SECTION 16621

STANDBY GENERATOR SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK: The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with standby generator system work as indicated herein and on the Drawings. Work includes but is not limited to prime mover, electrical generator, engine starting system including batteries, instrument control panel, weather protective housing, transfer switch, fuel tanks (main and day), remote annunciator panel, exhaust silencer, and all equipment, wiring and other accessories required for complete installation.

1.2 RELATED DOCUMENTS

A. Drawings.

B. General provisions of Contract, including General and Supplementary Conditions.

C. Division 1 - Specification Sections.

D. Section 16010 - General Electrical Provisions.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 3 sections for concrete and grout work required in connection with engine-generator sets.

B. Fuel piping - Division 15

C. Exhaust piping, air intake, exhaust connections/ductwork - Division 15 Drawings

D. Vibration isolation - Division 15

1.4 QUALITY ASSURANCE

A. Engine-Generator system shall be manufactured and tested in compliance with UL2200.

B. Agreement to Maintain: Engage Installer who is willing to execute with the Owner, required agreement for continued maintenance of engine-driven standby generator units.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver engine-driven generators properly packaged and mounted on pallets, or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for engine-generator and components which protect equipment from damage.

B. Store engine-driven generator equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's data on engine-driven electric generator systems and components. Include manufacturer's standard product warranty (for not less than one- year period) for replacement of materials and equipment used in standby engine-driven generator system.

B. Shop Drawings: Submit dimensioned drawings of engine-driven generator units and accessories including, but not limited to, automatic transfer switches, fuel line piping, remote annunciator stations, and instruments, showing accurately scaled generator set layout and its spatial relationship to associated equipment, and connections to remote equipment. Allow adequate clearance space for removal of engine-generator elements for maintenance purpose.

C. Wiring Diagrams: Submit wiring diagrams for engine-driven generator units showing connections to electrical power panels, feeders, automatic transfer switches, and ancillary equipment. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

D. Agreement to Maintain: Prior to time of final acceptance, the Installer shall submit four (4) copies of an agreement for continued service and maintenance of engine-driven generator sets, for Owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for one-year period with option for renewal of Agreement by Owner.

E. Certifications:

1. Provide engine-driven generator sets certified test record of the following final production testing:
   a. Single-step load pickup.
   b. Transient and steady-state governing.
   c. Safety shutdown device testing.
   d. Voltage regulation.
   e. Rated power.

f. Maximum power.

2. Provide certified test record prior to engine-driven generator set being shipped from factory to project location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide standby generator systems of one of the following:

1. Onan Corp. Div. of Cummins Co.
2. Kohler Co.
3. Waukesha-Engine Div., Dresser Industries Inc.
4. Caterpillar Co.

2.2 ENGINE-GENERATOR UNIT

A. Provide diesel engine driven standby generator set rated for continuous standby at the connected rating indicated on the Drawings. Unit's specified rating shall include capability for motor starting.

B. Engine: The engine shall be 1800 rpm, diesel fueled, turbo charged and aftercooled, four cycle water cooled with mounted radiator, fan, and water pump. Unit shall have 12 cylinders with replaceable wet liners. Intake and exhaust valves shall be heat resistive alloy steel, free rotating. Replaceable valve seat inserts shall be provided. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have coolant and oil filters with replaceable elements, lube oil cooler, a factory mounted fuel/water separator and a fuel transfer pump capable of 5 feet of fuel lift. Engine speed shall be governed by an electronic governor with electric actuator with speed droop externally adjustable from isochronous to 5% to maintain alternator frequency within 0.15 hertz from no load to full load alternator output, including speed control potentiometer. The engine shall have a 45 amp battery charging alternator with transistorized voltage regulator. Remote 2 wire starting shall be by a 24 volt solenoid shift electric starter.

C. Engine Instruments: The engine instrument panel shall contain an oil pressure gauge, coolant temperature gauge, tachometer, oil temperature gauge, battery charge rate ammeter, solid state engine monitoring system and emergency stop switch.

D. Engine Controls: The generating set shall contain a complete engine start-stop control system which starts the engine on closing contact and stops engine on opening contact. Solid state adjustable cycle cranking to provide 15 second crank time and 10 second rest with cranking limiter to open the starting circuit in approximately 75 seconds if the engine is not started within that time, in three cranking tries. Engine start stop control unit shall include a RUN-STOP-REMOTE selector switch.

E. The engine shall include the following additional equipment:

1. One (1) 4000 Watt, 480V, 1Ø jacket water heater.
2. Safety shutdown system including low oil pressure, high engine temperature, low engine temperature, low coolant level, overspeed, overcrank, and individual alarm terminals and indicator lights.

F. Brushless Alternator: The alternator shall be a four (4) pole revolving field type design with temperature compensated solid state voltage regulator and brushless rotating rectifier exciter system. The stator shall be directly connected to the engine flywheel housing. The rotor shall be driven thru a semi-flexible driving flange to insure permanent alignment. Insulation system shall be Class H. Maximum hot spot temperature rise shall not exceed 105 degrees Celsius at 40 degree Celsius ambient. One (1) 125 Watt, 120V generator space heater, with a thermostat, shall be provided in the stator windings. An output connection box shall be provided for output feeder connections.

G. Alternator Instrument Panel: Alternator instrument panel shall be built, wired, tested, and shock mounted on the generator set by the manufacturer of the alternator. Panel shall include panel lighting, manual reset field circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter, AC ammeter, volt/ammeter phase selector switch with OFF position, and fine speed control potentiometer. One (1) 75 Watt, 120V control panel space heater shall be provided.

H. Voltage regulation shall be within plus or minus 2% of rated voltage from no load to full load.

I. Safety Shutdown Monitoring System: Engine-Generator Unit shall include an automatic safety shutdown monitoring system with individual alarm terminals and indicating lights. Monitoring system shall indicate the following:

1. Low Oil Pressure
2. High Engine Temperature
3. Pre-warning for Low Oil Pressure
4. Overspeed
5. Low Engine Temperature
6. Overcrank
7. Run
8. Pre-warning for High Engine Temperature
9. Low Fuel
10. Two spare fault lights
11. Switch Off

Low oil pressure and high engine temperature shall be pre-alarm types prior to engine shutdown.

J. Remoter Annunciator Panel: Engine-Generator Unit shall include a remote annunciator panel with the following indicating lights:

1. High Battery Voltage
2. Low Battery Voltage
3. Normal Battery Voltage
4. Generator Running
5. Normal Utility Power
6. EPS Supplying Load
7. Pre-Low Oil Pressure
8. Low Oil Pressure
9. Pre-High Engine Temperature
10. High Engine Temperature
11. Low Engine Temperature
12. Overspeed
13. Overcrank
14. Not in Automatic
15. Battery Charger Malfunction
16. Low Fuel Supply
17. Auxiliary

Remote panel shall include both audible and visual signals for Conditions 7 thru 17. An alarm silencing switch shall be included to silence the audible alarm. A fuel level alarm switch shall be provide on the main fuel tank to signal the low fuel condition.

K. Skid: The Engine-Generator unit shall be mounted on a welded steel base which shall permit mounting to any level surface.

L. Vibration Isolators: Twelve (12) spring type vibration isolators shall be provided for installation beneath the unit skid.

M. Weatherproof Housing: A drop over type weatherproof outdoor enclosure shall be provided for the engine-generator unit. Housing shall be constructed of welded and bolted reinforced steel with louvered air openings of front and sides. Housing shall include lockable door on each side and in the rear to allow access to the generator unit and controls. Housing shall be finish coated for outdoor service.

N. Exhaust Silencer: A single critical exhaust silencer shall be mounted on top of the outdoor housing by the Contractor. Muffler, bracketry, exhaust tubing, and all fittings shall be designed and furnished as a complete assembly by the manufacturer. Critical silencer shall have a minimum sound attenuation of 45 dBA.

O. Batteries: Four (4) 12 volt, 225 ampere hour, heavy duty lead acid starting batteries shall be provided. Batteries shall be furnished mounted on the engine-generator set.

P. Main Fuel Tank: A UL listed, concrete encased, double wall diesel fuel tank, Convault or approved equivalent, of capacity indicated on the Drawings, shall be furnished. Tank shall be provided with a full skid and access ladder for mounting on a level surface. Tank shall be sandblasted, zinc primed, and finished with epoxy and white urethane. Tank shall contain an internal leak monitoring system.

Q. Day Tank: A float valve tank shall be provided between the skids of the engine-generator set and shall include a fuel solenoid valve for positive fuel shut off. Tank shall be of double wall steel construction with integral leak monitoring meeting requirements of state and local authorities for installation and use without provisions for separate fuel containment.

R. Anchor Bolts: Galvanized steel, of types and sizes required for the installation. Furnish anchor bolts set in concrete slab. Install in accordance with installation drawings and instructions - provided by the manufacturer.

S. Provide 50/50 antifreeze/distilled water coolant.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine areas and conditions under which diesel engine-driven generator units are to be installed. Do not proceed with the work until unsatisfactory conditions have been provided in a manner acceptable to the Installer.

3.2 INSTALLATION OF ENGINE-GENERATOR SYSTEMS

A. Install standby engine-generator units as indicated, in accordance with the equipment manufacturer's written instruction, and with recognized industry practices, to ensure that engine-generator units fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of standby engine-generator systems and accessories.

B. Coordinate installation of standby generator system as necessary to interface with other work.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A, B and the National Electrical Code.

D. Align shafts of engine and generator within tolerances recommended by equipment manufacturer.

3.3 GROUNDING: Provide equipment-grounding connections in accordance with all requirements for a "separately derived system" as defined in the NEC. Grounding

connections shall be sufficiently tight to assure a permanent and effective ground for all system components.

3.4 START-UP TESTING

A. Engage equipment manufacturer's local representative to perform start-up and building load tests upon completion of installation, with the Architect in attendance. Provide certified test record. Tests are to include the following:

1. Check fuel, lubricating oil, and antifreeze in liquid cooled models for conformity to the manufacturer's recommendations under environmental conditions present.
2. Test prior to cranking engine for proper operation, accessories that normally function while the set is in a standby mode. Accessories include: engine heaters, battery charger, generator strip heater, remote annunciator.
3. Check, during start-up test mode, for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
4. Test, by means of simulated power outage, automatic start-up by remote-automatic starting, transfer of load, and automatic shut-down. Prior to this test, adjust transfer switch timers for proper system coordination. Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage, amperes, and frequency.

B. Upon completion of installation, in the presence of the Architect, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Initial testing and retesting to be at no cost to Owner. Refill fuel tank after engine generator set has been accepted.

3.5 PERSONNEL TRAINING: Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating diesel engine-driven generator sets. In addition, train Owner's personnel in periodic maintenance of batteries. Training sessions shall be scheduled in two (2) - 4 hour sessions with the Owner.

END OF SECTION