starting Batteries: Heavy duty, diesel-starting type lead-acid storage batteries SAE group 8D.. Match battery voltage to starting system. Size for at least four 30 second cranking periods at an ambient temperature of 0 degree F (assume blanket battery heater is not operational). Review requirements with engine generator specifications.

2.2 BATTERY HEATERS

- A. Thermostatically controlled blanket heater shall be arranged to maintain each battery above 10 deg C (50 F) regardless of external ambient temperature within range specified in generator specification Section paragraph 1.1B Performance Requirements.

2.3 BATTERY TRAY

- A. Provide acid resistant battery trays. Include accessories required to support and fasten batteries in place.
- B. Provide weather proof non-metallic battery boxes for redundant batteries located outside the enclosure if required.

2.4 BATTERY CHARGER

- A. Provide redundant battery chargers – SENS type NRG, no substitutions.
- B. Static Battery Charger: SENS NRG with battery monitoring, current-limiting, automatic-equalizing and float-charging type. Provide parallel redundant 20A minimum battery chargers for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two charger sets separated by diodes so that a fault on one bank cannot effect the other. Units shall comply with UL 1236 and include the following features:
 - 1. Operation: Equalizing-charging rate of 20 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - 2. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - 3. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - 4. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - 5. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - 6. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
 - 7. Output current rating of at least 1/20th of ampere-hour capacity of battery. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to a fully charged condition within 24 hrs.
 - 8. Automatic and manual switching between low rate (float) and high rate (equalize) mode.
 - 9. Automatic cut-off switch when engine generator is operating.
 - 10. Solid state rectifiers, DC voltmeter and ammeter, fused input and output, 120 VAC, 1 phase input and output VDC to match battery float/equalize voltage.

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11. Malfunction alarm light for loss of AC voltage, low battery voltage, high battery voltage, loss of charge and battery failure or trouble. Provide two form "C" type auxiliary contacts for alarm summary remote signal.
12. Associated regulator to insure quick recharge of the batteries after an engine start.

2.5 BATTERY CABLE WITH LUGS

- A. Size as recommended by engine manufacturer for cable length required. Include required interconnecting conductors and connecting accessories. Include necessary cables and clamps. Size conductors to minimize total resistance, do not exceed manufacturer's recommendation for total resistance including contacts and solenoids.

PART 3 - EXECUTION

3.1 INSTALLATION AND STARTUP

- A. Included in the startup:
 1. Fuel tank and annular space pressure test
 2. 4 level Fuel level sensor set up wiring to panel
 3. Annular space sensor wiring to panel
 4. Provide a fuel gauge dip stick
 5. Check all vents and secure flanges.
 6. Install fuel level gauge, on site
 7. Overfill devices to be connected
 8. Install over fill protection around the fuel fill port.
 9. Provide and Connect fuel lines, supply and return
 10. Furnish Batteries, mount batteries and connect batteries. Support all cables between terminals.
 11. Provide wiring to the engine control panel so all battery charger alarms can be transmitted to the BMS system through the control panel Modbus interface.
 12. Install Modbus interface. Coordinate and assist BMS installer
 13. Provide engine-generator control panel programming and setup as required and requested.
- B. As a minimum, Level 4 acceptance testing shall include:
 1. Start engine and then apply the following loads:
 - a. 50% step load transient response showing frequency and voltage variation and recovery time both for application of load and for removal of load. This step load test shall be repeated a minimum of 4 times.
 - b. 90% step load transient response showing frequency and voltage variation and recovery time both for application of load and for removal of load.
 - c. 100% step load transient response showing frequency and voltage variation and recovery time both for application of load and for removal of load.
 2. Before and after and at each step load monitor unit vibration. Record if it is out of specification.
 3. 8 hours at 100% load at 1.0 power factor
 4. Record amount of fuel burned during the 8 hour burn test.
 5. Testing shall be conducted with the same type and constitution of coolant, oil, and other fluids as will be used in final site installation and as recommended by diesel engine generator manufacturer.
 6. If engine is shut down for any component failure during the test, or if equipment does not meet performance requirements, the entire test shall be repeated after defects have been corrected.
 7. Provide written report.

- 8. Coordinate testing with the Commissioning Agent. Cooperate and complete required testing.
- C. Provide battery cables with lugs, dual batteries and starters and blanket heaters.
- D. Provide wiring to generator control panel and coordinate interface with the BMS.
- E. Supervise work and assemble engine- generator, base mounted fuel tank and enclosure at the site.
- F. Provide a set of electrical schematics for the above equipment.
- G. Provide dual fuel and oil filters and associated valves and piping to allow filters to be changed while generator is operating.
- H. Provide water fuel separators with associated piping and valves to allow maintenance while generator is operating.

3.2 FIELD QUALITY CONTROL

- A. Testing
 - 1. Provide 8 hour full load test utilizing portable test bank. Simulate power failure, automatic starting cycle, and automatic shutdown and return to normal.
 - 2. Record in 20 minute intervals during four hour test:
 - a. Kilowatts.
 - b. Amperes.
 - c. Voltage.
 - d. Power factor.
 - e. DC Voltage.
 - f. Jacket water temperature.
 - g. Coolant temperature.
 - h. Air temperature at air inlet to engine.
 - i. Outdoor air temperature at source of ventilation air.
 - j. Frequency.
 - k. Oil pressure.
 - l. Fuel pressure.
 - m. Exhaust temperature.
 - 3. Test starting, load shedding, alarm and shutdown circuits by simulating conditions. Verify BMS receives signals.

3.3 INTEGRATED SYSTEMS TESTING

- A. After completion of satisfactory start up and acceptance testing, Installer shall provide support for Integrated Testing, per the commissioning schedule. Assume two 12 hour days on site per engine generator. Provide cost for a per day additional cost.
- B. Manufacturer to provide field technicians to Support Integrated Systems Testing (commissioning Level 5) in addition to and after successful completion of acceptance testing (Level 4). Provide for two 12 hour day(s) of Integrated Systems Testing for each engine-generator.

3.4 TESTING CLOSEOUT

- A. After acceptance and integrated systems testing is complete perform an oil analysis. Report results in writing to Owner.
- B. After receiving oil analysis results replace air, fuel and oil filters. Save filters for analysis if warranted by the results of the oil analysis

END OF SECTION