

SECTION 16622

PACKAGED ENGINE GENERATOR SYSTEMS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Packaged Engine Generator System.
- B. Exhaust Silencer and Fittings.
- C. Fuel Fittings and Sub-base Fuel Tank.
- D. Remote Control Panel.
- E. Battery and Charger.
- F. Weatherproof Enclosure.

1.2 RELATED SECTIONS

- A. Section 16495 - Transfer Switch.
- B. Section 16940 - Sequence of Operations.

1.3 REFERENCES

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NEMA MG 1 - Motors and Generators.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. ANSI/NEMA AB 1 - Molded Case Circuit Breakers.

1.4 SYSTEM DESCRIPTION

- A. Engine generator system to provide source of emergency and standby power.
- B. System Capacity:
  - 1. Station B: 35 kW, 44 kVA at elevation of 1000 feet above sea level, and ambient temperature between 0 and 122°F; standby rating using engine-mounted radiator.
  - 2. Station Epump: 125 kW, 156 kVA at elevation of 1000 feet above sea level, and ambient temperature between 0 and 122°F; standby rating using engine-mounted radiator.
  - 3. Station F: 35 kW, 44 kVA at elevation of 1000 feet above sea level, and ambient temperature between 0 and 122°F; standby rating using engine-mounted radiator.

- C. Operation: In accordance with ANSI/NFPA 99.

#### 1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01300 - Submittals.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, and remote annunciator.
- D. Submit manufacturer's installation instructions under provisions of Section 01300 - Submittals.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 01700 – Contract Closeout.
- B. Accurately record location of engine generator and mechanical and electrical connections.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01700 – Contract Closeout.
- B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in packaged engine generator system with minimum three years experience.
- B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of Project Site.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Site under provisions of Section 01600 – Material and Equipment.
- B. Store and protect products under provisions of Section 01600 – Material and Equipment.
- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.10 WARRANTY

- A. Provide five-year warranty under provisions of Section 01700 – Contract Closeout.

1.11 MAINTENANCE SERVICE

- A. Furnish service and maintenance of packaged engine generator system for one year from Date of Substantial Completion.

1.12 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Section 01700 – Contract Closeout.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system for each generator supplied. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system.

1.13 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Generator Package
  - 1. Basis of Measurement: Included in the unit price for control structures.
  - 2. Basis of Payment: Includes installation, labor, materials, electrical components, and startup, and diesel fuel.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Detention Area B Structure, Detention Area F Structure: Onan Model 35DGGD 60Hz.
- B. Detention Area E Outlet Control Structure: Onan Model 125 DGEA 60Hz.

2.2 ENGINE

- A. Type: Water-cooled inline or Vtype, four stroke cycle, compression ignition, direct injection, diesel internal combustion engine.
- B. Rating: Standby, Applicable for supplying power for the duration of normal power interruption.
- C. Fuel System: Appropriate for use of No. 2 fuel oil. All fuel lines are to be black iron. Cast Iron, Aluminum and galvanized piping will not be useful for the fuel system per manufacturer's requirements.
- D. Engine Speed: 1800 rpm.
- E. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.

- F. Electronic Control Package: Shall be PowerCommand Control 3200 with AmpSentry Protection.
1. Menu-driven digital display screen.
  2. Comprehensive display of engine and alternator data.
  3. Engine Shutdown Safety Devices:
    - Low oil pressure.
    - Low coolant level.
    - High coolant temperature.
    - Overspeed.
    - Fail to crank.
    - Overcrank.
  4. AC Alternator Shutdown Safety Devices:
    - Low AC Voltage.
    - High AC Voltage.
    - Underfrequency.
    - Over Current.
    - Short Circuit.
    - Magnetic Pickup Failure.
    - Emergency Stop.
  5. Warning Functions:
    - Low oil pressure.
    - High coolant temperature.
    - Oil pressure sender failure.
    - Temperature sender failure.
    - Over Current.
    - Low coolant temperature.
    - Overload, with load shed contacts.
    - Low Fuel.
    - Low DC Voltage.
    - High DC Voltage.
    - Weak Battery.
    - Up to Four Customer Inputs.
  6. Digital starting control provides functions for:
    - Fuel ramping.
    - Fail to Crank.
    - Temperature dynamic governing.
    - Digital excitation control.
    - Cycle cranking.
  7. Control components selected and integrated to withstand the vibration levels inherent in a generator set application and fully covered under the five-year warranty.
- G. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
- H. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 120 volts AC.

- I. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Air Flow Restriction: 0.5 inches of water, maximum.
- J. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, lube oil heater, required fuel pump(s), gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.
- K. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

### 2.3 GENERATOR

- A. Generator: ANSI/NEMA MG 1; four poles, brushless synchronous generator with brushless exciter.
- B. Ratings:
  - 1. Station B, Station F: 35 kW, 44 kVA at 0.8 power factor, 120/240 volts, 60Hz at 1800 RPM, single-phase.
  - 2. Station Epump: 125 kW, 156 kVA at 0.8 power factor, 480/277 volts, 60Hz at 1800 RPM, three-phase.
- C. Insulation: ANSI/NEMA MG 1, Class F.
- D. Temperature Rise: 220°F continuous.
- E. Enclosure: ANSI/NEMA 3R or 4X weather protective with silencer (QuietSite Stage II with silencer).
- F. Voltage Regulation: Include generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics, with voltage regulation +/- one percent from no load to full load. Include manual controls to adjust voltage drop +/- 5 percent voltage level, and voltage gain.
- G. PMG excitation.

### 2.4 ACCESSORIES

- A. Sub-base Tank: sized for 48 hours of full load operation with flexible fuel line connections, fuel gauge, check valve, and low fuel level alarm contact. Fuel gauge shall have contacts to indicate tank levels at 80 percent, 50 percent and 25 percent of full capacity.
- B. Exhaust Silencer: Critical grade with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.
- C. Batteries: Heavy duty, diesel starting type lead-acid storage batteries. Match battery voltage to starting system. Include necessary cables and clamps.
- D. Battery Tray: Plastic coated metal or wooden tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.

- E. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.
- F. Line Circuit Breaker: NEMA AB 1 molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole; sized in accordance with ANSI/NFPA 70. Include battery voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements.
- G. Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators.
  - 1. Frequency Meter: 45-65 Hz range, 3-1/2 inch dial.
  - 2. Digital AC Output Voltmeter: Monitoring all phases. 3 Color indicators: Green: normal conditions, Amber: Warning levels, Red: shutdown conditions.
  - 3. Digital AC Output Ammeter: Monitoring all phases. 3 Color indicators: Green: normal conditions, Amber: Warning levels, Red: shutdown conditions.
  - 4. Output voltage adjustment.
  - 5. Panel/indicator lamp test.
  - 6. Engine start/stop selector switch.
  - 7. Engine running time meter.
  - 8. Oil pressure display.
  - 9. Water temperature display.
  - 10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
  - 11. Remote Alarm Contacts: Prewire SPDT contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
  - 12. Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load exceeds 110 percent of the rated current of the machine for more than 60 seconds. The controls shall shut down and lock out the generator set when the output current level approaches the thermal damage point of the alternator. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when the total load on the generator set exceeds the generator set rating for more than 5 seconds. An individual phase AC over voltage monitoring system monitoring all three phases of the alternator shall be provided to initiate shutdown of the generator set when alternator output voltage exceeds 110 percent of the operator set voltage level for more than 10 seconds. Shutdown shall occur with no intentional delay if alternator output voltage exceeds 130 percent. Under voltage shutdown shall occur when the alternator output voltage is less than 85 percent of the operator set voltage for more than 10 seconds.
  - 13. Kilowatt meter.
  - 14. "Not in Auto" flashing indicator LED.
- H. Remote Engine Annunciator Panel: ANSI/NFPA 99; include engine run and low fuel indicator lights and remote start/stop switch; surface mounted panel with standard finish.

### 3. PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on plans.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means Contractor accepts existing conditions.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install at locations indicated on plans.
- C. Connect fault alarm and run alarm to control panel per plans.
- D. Completely fill fuel tank with proper fuel.
- E. Connect engine block heater power to structure generator is feeding.

#### 3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01400 – Quality Control.
- B. Engineer to be present during generator start-up and testing. Provide at least one weeks advance notice.
- C. Provide full load test utilizing portable test bank, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
- D. During test, record the following at 20 minute intervals:
  - 1. Kilowatts.
  - 2. Amperes.
  - 3. Voltage.
  - 4. Coolant temperature.
  - 5. Room temperature.
  - 6. Frequency.
  - 7. Oil pressure.
- E. Test alarm and shutdown circuits by simulating conditions.

#### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare, start, test, and adjust systems under provisions of Section 01600 – Material and Equipment.

3.5 ADJUSTING

- A. Adjust Work under provisions of Section 01700 – Contract Closeout.
- B. Adjust generator output voltage and engine speed.

3.6 CLEANING

- A. Clean Work under provisions of Section 01700 – Contract Closeout.
- B. Clean engine and generator surfaces.
- C. Replace oil and fuel filters.
- D. Top off fuel tank with proper fuel.

3.7 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01600 – Material and Equipment.
- B. Describe loads connected to emergency and standby system and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency and standby power.

3.8 TRAINING

- A. Provide for training of owners personnel on operation and routine maintenance of generator system on Site at each generator location independently.

END OF SECTION