**THE SCHOOL DISTRICT OF PHILADELPHIA**
**Office of Capital Programs**
**440 North Broad Street, 3rd. Floor – Suite 371**
**Philadelphia, PA 19130**

**TELEPHONE: (215) 400-4730**

# ADDENDUM NO. 03

**Subject:** **Northeast HS Fire Alarm & Generator Replacement**
SDP Contract No. 2022-039-E

**Location:** **Northeast High School**
1601 Cottman Avenue
Philadelphia PA 19111

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**This Addendum dated September 06, 2022, shall modify, and become part of the Contract Documents for the work of this project. Any items not mentioned herein, or affected by, shall be performed strictly in accordance with the original documents.**

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- **CORRECTION:** **PLEASE REPLACE THE SECTION 26 32 13 INCLUDED IN ADDENDUM 02 WITH THE ATTACHED**

SECTION 26 32 13

DIESEL ENGINE DRIVEN GENERATOR SETS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of services and work to install a standby power generator system.

B. Related Sections:
1. Section 03 33 00 – Cast-in-Place Concrete
2. Section 26 05 00 – Common Work Results for Electrical
3. Section 26 05 26 – Grounding and Bonding for Electrical Systems
4. Section 26 05 26 – Hangers and Supports for Electrical Systems
5. Section 26 05 53 – Identification for Electrical Systems

1.02 MANUFACTURERS QUALIFICATIONS

A. Provide generating sets built, tested and shipped by one manufacturer to insure single source of supply and responsibility. Consideration shall be given only to manufacturers meetings the following qualifications:
1. The standby generating units shall receive the manufacturer's standard testing to ascertain that they are functioning correctly prior to shipment.
2. Twenty-four hours, seven days a week operating service facility with complete spare parts stock within 50 miles of Project Site. Delegation of this service responsibility for any or all of the equipment listed herein shall not be considered fulfillment of these Specifications.
3. Service capability to provide, after acceptance of equipment, four service calls per year in two years by a qualified maintenance or service representative, with provision that each call shall not exceed one day of service. Service calls shall not include materials, parts or equipment.

1.03 DESIGN CRITERIA

A. Standby generator sets rated continuous standby (defined as continuous for the duration of any power outage) at the following capacities:
1. Generator Rating capacities as herein specified at 0.8 power factor for standby applications (without fan), and rated in accordance with NEMA Class H temperature rise.
2. Generator Characteristics: (Minimum Nameplate Rating Values at Specified Design Conditions Including Step Loading and Ambient Temperature.)
a. 150 KW
b. All units shall conform to:
1) Voltage 208/120V
2) Phase 3
3) No. Of Service Wires 4

B. The basis of design is a Kohler (150REOZJF) 150 kW with permanent magnet excitation and 105 degree C rise alternator.
1. Load and sizing calculations must be submitted to the Engineer for approval as specified below for any substitution to the above generator.

C. Air Flow Requirements

1. The following air flow rates and maximum static restriction are the basis of design for cooling the generator while running.
   a. Combustion Air: 60 scfm
   b. Radiator Cooling: 1,300 scfm
   c. Static Restriction: 0.5 in. of water column, maximum
   d. Contractor shall be held responsible for required changes to the louvers, dampers or other equipment in the air flow path as a result of a substitution to the above generator.

D. Site Conditions:
1. The operating environment of the power generating system shall be:

| | | |
|---|---|---|
| a. | Altitude | Less than 2,000 feet |
| b. | Outside temperature, max. | 104 deg. F |
| c. | Outside temperature, min. | -20 deg. F |
| d. | Engine jacket water, glycol | 50 percent |
| e. | Fuel type | Diesel Fuel Oil No. 2 |
| f. | Cooling system type | Radiator, blower fan |

## 1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM A 126; Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
2. ASTM D 396; Specification for Fuel Oils.

B. Institute of Electrical and Electronics Engineers (IEEE):
1. IEEE Standard 446; Recommended Practice for Emergency and Standby Power Systems.

C. National Electric Manufacturer's Association (NEMA):
1. NEMA MG 1 - Motors and Generators
2. NEMA ICS 2 - Industrial Control and Systems - Controllers, Contactors and Overload Relays.
3. NEMA ICS 6 - Industrial Control and Systems - Enclosures.

D. National Fire Protection Association (NFPA):
1. NFPA 37: Stationary Combustion Engines and Gas Turbines.
2. NFPA 70: National Electrical Code. (NEC)
3. NFPA 110: Emergency and Standby Power Systems.

E. Underwriter’s Laboratories, Inc. (UL):
1. UL 142 - Above Ground Tanks for Flammable and Combustible Liquids.

## 1.05 QUALITY ASSURANCE

A. Product Quality Control:
1. Manufacturers must fabricate their products in such a manner that ensures all criteria for appearance, fit and tolerances are met.
2. Each manufacturer must carefully control his operations to ensure that the engineering, quality, safety and reliability of product are achieved.

## 1.06 SUBMITTALS

A. As specified in Section 26 05 00; submit product data for the products contained within this Section, including:
1. List of materials to be used.

2. Catalog cuts of all materials and equipment.

B. Shop Drawings: Shop drawings are required for the following:
   1. Diesel Engine.
   2. Generator.
   3. Engine and Generator Foundation Details.
   4. Engine and Generator Vibration Isolators.
   5. Generator Engine Systems Interface; Detail Drawings.
   6. Engine/Generator Control Schematics, One-Lines, and Generator Accessories Wiring Diagrams.
   7. Automatic Transfer Switches
   8. Generator Docking Station
   9. Main Line Circuit Breakers.
   10. Exhaust Silencer.
   11. Battery Charger.
   12. Batteries.
   13. All Heaters and Controls.
   14. Control Panel with Safety Controls.
   15. Manufacturer shall submit curves/calculations to indicate each generator meets the load starting and transient voltage dip requirements.

C. Factory Tests:
   1. Upon approval of all shop drawings and the engine generator calculations, the manufacturer shall fabricate and factory test each unit. A certified factory test report certifying each units full power rating, stability along with voltage and frequency regulation shall be forwarded to the Engineer for review, comments and approval.
   2. Upon receipt of the above referenced factory test approval, the manufacturer shall release the units for shipment; and forward the Operational and Maintenance Manuals to the Engineer for review and comments.

D. Field Tests: Field test of the engine generator set shall take place after the installation of the unit is completed; and shall conform to stipulations outlined in Section 26 05 63. A factory authorized representative shall be present during the tests; and a manufacturer's certification indicating acceptance and approval of each engine generator installation and the associated field tests shall be forwarded to the Engineer for review and comments and subsequent insertion into the O & M Manuals.

E. Operation and Maintenance Manual Contents: shall include spare parts lists, fuel types, lubricating oils, special tools, maintenance requirements and schedule, equipment/systems operation for the following:
   1. Engine.
   2. Generator.
   3. Cooling system - complete.
   4. Air intake and discharge system.
   5. Fuel system.
   6. Fuel tank.
   7. Control panel/control system.
   8. Automatic Transfer Switches
   9. Generator Docking Station
   10. Main circuit breakers, solid-state type.
   11. Battery charger.
   12. Batteries.
   13. Exhaust system.
   14. Other auxiliaries as called out in this section.

1.07 WARRANTY TERMS

A. The manufacturer's and dealer's extended warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Applicable deductible costs shall be specified in the manufacturer's warranty. Running hours shall not be a limiting factor for the system warranty by either the manufacturer or servicing dealer. Submittals received without written warranties as specified will be rejected in their entirety.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Basic Electrical Materials: Those Products such as conduit, wireways, wire and connectors, cable, support devices, fasteners, and similar devices, as required for Work of this Section are as specified in other Sections of these Specifications.

B. Diesel Engine Generator Sets:
   1. Diesel Engine: Heavy duty industrial type, water-cooled, of four stroke cycle compression ignition operation, having solid-injection, and of either vertical in-line or V-type design. Minimum displacement shall be 158 cubic inches, with 4 cylinders.
      a. Engine designed to operate at 1800 RPM at normal full load operation.
      b. Provide engine with removable wet or dry type cylinder liners of close-grained alloy cast iron.
      c. Provide engine capable of satisfactory performance when operating on commercial grade No. 2 Fuel Oil (ASTM D 396). Engines requiring premium or special fuels will not be considered.
      d. Provide engine capable of operating without loss in power up to 2,000 feet elevation in an ambient temperature of 125 degrees F.
   2. Electronic Governor: Engine provided with an electronic solid state governing system for precise speed control of the prime mover. Provide a governor capable of operation in a droop or constant speed system with control at any set speed to be isochronous within plus or minus .25 percent.
      a. Governing system shall comprise an electronic control module, a speed setting potentiometer, a magnetic pick-up and a hydraulic actuator with fail-safe provisions for loss of power or speed. A sensor signal is incorporated in control module to shutdown the prime mover.
      b. The governor system shall operate from starting batteries and allow automatic paralleling with one or more generator sets.
      c. Fail-safe features shall include a separate overspeed device to prevent prime mover run-away in the event of any failure, which might render the governor inoperative.
   3. Diesel Fuel System Components:
      a. Fuel system equipped with a fuel filter having replaceable elements, which may be easily removed from their housing for replacement without breaking any fuel line connections, or disturbing the fuel pumps or any other part of the engine. Locate fuel filters in one easily accessible housing, ahead of fuel injection pumps so fuel is thoroughly filtered before it reaches the pumps. No screens or filters requiring cleaning or replacement permitted in the injection pump or injection valve assemblies.
      b. Injection pump of positive action, constant-stroke design and actuated by a cam driven by gears from the engine camshaft. Engine shall have an individual mechanical injection pump and injection valve for each cylinder, of a type not requiring adjustment in service and capable of replacement within a few minutes.

c. Provide a manual shut-off valve on the fuel line and any check valves, flexible fuel connections and such other items that may be required for proper operation of the engine.

4. Lubrication:
   a. Engine provided with a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, cam-shaft bearings and valve rocker arm mechanism.
   b. Provide a suitable water-cooled oil cooler.
   c. Threaded spin-on type oil filters provided and so located and connected that lubricating oil is continuously filtered and cleaned. Filters shall be conveniently located for servicing. Equip filters with a spring loaded bypass valve as an assurance against stoppage of lubricating oil circulation in the event filters become clogged.
5. Air Cleaners: Engine provided with one or more dry type replaceable element air cleaners of sufficient capacity to effectively protect working parts of the engine from dust and grit. Crankcase connected together with engine air intake with a tube to eliminate crankcase emissions.
6. Automatic Starting System:
   a. Provide engine equipped with an electric starting system with positive engagement drive and of sufficient capacity to crank the engine at a speed, which will allow full diesel starting of the engine. System shall be 12 volts or as recommended by engine manufacturer.
   b. Automatic Controls: Fully automatic start-stop controls provided in generator set control panel. Controls shall provide shutdown for low oil pressure, high coolant temperature, engine overspeed, engine overcrank, and three single pole double throw auxiliary contacts for activating accessory items, contacts actuate upon an engine start signal. Include a minimum 30 second single cranking cycle limit with lockout. Also provide two timed output contacts meeting intake louver control requirements.
   c. Batteries: Lead-acid storage battery set of heavy-duty diesel starting type. Battery voltage compatible with starting system. Batteries of sufficient capacity to provide for four consecutive full starts consisting of four complete cranking cycles of ten seconds each and ten seconds rest, and in no case less than 225 AH (minimum of 650A. CC). Provide battery rack, necessary cables, and clamps.
7. Heaters:
   a. Generator winding anti-condensation strip heater, 120 volts A.C. thermostatically controlled. Factory wired to the generator control panel. Wattage as per manufacturer's recommendations.
   b. Generator control panel heater, 120 volts A.C. thermostatically controlled. Factory wired to the generator control panel. Wattage as per manufacturer's recommendations.
   c. Battery heater, 120 volts A.C. thermostatically controlled. Factory wired to the generator control panel. Wattage as per manufacturer's recommendations.
8. Engine Cooling: The cooling system for each emergency standby unit shall have sufficient capacity for cooling the respective engine when the generator set is delivering full-rated load at the design ambient temperature.
   a. Engine Circulating System:
      1) Each engine shall be equipped with an engine driven, centrifugal-type water circulating pump for circulating water through engine jacket, cylinder heads and radiator;
      2) Thermostatic valve to maintain the engine at recommended temperature level under all load conditions.
      3) Each cooling system shall be equipped with one or more spin-on type engine water filters, which will treat the coolant and prevent corrosion and scale deposits from forming inside the cooling system.

4) Provide a gate valve between engine and jacket water heater to facilitate maintenance on jacket water heater.

b. Provide a skid-mounted radiator and cooling system rated for full load operation in 122 degrees F ambient as measured at the generator air inlet. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact per OSHA requirements.

9. Jacket Water Heaters:
   a. An engine mounted, thermostatically controlled immersion type engine water jacket heater to be provided to insure maintaining engine block coolant temperature in the range of 120 to 140 degrees F.
      1) Heater to be suitable for operation on 240 volts, 1-phase AC power, wattages per manufacturer's recommendations.
      2) Heater shall include a lube oil pressure switch for automatic cut-out on engine start.
      3) Each engine shall be equipped with an engine driven, centrifugal-type water circulating pump for circulating water through engine jacket, cylinder heads and radiator;
      4) Thermostatic valve to maintain the engine at recommended temperature level under all load conditions.
      5) Each cooling system shall be equipped with one or more spin-on type engine water filters, which will treat the coolant and prevent corrosion and scale deposits from forming inside the cooling system.
      6) Provide a gate valve between engine and jacket water heater to facilitate maintenance on jacket water heater.
   b. Provide a skid-mounted radiator and cooling system rated for fuel load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact per OSHA requirements.
10. Generator: Generator shall be a 4 pole revolving field synchronous type, brushless, with a permanent magnet exciter, coupled directly to the engine flywheel through a flexible coupling arrangement designed for positive alignment. The generator shall be of a single sealed bearing design, bearing being maintenance free and lifetime lubricated. The generator housing shall bolt directly to the engine flywheel housing. The rotor shall be dynamically balanced for operating speeds up to 125 percent of rated speed. The rotor shall be constructed using techniques such that shaft currents are negligible and an insulated bearing is not needed. The rotor shall be provided with full amortisseur windings.
    a. Generator construction shall comply with all applicable sections of NEMA Standard MG-1. Generator insulation shall be Class H protected with 100 percent epoxy impregnation and an overcoat of resilient insulating material on the stator and rotor to reduce possible fungus and/or abrasion deterioration. Incorporate reactive droop compensation.
    b. Generator field excitation performed through a solid state, brushless, full wave rectification, rotating diode system.
    c. The generator shall be capable of maintaining 300 percent of the standby current during short circuit conditions for a minimum of 10 seconds without the addition of external hardware such as a current boost system.
    d. Generator provided with a solid state voltage regulator. Voltage regulator mounted in the control panel on the generator. A built-in voltage adjusting rheostat shall provide five percent voltage adjustment. The voltage regulator shall have an adjustable maximum voltage dip. The voltage regulator shall also include overexcitation protection that will turn the voltage regulator off to protect the generator in the event of extended operation in an overload condition. The generator shall be equipped with an overvoltage protection device as standard equipment to prevent damage to the generator and connected loads in the event

that the generator goes into an overvoltage situation. The overvoltage device shall be factory set for 125 percent of rated voltage. The voltage regulator shall have been designed for use with a diesel engine prime mover. The voltage regulator shall have been designed around the engine generator match for optimum load pick up.

e. Voltage Regulation: From no load to rated load maintained within a band of plus or minus 0.5 percent of rated voltage. The steady state voltage stability shall remain within a 0.5 percent band of rated voltage. Steady state voltage modulation shall not exceed one cycle per second.

f. One step load acceptance shall be 100 percent of nameplate KW rating to meet NFPA 110, Paragraph 5-13.2.6.

g. For any addition of load up to and including 100 percent of rated load, the transient voltage dip shall not exceed 20 percent of rated voltage. The voltage shall recover to, and remain within, the steady band in not more than 1.5 seconds. The unit to be able to nameplate power output in ambient temperature of 125 degrees F (52 degrees C).

11. Frequency Regulation: Under varying loads from no load to full load shall be isochronous. Random frequency variation shall not exceed plus or minus 0.25 percent.

12. Circuit Breaker:

a. A generator mounted main line molded case circuit breaker shall be provided for each unit. Each circuit breaker shall serve as a load circuit interrupting and protective device which shall operate both manually for normal switching functions and automatically during overloads and short circuit conditions.

b. Circuit breakers shall be sized as follows:

| | Circuit Breakers | |
|---|---|---|
| Unit Size KW | Frame Size Amps | Trip Amps |
| 150 | 100 | 100 |
| | 400 | 400 |

Circuit breakers shall be a solid state trip breaker

c. Circuit breaker shall be 80% rated; and be provided with a shunt trip attachment for emergency power shut-off.

d. Circuit breakers shall conform to types indicated above as manufactured by the Square D Company, General Electric, Siemens Industry for LV Power Distribution, Eaton Electric.

13. Engine-Generator Set Control. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

a. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

1) The generator set mounted control shall include the following features and functions:

2) Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

3) RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

4) PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power.

5) Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:
   a) Analog AC Voltmeter, dual range, 90 degree scale, 2% accuracy;
   b) Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy;
   c) Analog Frequency/RPM meter, 45-65 Hz, 1350-1950 RPM, 90 degree scale, +/- 0.6 Hz accuracy.
   d) Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. When supplied with reconnectable generators, the meter panel shall be reconnectable for the voltage specified.

b. Generator Set Alarm and Status Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
   1) Low oil pressure (alarm)
   2) Low oil pressure (shutdown)
   3) Oil pressure sender failure (alarm)
   4) Low coolant temperature (alarm)
   5) High coolant temperature (alarm)
   6) High coolant temperature (shutdown)
   7) Engine temperature sender failure (alarm)
   8) Low coolant level (alarm or shutdown--selectable)
   9) Fail to crank (shutdown)
   10) Fail to start/overcrank (shutdown)
   11) Overspeed (shutdown)
   12) Low DC voltage (alarm)
   13) High DC voltage (alarm)
   14) Weak battery (alarm)
   15) High AC voltage (shutdown)
   16) Low AC voltage (shutdown)
   17) Under frequency (shutdown)
   18) Over current (warning)
   19) Over current (shutdown)
   20) Short circuit (shutdown)
   21) Over load (alarm)
   22) Emergency stop (shutdown)

c. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

d. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
   1) Engine oil pressure (psi)
   2) Engine coolant temperature (degrees F)
   3) Engine oil temperature (degrees F)
   4) Engine speed (rpm)
   5) Number of hours of operation (hours)
   6) Number of start attempts
   7) Battery voltage (DC volts)

e. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as

well as total time of operation at various loads, as a percent of the standby rating of the generator set.

f. Alternator Control Functions:
   1) The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
   2) Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator. The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
   3) Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
   4) Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
   5) An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
   6) A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

g. Control Interfaces for Remote Monitoring. Provide the following features in the control system:
   1) Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
   2) One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
   3) A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

4) A fused 20 amp 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

h. Furnish and install a 20-light LED type remote alarm annunciator with horn, located as per direction in the field. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for fuel leak, high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

14. Battery Charger:
    a. Fully automatic, transistorized controlled, constant voltage, current-limiting charger having and equalize charge timer with SCR controls. Equalizing charge must be up to 12 hours. Instruments must include a DC voltmeter, DC ammeter, ON/OFF switch, loss of AC power light, low battery voltage light, high battery voltage light and power ON light.
    b. Charging range must be adjustable from 10 volts to 15 volts and taper to 0 at full charge. Amperage must be 10 amps, tapering to 0 amps at full charge. Operating temperature must be -40 degrees F to 140 degrees F. Battery charging system must be negative ground.
    c. Operational monitors shall provide visual output along with individual form C contacts rated at 2 amps, for remote indication of:
        1) Loss of AC power - red light
        2) Low battery voltage - red light
        3) High battery voltage - red light
        4) Power ON - green light (no relay contact)
    d. Acceptable Manufacturers:
        1) Lamarche Manufacturing Company.
        2) Master Control Systems, Inc.
15. Base: The engine-generator set shall be mounted on a heavy, duty steel base to maintain alignment between components. The base shall include a battery tray with hold-down clamps within the rails.
    a. Provide a sub-base fuel tank for the generator set, sized to allow for full load operation of the generator set for 24 hours. The sub-base fuel tank shall be UL142 listed and labeled. Installation shall be in compliance to NFPA37. The fuel tank shall be a double-walled, steel construction and include the following features:
        1) Emergency tank and basin vents.
        2) Mechanical level gauge.
        3) Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
        4) Leak detection provisions, wired to the generator set control for local and remote alarm indication.
        5) High and low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level
        6) Basin drain.
        7) Integral lifting provisions.

16. Acceptable manufacturers for the diesel engine generator sets:
    a. Kohler Power Systems (Basis of Design)

b. Cummins Power Generation
c. Caterpillar

2.02 SPARE PARTS

A. Filters:
1. Provide three complete sets of filters for each unit as required for normal service and maintenance routines.
a. Corrosion Filter(s).
b. Primary Fuel Filter(s).
c. Secondary Fuel Filter(s).
d. Lubrication Filter(s).
e. Air Intake Filter(s).
f. Related Gasket(s).
g. Coolant Filter(s).
2. Pack spare filters in manufacturer's standard cartons and turned over to Owner upon the completion of the final performance test and acceptance of equipment by Owner.

2.03 FOUNDATION FOR GENERATOR SET

A. Concrete work shall be as specified in Section 03 30 00.

B. Final connections shall be made with liquid tight flexible metallic conduit.

C. The construction of the generator set concrete pad and the installation of same shall be in strict conformance with these specifications and the details indicated on the drawings.

2.04 GROUNDING MATERIALS

A. Grounding materials shall be as specified in Section 26 05 26.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install equipment with skilled mechanical erection labor in accordance with manufacturer's instructions. Provide such operations and work as may be necessary to provide a complete installation in accordance with these Specifications and/or Drawings, or as may be reasonably interpreted there from for a complete installation ready for service operation.
1. Following the mechanical performance test, instruct Owner's operating personnel regarding each engine-generator operation and maintenance.

B. Mounting:
1. Provide pre-set anchor bolts as specified in Section 26 05 28, to anchor each engine-generator in place on concrete foundation.

C. Identify generators in accordance with Section 26 05 53, Electrical Identification.

D. Generator is shipped with fuel tank removed. Manufacturer representative to be on site during rigging and final assembly.

3.02 GROUNDING

A. Generator set shall have all ground pads connected to a solid earth ground using cone pointed drive ground rods as specified in Section 26 05 26 of these specifications. Install as indicated to provide an earth ground having a test resistance of no more than 5 ohms.

3.03 TESTING/CERTIFICATION

A. Testing/Certification: Consult Section 26 05 63 for requirements for field inspection and testing of the diesel-engine generator set.

END OF SECTION