

## SECTION 26 32 13 - DIESEL ENGINE DRIVEN GENERATOR SETS

### PART 1 - GENERAL

#### 1.1 DESIGN REQUIREMENTS

- A. Locate generators down wind taking into account the location of future buildings. Also if possible place generators on opposite side of building air intakes. Coordinate final location with the University Project Manager.
- B. Provide lighting and receptacles on individual circuits inside and outside of the generator enclosure. Circuit lighting and receptacles to a standby panel.

#### 1.2 SUBMITTALS

- A. Drawings to indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, required clearances, and electrical diagrams including schematic and interconnection diagrams.
- B. Drawings 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 radiator.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufactures: Subject to compliance with requirements, provide products by the following:
  - 1. Caterpillar
  - 2. Cummins
  - 3. Stewart & Stevenson

#### 2.2 MATERIALS, GENERAL

- A. Engine:
  - 1. Type: Water-cooled V-type, four stroke cycle, compression ignition Diesel (No. 2 fuel oil) internal combustion engine.
  - 2. Rating to equal the load and compensated for elevation with 70% overload for 1 hour.
  - 3. 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.
  - 4. Safety Devices: Engine shutdown on high water temperature, low oil pressure, over speed, and engine over crank. Limits as selected by manufacturer.
  - 5. Engine Starting: DC starting system with positive engagement.
  - 6. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 208 volts AC.
  - 7. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator airflow restriction will be 0.5 inches of water maximum. Provide low-level indicator alarms.
  - 8. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil circulation pump, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine/generator control panel.

9. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.
- B. Generator:
1. Generator: NEMA MG1, three phase, four pole, re-connectible brushless synchronous generator with brushless exciter.
  2. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Manual controls to adjust voltage drop, voltage level (plus or minus 5 percent) and voltage gain.
  3. AC Waveform Total Harmonic Distortion (THD), less than 3% for any single harmonic.
  4. Telephone Influence Factor (TIF), less than 50% per NEMA MG1-22.43.
- C. Fuel Tank:
1. Fuel Tank shall be sized to accommodate run times as required per code. All research laboratory buildings shall have tank sized for 24 hours minimum.
  2. Provide Integral Skid mounted belly tank. If tank size is too large to be skid mounted then coordinate above ground tank with the university.
  3. All tanks shall be double containment with leak detection.
  4. Below grade tanks are prohibited without prior approval from the University Project Manager.
- D. Accessories:
1. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.
  2. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 24 volt system 240 ampere-hours minimum capacity. Match battery voltage to starting system. Include necessary cables and clamps.
  3. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage. If in a cool area, provide heating pads.
  4. 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 NEMA 250, Type 1 requirements.
  5. 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 NFPA 70. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements. Circuit Breaker to be 100% rated.
  6. Engine-Generator Control Panel: NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
    - a. AC Output Voltmeter: 3.5-inch dial, 2 percent accuracy, with phase selector switch.
    - b. AC Output Ammeter: 3.5-inch dial, 2 percent accuracy, with phase selector switch.
    - c. Output voltage adjustment.
    - d. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, over speed, and over crank.
    - e. Engine start/stop selector switch.
    - f. Engine running time meter.
    - g. Oil pressure gauge.
    - h. Water temperature gauge.
    - i. Auxiliary Relay: 3PDT operates when engine runs, with contact terminals pre-wired to terminal strip.
    - j. Additional visual indicators and alarms as required by NFPA 110.
    - k. Remote Alarm Contacts: Pre-wire SPDT contacts to terminal strip for remote alarm functions required by NFPA 110.
    - l. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
    - m. "Manual" off-remote starting switch.

7. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Provide alarm horn, and indicators and alarms as follows:
  - a. High battery voltage (alarm).
  - b. Low battery voltage (alarm).
  - c. Low fuel (alarm).
  - d. System ready.
  - e. Anticipatory-high water temperature.
  - f. Anticipatory-low oil pressure.
  - g. Low coolant temperature.
  - h. Switch in off position (alarm).
  - i. Over crank (alarm).
  - j. Emergency stop (alarm).
  - k. High water temperature (alarm).
  - l. Over speed (alarm).
  - m. Low oil pressure (alarm).
  - n. Line power available.
  - o. Generator power available.
  - p. Lamp test and horn silence switch.
8. Building Automation System Interface: Provide interface to the BAS for all alarm points required to The Remote Annunciator panel.
9. Provide spare Generator breaker for exterior generator sets for connection to portable Load Bank. Provide remote bus connection cabinet for interior mounted generators for portable load bank.

### PART 3 - EXECUTION

#### 3.1 TESTING, CLEANING, AND CERTIFICATION

- A. 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.
- B. Record in 20-minute intervals during four hour test:
  1. Kilowatts.
  2. Amperes.
  3. Voltage.
  4. Coolant temperature.
  5. Room temperature.
  6. Frequency.
  7. Oil pressure.
- C. Test alarm and shutdown circuits by simulating conditions.

**END OF SECTION 26 32 13**