SECTION 26 32 13

ENGINE GENERATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Outdoor engine driven generator.
      a. Bid Unit Price as follows:
         1) Diesel
   2. Generator shall be a standby rated generator.
   3. Accessories as specified.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Engine Generator – Diesel: The Engine Generator – Diesel shall be measured by each Engine Generator – Diesel furnished and installed. The Bid Unit Price shall be full compensation for furnishing and installing all materials, including all hardware, breakers, delivery, placing the generator on the pad, and incidentals necessary to complete the work.

1.03 REGULATORY REQUIREMENTS

A. Equipment shall conform to the following:
   1. OSHA
   2. Environmental Protection Agency.
   3. Minnesota Pollution Control Agency.
   4. National Electrical Code (NFPA 70).

1.04 SUBMITTALS

A. Submit the following items consistent with Section 01 33 00.

B. The following information shall be included with each submittal:
   1. Engine-generator assembly base dimensions, unit enclosure dimensions, equipment weights and loading data. This information shall include detailed dimension and weight data for the generator silencer and exhaust stack (where applicable).
   2. Drawing(s) showing the general arrangement and dimensions of the engine generator unit and the outdoor enclosures (where applicable). Include location of all auxiliary system component connections and engine-mounted equipment.
   3. Catalog cut sheets on generator assembly including major on and off-engine auxiliary components (those items not integral with the manufacturer's package purchased from other vendors) indicating size, capacity, performance, design data, materials of construction and operating conditions. If catalog data is not available, include a Bill of Materials for the equipment proposed and all available data.
   4. Provide locations of and specifications/dimensions for all required field connections to generator assembly.

5. Provide guaranteed fuel rate data for engine operation. Fuel rates shall include operation at 50 percent, 75 percent and 100 percent of design rated net Standby Power output in kW.
6. Provide guaranteed emission data. Provide supplemental information on other pollutants that are regulated by the governing environmental control agency relevant to this project.
7. Detailed schematic wiring diagrams showing Automatic Transfer Switch (ATS) wiring terminations, and all other internal and external wiring terminations. Drawings shall be developed custom for this project. Terminal numbers shall be coordinated and reflect the actual terminal numbers used at the ATS.
8. Color chips for enclosure.
9. Certified copies of factory production test results.

C. Operation and Maintenance Manual
   1. The following information shall be included:
      a. Include all the information provided with the shop drawings and manufacturer's information.
         1) Update and complete control system drawings and descriptions for all equipment.
         2) All documentation shall include modifications made which reflect the final installation.
      b. Operating instructions.
      c. Maintenance information.
      d. Recommended spare parts list with pricing.
      e. Accurate wiring diagrams for trouble shooting purposes.
      f. Manufacturer's literature on all equipment and systems.
      g. Name, address, phone number of manufacturer's local representative and maintenance facility.
      h. Warranty information.
      i. Copy of test results and certifications.

1.05 DESIGN CRITERIA

A. Ratings shall be for service at 60 Hz, 3-phase, 4-wire, 480/277-volts, and 0.80 power factor.

A. Each engine-generator shall be capable providing-backup power at the standby rating.

B. All ratings shall be based upon the equipment located at an elevation of 1,000 feet above sea level.

C. Engine-generator shall be sized by the manufacturer to operate the required loads, however, engine-generator assembly shall have a standby power output rating of not less than 300kW (Diesel), without written approval of Engineer
   1. The following loads shall be started and operated in the order mentioned below:
      a. Step 1:
         1) 225kVA Transformer T1 including the following loads.
            a) Electric Vehicle Chargers = 14.4kVA
            b) Electric Vehicle Chargers (Future) = 28.8kVA
            c) Panelboard LPB2 Lighting = 11.68kVA (Connected), 11.68kVA (Demand)
            d) Panelboard LPB2 Receptacle = 42.1kVA (Connected), 26kVA (Demand)
            e) Panelboard LPB3 Miscellaneous = 55.46kVA (Connected), 36kVA (Demand)
            f) Panelboard LPB4 Miscellaneous = 37.58kVA (Connected), 21kVA (Demand)

g) Panelboard LPB5 Miscellaneous = 11.26kVA (Connected), 10kVA (Demand)
h) Panelboard G Miscellaneous = 18kVA (Connected), 14kVA (Demand)

b. Step 2: Roof Top Unit No.1 (RTU1) = 33 Minimum Circuit Amps, VFD starter
c. Step 3: Roof Top Unit No.1 (RTU2) = 33 Minimum Circuit Amps, VFD starter
d. Step 4: Roof Top Unit No.1 (RTU3) = 33 Minimum Circuit Amps, VFD starter
e. Step 5: Roof Top Unit No.1 (RTU4) = 25 Minimum Circuit Amps, VFD starter
f. Step 6: Electric Unit Heater (EUH1) = 3kW
g. Step 7: VAV Box Electric Heater (VAV9) = 6.23kW
h. Step 8: VAV Box Electric Heater (VAV11) = 9.97kW
i. Step 9: VAV Box Electric Heater (VAV11) = 9.97kW
j. Step 10: VAV Box Electric Heater (VAV11) = 7.47kW

2. Diesel:
   a. Instantaneous voltage drop shall not exceed 35 percent as measured at the main switchboard assembly at any time.
   b. Instantaneous frequency drop shall not exceed 10 percent as measured at the generator output main circuit breaker at any time.
   c. Maximum Generator Set Loading shall note exceed 85 percent.

D. Harmonic distortion levels when powered from its associated generator, shall not exceed the guidelines and recommendations put forth by IEEE 519, latest edition. The Point of Common Coupling shall be the service entrance switchboard, motor control center, or distribution panelboard.

E. Each engine-generator unit shall be emissions certified for the calendar year in which it is installed. Guarantees are to be provided for verification of allowable emission levels for pollutants that are regulated by the governing environmental control agency relevant to this project.

1.06 FACTORY TESTS

A. All system components and hardware necessary for complete and fully functional standby generation systems shall be factory tested as complete assemblies prior to installation at the project site. These tests shall include, in addition to "standard" factory tests, additional testing as described below.

B. Factory production tests shall be conducted, certified, and documented by Contractor. Tests shall be performed at rated standby load and at 0.8 power factor in accordance with NFPA 110. These tests shall include, but not be limited to
   1. Steady state voltage and frequency analysis.
   2. Transient response.
   3. Maximum power output analysis.
   4. Supplier's standard factory engine tests.
   5. Supplier's standard factory generator tests.
   6. Safety shutdowns.
   7. Hydrostatic test of radiator and oil cooler.
   8. Continuity test and insulation resistance on electrical power and control system components and circuits. Do not include in these tests any device or equipment not design to withstand an insulation resistance test.
   9. 100-percent block load acceptance test per NFPA 110.
   10. Load carrying capability tests:
       a. 1 hour at 100-percent standby rated net output (0.8 p.f.).

C. Data points to be approved by Engineer before testing of engine commences.

D. Contractor shall give Engineer a minimum of 2-weeks advanced notice of scheduled testing of engine-generator so that Engineer and/or Owner may observe testing.

E. The Owner shall retain all copyrights to the test data.

F. Test result data shall be submitted to the Engineer for approval before the generator assembly is released for delivery to the project site.

1.07 FIELD LOAD BANK TEST

A. Provide a 2-hour field load bank test at 100 percent of standby rating.

B. Record beginning fuel level, ending fuel level, KW load, output voltage, output current, oil pressure, water temperature, and ambient temperature at 15-minute intervals throughout the test.

C. Include copies of the load bank test in each O&M manual.

1.08 WARRANTY

A. The Contractor shall be held responsible for any and all defects in workmanship, materials and equipment that may be found in any part of the engine-generator assemblies (except for batteries). Contractor shall immediately replace and make good without expense to the Owner any such faulty parts and damage done by reason of same, during the period of 5 years or 1,500 machine hours, minimum, from the date of final project completion.

B. Where installed materials and/or equipment carry a manufacturer's warranty for a longer period; the generator assembly supplier shall, at no additional cost to Owner, replace any and all parts that fail during the manufacturers' warranty periods.

C. All warranties shall be comprehensive covering parts and labor. No deductibles or costs shall be allowed for travel time, service hours, repair parts, tools, etc.

D. Should the Contractor fail to make good the defective parts within 30 days of such notifications, Owner may replace these parts charging the expense, including labor, to the Contractor.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers shall have an authorized service organization within a 30 mile radius of the City of Spring Lake Park.

B. Acceptable Manufacturers are as follows:
   1. Caterpillar.
   2. Cummins.
   3. MTU Detroit Diesel.
   4. Kohler.

2.02 DIESEL ENGINE

A. Multi-cylinder, 4 cycle, diesel for Standard No. 2 diesel fuel.

B. Engine shall be certified to meet all required EPA and governing environmental control agencies air emission limits.

C. Rated horsepower sufficient to drive the generator at rated kW.

D. Water cooled, thermostatically controlled utilizing an engine mounted radiator with flanges for duct connections. Provide a readily accessible and viewable overflow tank.

E. 208 volt, 1 phase jacket water heater to maintain engine block at 100 degrees F to assure rapid starting.
   1. Provide disconnect/automatic sealing couplers to isolate the heater for replacement of the heater element.
   2. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

F. Pressurized circulating lube oil system complete with filtering system.

G. Crankcase breather kit. Provide heater kit for crank case breather if required for cold weather applications.

H. Heavy duty, dry element type air cleaner with restriction indicator.

I. Electric isochronous governing system.

J. DC starting motor capable of cranking engine at starting speed for a duration of at least 30 seconds.

K. Battery charging alternator.

L. Sub-base fuel tank for 24 hours of operation at full load.
   1. Full load bearing structural base with integral fuel cell. Fuel cell shall be dual wall, constructed of 12-gauge steel.
   2. Readily accessible level gauge, rupture alarm, supply line, return line, vent, fill fittings on top of tank, and drain line on side.
   3. Fuel containment area shall be supplied with a leakage alarm and a minimum of 2 alarm contacts. Alarm shall not shut down the generator automatically.
   4. Primed and painted exterior finish
   5. Low fuel level alarm contacts (2).
   6. Tank shall be UL listed and shall meet spill containment requirements of the Environmental Protection Agency and the State of Minnesota.

M. Vibration isolation dampers between engine/generator and fuel tank.

N. Vibration isolation dampers between base of generator assembly and concrete pad.

O. Clear access shall be provided to all filters and to the oil drain to facilitate on site maintenance.

2.03 GENERATOR

A. Synchronous machine with brushless revolving field.

B. 480Y/277 volt 3 phase, 4 wire windings.

C. Skewed stator and 2/3 pitch windings.

D. The generator neutral point shall be bonded to the generator frame, and the housing.

E. Separately excited generator that uses a separate permanent magnet generator (PMG) to power the voltage regulator.

F. Automatic static voltage regulator that senses all 3 phases to regulate output voltage from no load to full load within 0.5 percent, and shall include under-frequency protection.

G. Thermostatically controlled strip heater.

2.04 BATTERY AND CHARGER

A. Lead acid battery.

B. Sufficient amp-hour rating to match cyclic starting control for a minimum of 3 cranking cycles.

C. Automatic standby battery charger with dual charging rates and charging DC ammeter.

D. Charger shall disconnect either during starting or operation.

E. The battery package shall be complete with cables and hardware.

F. Charger shall be mounted within the generator assembly footprint.

2.05 CONTROL PANEL

A. Manufactured to minimize field wiring and terminations. Locate so all controls, gages, and meters are readily accessible from the floor or ground. Top of control panel shall not exceed 6'-6" above the floor, ground or catwalk.

B. Contain all engine and generator controls, meters, switches, and annunciator indicators.

C. Control panel lamps shall be provided for night time viewing.

D. Panel shall be mounted on vibration isolators.

E. Control Provisions:
   1. Generator set controller shall have a graphical display with positive image, transflective LCD, and adjustable backlight/contrast.
      a. Graphical display shall display at a minimum: modes of controls, alarms and generator status, and electrical measurements.
   2. Automatic cyclic engine start controller which will start or stop generator under the control of an automatic transfer switch.
   3. Mode selector switch which is capable of selecting automatic, manual, off, and lock-out modes.
   4. Voltage adjust potentiometer to regulate voltage manually in the range of ± 5 percent.

5. Safety shutdown controls and alarm notification for the following:
    a. Low oil pressure.
    b. High coolant temperature.
    c. Overspeed.
    d. Overcrank.
    e. Activation of Emergency Stop switch.
    f. Low coolant level.
6. The following features, at a minimum, shall be provided at the panel:
    a. Alarm horn with Alarm acknowledge button.
    b. Auto/Start(Run)/Stop buttons or switch.
    c. Engine Running notification.
    d. Engine cool down timer.
    e. Low oil pressure warning alarm.
    f. High coolant temperature warning alarm.
    g. Failure to start alarm.
    h. Overspeed warning alarm.
    i. Over crank warning alarm.
    j. Low fuel level alarm.
    k. Fuel tank full notification.
    l. 75% fuel level warning alarm.
    m. 50% fuel level warning alarm.
    n. Rupture basin alarm.
    o. Charger fail (low battery voltage) alarm.
    p. Low coolant temperature alarm.
    q. System ready notification.
7. Provide isolated SPDT contacts:
    a. Provide a contact for common alarm, low fuel, and generator running signals.
    b. Contacts shall be rated for a minimum of 2A @ 120V.
    c. Contacts shall be located in the generator control panel.
    d. Coordinate the requirements for remote monitoring with all trades.
8. At a minimum, provide the metering devices as required for the following, each point shall be displayed on the control panel graphical interface:
    a. Generator AC Voltage - 3 phase (L-L & L-N).
    b. Generator AC Current (per phase & average).
    c. Generator Power kW (total & per phase).
    d. Generator kVA (total & per phase).
    e. Generator kW-hr (total)
    f. Generator Frequency.
    g. Generator Power Factor (average & per phase)
    h. Battery Voltage.
    i. Engine Hours.
    j. Engine RPM.
    k. Engine Oil Pressure.
    l. Engine Coolant Temp.
    m. Engine Crank Attempt Counter.
    n. Service Maintenance Interval (Engine Operating Hours and Calendar Days)
    o. Real Time Clock
    p. Twenty Event Fault Log.
9. Control panel shall be equipped with communication provisions for an Ethernet connection. Provide the manufacturer's generator monitoring software and coordinate with the installation and communication network requirements with the Control Integrations Contractor.

F. Overload protection
   1. 3-pole thermal-magnetic main circuit breaker for each voltage provided.
   2. The circuit breaker(s) shall be identified with engraved phenolic nameplates which have white lettering of not less than 3/16 inch on a black background. Nameplates shall be attached with stainless steel screws.

2.06 SILENCERS

A. "Residential Grade" silencer.

B. Attenuation of 30 decibels in the 100 to 250 Hz range, 22 decibels above 4,000 Hz.

C. Mounted inside the generator enclosure.

2.07 SOUND ATTENUATING WEATHERPROOF HOUSING

A. Operating handles for latching the panels shall be lockable. 2 sets of keys shall be provided.

B. All metal parts shall be cleaned, primed, and painted with a durable, weather-resistant, semi-gloss, baked enamel finish. Color as selected by the Owner from color chips which shall be provided with the shop drawings.

C. Stainless steel hinges.

D. Bird / rodent screens over intake and exhaust louver opens. Screen openings shall be no larger than ¼ inch.

E. Adequate size to contain the engine-generator set and all accessories including the silencer.

F. Oil/moisture resistant acoustical insulation.

G. Sound performance at rated load; 75dBA at 7 meters.

H. Provide steel cage around exhaust discharge to prevent vandalism.

I. Hard wired, thermostatically controlled space heater.

J. Motorized dampers for the intake louver. Gravity damper for exhaust louver.

2.08 CONVENIENCE LIGHTS

A. 2 lamp holders for LED lights inside the enclosure. Mount the lamp holders for most effective lighting. Provide rough service LED lamps for each lamp holder.

B. Toggle switch mounted at a convenient location for control of the above lamp holders. Toggle switch shall be identified with laminated plastic nameplate which has white lettering of not less than 3/16 inch on a black background. Nameplate shall be attached with stainless steel screws.

2.09 LOAD CENTER

A. A load center shall be sub-fed from the control panel and shall feed all 120V and 208V? equipment associated with the generator.

B. Load center shall be provided with a 30A, 2P main breaker and branch breakers sized as required to feed all loads. Load center shall be mounted in the generator enclosure.

C. All loads shall be hardwired to the load center when delivered to the Site.
   1. Provide branch breakers as follows:
      a. 20A, 2P - Housing space heater.
      b. 15A, 1P – Louver Motor(s).
      c. 15A, 1P – Generator Strip Heater.
      d. 20A, 1P – Battery charger
      e. 20A, 1P – Convenience receptacle.
      f. 20A, 2P – Block heater
      g. 15A, 1P – Housing lights
      h. 15A, 1P – Spare

2.10 SPARE PARTS

A. Air filter.

B. Fuel filter.

C. Oil filter.

D. Fuses (2 of each type used in generator set).

PART 3 EXECUTION

3.01 INSTALLATION

A. The manufacturer shall be responsible for furnishing and installing generator on concrete pad. Concrete pad and wiring will be provided by others.

B. Provide cover plates (painted to match the skid) to cover any openings in the enclosure and / or skid.

C. Rodent proof the installation by sealing all openings and gaps.

3.02 FULL FLUID RESERVOIRS

A. The batteries, radiator, crankcase, and any other reservoir shall be filled as part of this Contract.

3.03 TESTING

A. Prior to delivery, the engine generator set and all support components shall be factory tested and certified by the manufacturer. Engineer and Owner shall be given a 2-week notice prior to test date.

B. Prior to field tests, manufacturer's field service representative shall inspect the complete installation to assure that all components have been installed and connected in accordance with the manufacturer's requirements.

C. After completion of the installation, the generator set and support components shall be field tested by manufacturer's field service representative. The test shall include actual start-up and operation in both the automatic and manual modes. Engineer and Owner shall be given a 2-week notice prior to test date.

3.04 TRAINING

A. After the engine-generator set installation is complete and the manufacturer's field service representative has completed all field testing, the Owners personnel shall receive operation and maintenance instruction.

B. The instructions shall include demonstration and/or review of features, including but not limited to:
   1. All accessories.
   2. Lubrication procedures.
   3. Removal and installation of filters.
   4. Start up and shut down procedures.
   5. Power outage simulation.
   6. Transfer switch operation.
   7. Control panel features.
   8. Field adjustment of output voltage.
   9. Alarm and shutdown features.

END OF SECTION

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