SECTION 26 3200
PACKAGED GENERATOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor designed and installed packaged, pre-wired, turnkey generator power distribution system and walk-in module. This is a performance type specification describing the minimum acceptable packaged engine generator system. The Contractor shall design and install the packaged engine generator system and power distribution system in accordance with the requirements of NFPA 70, NFPA 110 and IBC. The packaged engine generator and power distribution system and module on the drawings are shown in suggested locations and suggested dimensions, the final layout, location and dimensions of equipment and devices shall be solely determined by the Contractor and shall be in accordance with NFPA 70, NFPA 110 and IBC:

1. Packaged engine generator systems.
2. Walk-in enclosure.
3. Walk-in enclosure Electrical and Mechanical systems.
4. Genset accessories.

1.02 RELATED SECTIONS

A. Division 03 - Cast-In-Place Concrete.

B. Section 26 0500 – Common Work Results for Electrical.

C. Section 26 0519 – Low Voltage Electrical Power Conductors and Cables.

D. Section 26 0526 – Grounding and Bonding for Electrical Systems.

E. Section 26 0529 – Hangers and Supports for Electrical Systems.

F. Section 26 0533 – Raceway and Boxes for Electrical Systems.

G. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

H. Section 26 0553 – Identification for Electrical Systems.

I. Section 26 2416 – Panelboards.

J. Section 26 2726 – Wiring Devices.

K. Section 26 5000 – Lighting.

L. Section 26 3600 – Automatic transfer switches.

1.03 REFERENCES

A. ASCE 7 Chapter 13.

B. ANSI/NEMA AB 1 – Molded Case Circuit Breakers.

C. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. ANSI/NEMA MG 1 - Motors and Generators.

E. ANSI/NFPA 70 - National Electrical Code.

F. ANSI/NFPA 110 – Emergency and Standby Power Systems.

G. ASTM A36 – Specification for Carbon Structural Steel.

H. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

I. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

J. IBC, Chapter 16 – Structural Design.

K. IEEE446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

L. ISO 8528 – Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets.

M. UL 2200 – Stationary Engine Generator Assemblies.

N. UL 142 - Aboveground Flammable Storage Tanks

1.04 SYSTEM DESCRIPTION

A. Engine generator system to provide source of standby power for entire facility. The engine generator assembly shall be listed in accordance with UL 2200.

B. System Capacity: 900kW, 1,125 KVA, emergency/standby rated at elevation of 1000 feet above sea level, and ambient temperature between -40 and 104º F.

C. Operation: In accordance with ANSI/NFPA 110.

D. The Packaged Generator Assembly, enclosure, all dimensions, and performance data are based on Kohler model: KD900. The CONTRACTOR shall make all necessary modifications required for other manufacturers, at no additional cost to the OWNER, if Kohler Generation's equipment is not supplied.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

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, sub-base fuel day tank, duct-mount load bank, and remote annunciator.

D. Provide structurally engineered shop drawings as specified in Section 26 0548 for seismic restraint of all equipment required by the 2012 IBC, Chapter 16 (1621).

E. Submit shop drawings, product data and calculations for the walk-in enclosure and all associated equipment. Shop drawings shall include dimensioned layout of all equipment in plan view and elevation view. Drawings and calculations shall show compliance with IBC seismic, wind, and snow loading criteria specific to the Project location, and shall be stamped by a Licensed Professional Structural Engineer in the State of Alaska.

F. Submit technical data including features, performance, electrical characteristics, physical characteristics, ratings and finishes for the load bank. Shop drawings shall include dimensional plans and mounting details sufficient to properly install the load bank. Load bus configuration and load connections and load termination area shall be clearly identified. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. Over-current protection and control devices shall be identified and their ratings marked. A system interconnection drawing shall be included for control wiring related to the load bank.

G. Submit manufacturer's installation instructions under provisions of Division 01.

1.06 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Division 01.

B. Accurately record location of packaged generator assembly, and all external mechanical and electrical connections. Provide dimensioned routing of underground utilities from building to enclosure, as applicable.

C. Submit onsite test records showing the results of the testing per Part 3.3 below.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include instructions for the following:

1. Normal operation.
2. Routine maintenance requirements, including replacement of filters.
3. Starting battery inspection/maintenance.
4. System coolant and other fluid inspection and replacement.
5. Oil sampling and analysis for engine wear.
6. Emergency maintenance procedures.

C. Provide manufacturer's service manuals for all equipment, including but not limited to the following: Engine, generator, radiator, and fuel tank.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in packaged generator assemblies with a minimum of five years of documented experience.

B. Supplier: Authorized distributor of the packaged generator assembly with service facilities in Anchorage, AK. Supplier shall be authorized by the manufacturer to maintain and administer the warranty and employ factory certified mechanics to perform warranty work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

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. Under the provisions of Division 01, the complete electrical power system (generator sets, enclosure, controls, automatic transfer switches and associated switches and accessories) shall be warranted by the manufacturer against defects in materials and workmanship for a period of five years or 1,500 hours from the date of generator commissioning, whichever occurs first. Warranty shall include parts, labor, travel expenses and labor to remove/reinstall equipment. There shall be no deductibles applied to the warranty.

1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of packaged engine generator system for three years from Date of Substantial Completion. The maintenance service shall include two semi-annual inspections and test run the engine to perform manufacturers recommended preventative maintenance service on the equipment furnished.

1.12 EXTRA MATERIALS

A. Submit maintenance materials under provisions of Division 01.

B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kohler (Basis of Design).

B. Substitutions: Under provisions of Division 01.

2.02 ENGINES

A. Type: Water-cooled inline or V-type, four stroke cycle, compression ignition internal combustion engine.

B. Rating: Emergency power rated per ISO 8528 at specified elevation and ambient limits.

C. Fuel System: Appropriate for use of #2 fuel oil.

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. Safety Devices: Engine shutdown on high water temperature, high lube oil temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

G. Engine Starting: Electric DC starting system capable of three complete cranking cycles without overheating. Starters shall have 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: Model 10305000145-KA6 UL listed and labeled thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 120º F, and suitable for operation on 208 volts AC.

I. Radiator: Integral cooling system that is closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump. Engine-driven fan shall be blower type and rotating parts shall be guarded against accidental contact.

1. Modular radiator cores for ease of maintenance, repair, or replacement.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives. Coolant must be part GM109949.
3. Size of Radiator: Adequate to contain expansion of total system coolant to 110 percent of capacity.
4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by Kohler.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant material.
   a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 215º F, and noncollapsible under vacuum.

J. Engine Accessories:

1. Oil Pump: Positive displacement, mechanical, full pressure, lubrication oil pump.
2. Fuel Pump: An engine driven, mechanical, positive displacement fuel pump. Include fuel priming pump.
3. Fuel filter with a replaceable spin-on canister element. Provide Kohler 230510003 or approved equal pre-filter, with water shutdown sensor tied to control panel.
4. Replaceable dry element air cleaner with restriction indicator.
5. Water pump.
6. Lube oil cooler.

7. Lube Oil Drain: Extend the lube oil drain to the outside of the generator skid using Areoequip fittings. Install a Nibco T - 113 shut off valve on the hose at an accessible location of the unit and cap the end of the hose with a ¾" NPT cap.

K. Mounting: Provide structural steel base for mounting the genset. Include vibration isolators between the genset and skid base per the manufacturer's IBC Seismic Certified package requirements.

2.03 GENERATORS

A. Generator: ANSI/NEMA MG 1; three phase, four pole, reconnectible brushless synchronous generator with brushless PMG excitation.

B. Rating: 900kW, 1,125 kVA, at 0.8 power factor, 480Y/277 volts, 60Hz at 1800 rpm.

C. Insulation and Temperature Rise: ANSI/NEMA MG 1, Class F, 130º C, standby.

D. Enclosure: ANSI/NEMA MG 1; open drip proof.

E. Voltage Regulation: Microprocessor-based, high-speed digital voltage regulator, separate from exciter, with three-phase, true RMS sensing, providing performance as specified.

1. Maintain steady-state voltage within 0.25 percent from no load to full load.

2. Adjusting Feature on Control and Monitoring Panel: Provide plus or minus 10 percent adjustment of output-voltage operating band.

F. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady state operating band within 5 seconds. On application of a 100% load step, the generator set shall recover to stable voltage within 10 seconds.

G. Frequency Regulation: Isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

H. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of 100% load step, the generator set shall recover to stable frequency within 10 seconds.

I. Output Waveform: The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall not exceed 50 in accordance with NEMA MG 1.

J. Sustained Short-Circuit Current: For a 3-phase bolted short circuit at system output terminals, the generator set shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to the generator system components. For a single-phase bolted short circuit at system output terminals, the system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

K. Start Time: Comply with NFPA 110, Level 1, Type 10 system requirements.

L. Generator Leads: The generator leads shall be brought out and terminated on a unit-mounted generator circuit breaker. The generator leads shall have sufficient length to allow for any connection configuration.

2.04 WALK-IN ENCLOSURE

A. Manufacturer: Enclosure manufacturer shall be qualified to perform the work under this section with a minimum of five (5) years documented experience with similar enclosures. The walk-in module and all associated equipment shall be furnished as an integral unit, packaged, turnkey with generator by a single supplier.

B. The building structural design shall meet the seismic, wind, and snow loads as required by the IBC for the specific project area. The building structure shall comply with the requirements for the rain test and accumulation of water under abnormal conditions for NEMA 3R enclosures.

C. Structural design shall be stamped and signed by a Licensed Professional Engineer in the State of Alaska.

D. Structural Framing:

1. Framing consists of rolled structural shapes in accordance with ASTM-A36 specifications.
2. All connections shall be of all welded design in accordance with the International Building Code (IBC) latest edition and amendments.
3. The roof shallbe shed type and sloped 2” in one direction as shown on the Drawings.
4. All structural steel shall be primed with a marine alkyd primer proceeding fabrication. No top coat is applied.

E. Walls and Roof:

1. Exterior wall panels of the module shall be formed and welded 14-gauge galvanneal Satin Coat per ASTM-A653.
2. Roof shall be 12-gauge galvanneal Satin Coat per ASTM-A653 and is fully seam-welded, guaranteed not to leak.
3. Walls insulated with 5” mineral wool (R20) and lined 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.
4. Roof insulated with 5” mineral wool (R20) and lined 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.
5. Two (2) Fall Restraint pads shall be provided on the roof.
6. Enclosure paint system shall require exterior wall panels surface prep to SSPC-SP1: Solvent Clean. Prime with two-part epoxy primer to 2.0 to 4.0 mils dft. Finish coat two-part aliphatic urethane to 2.0 to 4.0 mils dft. High Standard Power Systems standard paint system color shall be per the project Architect. Sub-Base Tank shall be surface prep to SSPC-SP6: Commercial Blast. Prime with two-part epoxy primer to 3.0 to 5.0 mils dft. Finish coat two-part aliphatic urethane to 3.0 to 5.0 mils dft. Color shall match the enclosure color.
7. Exterior Doors shall be High Standard Power Systems Standard formed and welded 14-gauge galvanneal Satin Coat to ASTM-A653 construction with an insulated core. Doors shall be flush on the exterior and sealed with neoprene “Bulb Seal” to NEMA 3R and shall have the same finish as the exterior of the building. Doors insulated with 5” mineral wool (R20) lined with 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.

F. Support Baseframe:

1. The generator sets and all ancillaries shall be supported on the prefabricated steel baseframe designed to withstand the forces of damage fatigue as a result of transportation and placement at site.
2. All frame structural material shall be in accordance with ASTM A36. Galvanized steel shall be Grade 30 in accordance with ASTM A653. Tolerances shall be +/- 1/8”.
3. There shall be two longitudinal wide flange beams provided as the main support positioned inward of the perimeter and to provide skidding as required. Additional thermal break between the rails and the enclosure shall be provided.
4. Floor plate shall consist of 3/16” diamond plate galvanized steel properly braced and stiffened to prevent “oil canning.” All seams shall be stitch welded. At the Contractor’s option an epoxy coated floor system may be used in lieu of the diamond plate.

5. Four lifting eyes shall be provided in relation to the center of gravity.

G. Enclosure Access Stairs:

1. Provide stair access and landing at building entrance(s). Provide number of steps as required to meet IBC requirements and suitable for site conditions. Stairs and landing shall be manufactured from structural grade aluminum or stainless steel grip strut. Provide aluminum or stainless steel handrails as required per the IBC.

H. Electrical:

1. The following electrical components shall be supplied and installed in accordance with the applicable project Specification Sections, the National Electric Code (NEC), and as shown on the Drawings.
2. 225 amp, 120/208V, 3-phase, 4W lighting and service panel complete with 225AF/100AT main breaker and required branch circuit breakers. Reference Section 26 2416 Panelboards.
3. Provide interior LED fixtures, Lithonia #FEM L48 or equal, to provide an average lighting level of 30 footcandles throughout the module. Reference Section 26 5000 Lighting. Provide light switch at entries to module to control interior lights. Reference Section 26 2726 Wiring Devices.
4. Provide interior emergency lighting via LED dual lamp emergency fixtures with integral battery backup, Lithonia ELM4L or equal. Reference Section 26 5000 Lighting.
5. Provide exterior LED fixtures with integral photocell at each door, Lithonia TWR1 LED P2 40K PE DDBTXD or equal. Reference Section 26 5000 Lighting. Provide one light switch at an entry for manual control exterior lights. Reference Section 26 2726 Wiring Devices.
6. A minimum of three interior duplex receptacles in addition to those required to operate the battery charger and engine block heater. A minimum of one GFCI protected exterior duplex receptacle with an “In-Use” listed weatherproof cover. Reference Section 26 2726 Wiring Devices.
7. All components shall be installed, wired, and tested in accordance with the applicable Division 26 Specifications and the NEC.
8. Providing labeling on all equipment as required by Section 26 0553 Identification for Electrical Systems.

I. Ventilation:

1. All motor operated dampers and motors shall be provided and pre-wired to a relay panel with controls.
2. All openings shall include weatherhoods and birdscreens. Coordinate hood locations and configuration with site and building layout. Intake openings shall be a minimum of 72” Above finished grade.
3. Ventilation and Combustion Air:
   a. One (1) Fixed, 4” insulated and lined horizontal intake hood with integral duct silencers and fixed louvers with galvanized bird screen.
   b. One (1) Insulated Aluminum Volume Control Damper with four (4) Belimo AFB24-MFT-S modulating actuators (Fail open – power close).
4. Radiator Air Discharge:
   a. One (1) Flex connector between radiator and damper.
   b. One (1) Aluminum insulated volume control damper with two (2) Belimo AFB24-MFT-S modulating actuators (Fail open / power close).
   c. One (1) 4” Insulated and lined vertical discharge hood with removable duct silencer with integral duct silencers and galvanized bird screen.

5. One (1) Thermostatically controlled 1,640 CFM exhaust fan with gravity backdraft damper. Fan to be interlocked with the intake damper.
6. One (1) PLC Based Ventilation Control Panel based on room temperature only.

J. Heating:

1. Two (2) 4.8kW Electric Fan Forced unit heaters shall be provided with built-in thermostats to heat generator enclosure.

K. Temperature Control System:

1. Temperature controls shall be provided to operate electric unit heaters and generator dampers.

L. Insulation:

1. Insulate all ductwork, engine exhaust piping and muffler.

2.05 ACCESSORIES

A. Sub-Base Tanks: Double-wall, all-welded construction, base-mounted fuel tank with a minimum capacity for 36-hour runtime. The tank outside dimensions shall not exceed the dimensions of the generator enclosure framework. The tank the structural integrity to support the engine-generator set, shall be supplied by the engine-generator set distributor, and shall be installed before shipment. The tank shall be UL 142 listed for both primary and secondary containment and shall meet all of the requirements of NFPA for the intended use. The tank shall have the following features:

1. 2,330 useable gallons capacity providing 36 hours of generator run time at 100% nameplate rating
2. Five (5) Internal generator supports with ten (10) mounting pads.
3. 2" perimeter containment
4. Exterior 4” UL Listed 5-gallon spill bucket with 2” lockable manual fill cap with 2” cam lock and ULC overfill prevention valve.
5. One (1) Mechanical Fuel Level Gauge
6. ULC Listed High (90%), low (30%) and critical low (10%) level switches
7. One (1) Supply fitting with dip tube, foot valve
8. One (1) Return fitting with dip tube
9. One (1) Stub-up under both generator circuit breakers with 2” containment
10. One (1) Stub-up under the distribution panel with 2” containment
11. ULC listed stainless steel flexible fuel lines provided from the sub-base tank to the engine
12. Venting per B139
13. One (1) Normal vent (2”) with vent extended
14. Two (2) Emergency vents

15. Four (4) Spare 2” Fittings

16. One (1) Spare 4” Fitting

B. Exhaust Silencers: One (1) Interior, Hospital Plus Grade, mild steel, rectangular silencer with 90 degree elbow. Two (2) 18” stainless steel exhaust flexible connections. One (1) 40” Exterior exhaust stack with heavy-duty rain cap. Nut, bolt, and gasket kits shall be provided for all flanged exhaust connections with all bolts double-nutted. Removable insulation blankets shall be provided and installed for the interior silencer, exhaust flexes, and exhaust elbow.

C. Batteries: Shall be heavy duty Kohler part 10702002501-KA1 Absorbent glass mat (AGM), no exceptions.

D. Battery Trays: Non-metallic battery boxes with covers and hold-downs, treated for electrolyte resistance and constructed to contain spillage of electrolyte. Provide with seismic restraints to secure batteries during earthquakes. The battery housing shall be accessible for maintenance.

E. Battery Charger: Provide Kohler 10702000502-KA1 Industrial 20A Battery Charger. Battery charger shall comply with UL1236 for Category BBHH. Battery charger operation shall be current-limited, constant-voltage, automatic-boost-type charger designed for AGM maintenance-free batteries, with the following features:

   a. Automatic three-stage charge cycle for up to three independent batteries simultaneously per charger.
   b. Output Voltage Regulation: Charger regulates output to within plus or minus 0.5 percent of manufacturer-provided voltage settings despite variations of input voltage, input frequency, and output current.
   c. Battery Thermal Compensation: Battery temperature compensation with adjustable slope, factory set at minus 0.18 percent per degree C, and equipped for sensing battery temperature.
   d. AC Input: Charger operates from any 45- to 65-Hz ac source with voltage ranging from 105- to 264-V rms.
   e. LCD Digital Display: AC input voltmeter, DC output voltmeter, and ammeter (1 percent accuracy).
   f. LED Lamp Indicators: Current limit, AC ON, and charger fail.
   g. Charger Fail Alarm Contact: Voltage-free (dry type) form "C" output.
   h. Filtered output for type VRLA AGM batteries.
   i. Charger Enclosure: NEMA 250, Type 1 (IP20), wall mounted and rated for generator duty with charger enclosure vibration resistance.

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: Shall be Kohler APM603 and provide the following equipment and features:

   1. Digital engine generator controller with integrated graphical touch screen TFT display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
   2. Controller Face Ingress Protection: IP 65.
   3. Operating Temperature: Minus 40 to plus 70 deg F (Minus 40 to plus 21 deg C).
   4. Maximum Operating Humidity: 95 percent non-condensing.
   5. Corrosion Resistant: Tested in accordance with ASTM B117 (salt spray test).
   6. Controller Features:

a. Mode Selector: Allowing selection of one of the following modes:

1) Off/Reset: Prohibits the generator from starting and resets shutdowns. In this mode the controller does not respond to remote start and stop commands.
2) Manual: Allows user to locally start and stop to operate the generator. In this mode the controller does not respond to remote start and stop commands.
3) Auto: Allows generator to start and stop based on remote commands. In this mode the generator does not respond to manual start and stop commands.

b. Emergency Stop Switch: Latch-type remote stop switch, red in color with mushroom-type head. Depressing the stop button will immediately stop the generator set and lock out any automatic remote starting.
c. Audible Alarm: Horn sounds for specific warning and shutdown conditions.
d. Alarm Silence/Lamp Test Pushbutton: Silences audible alarm when depressed. All controller indicating lights are simultaneously illuminated while actuated.
e. Fault Light: LED indicating abnormal conditions:

1) Yellow: Active warning condition or mode selector switch not in automatic.
2) Red: Active shutdown condition.

f. Real-time clock and calendar for time stamping events.
g. Load Management:

1) Programmable outputs to command the connect and disconnect of loads based on system state:

a) Loads connected based on available capacity.
b) Loads disconnected at system startup.
c) Loads disconnected based on a maximum kW setting or under frequency setting.

2) Support up to 16 load steps.

h. Engine Control Features:

1) Programmable engine start delay.
2) Programmable engine cool-down delay.
3) Programmable warm-up delay based on time or engine temperature.
4) Programmable idle speed.
5) Programmable cyclic cranking with adjustable on time, off time, and number of cycles.

i. Event Logging:

1) Maintain record of a minimum of 1,000 events with date and time locally for warning and shutdown faults.
2) Event log easily available for download onto USB storage device or PC.
3) Event Snapshot: Capture 15 seconds of critical data around the time of a fault or warning. Data to be viewable on the controller and downloadable.

j. Data Logging: Capable of time-based recording of customized parameters.

1) Parameters selectable from all monitored parameters.

2) Sample period configurable from one second to one day.
3) Collected data stored on USB storage device plugged into the control panel.

k. Minimum of three user access levels.
l. Password protection to prevent unauthorized modification to system parameters.
m. Customizable Interface:

1) Overview Screen: Dedicated screen allowing user to display up to 16 parameters for immediate access.
2) Favorites: User customizable menu set up for enhanced usability.

7. Monitoring Instruments: Accessible through the digital engine generator controller and viewable during operation.

a. Engine-coolant temperature.
b. Battery voltage.
c. Running-time meter.
d. Engine speed.
e. Oil pressure.
f. Fuel level (with optional sensor).
g. Fuel pressure.
h. Fuel consumption rate.
i. Crankcase pressure.
j. Oil temperature.
k. Coolant level.
l. Coolant pressure.
m. Common rail fuel pressure.
n. Fuel temperature.
o. Intake air temperature.
p. Exhaust temperature (with optional sensor).
q. Charge air pressure.
r. Charge air temperature.
s. Ambient temperature.
t. AC output voltage including all phase-to-phase quantities, 0.25 percent accuracy.
u. AC output current for each phase, 0.25 percent accuracy.
v. AC frequency, 0.25 percent accuracy.
w. Power factor total and per phase with leading/lagging indication.
x. kW total and per phase, 0.5 percent accuracy.
y. kVARS total and per phase, 0.5 percent accuracy.
z. kVA total and per phase, 0.5 percent accuracy.
aa. kW hours.
bb. Generator duty level (actual kW loading divided by kW nameplate).

8. Service Data: Stored in the controller and available for display.

a. Generator model number and serial number.
b. ECM serial number.
c. Alternator part number.
d. Engine model number and serial number.
e. Controller serial number and firmware version.

9. Operational Records: Stored in controller beginning at system startup.

a. Total run-time hours.
b. Total loaded hours.
c. Total unloaded hours.
d. Total kW hours.
e. Controller hours.
f. Controller run-time hours.
g. ECM run-time hours.
h. Number of starts.
i. Number of crank attempts.
j. Last crank duration.
k. Last start runtime duration.
l. Last start date and time.
m. Last stop date and time.

10. Maintenance Records: Stored in controller beginning at system startup, user resettable to zero.

    a. Total run-time hours since last maintenance.
    b. Total loaded hours since last maintenance.
    c. Total unloaded hours since last maintenance.
    d. Total kW hours since last maintenance.

11. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

    a. Mode selector switch not in automatic position.
    b. Overcrank shutdown.
    c. Low lubricating-oil pressure warning.
    d. Low lubricating-oil pressure shutdown.
    e. Low coolant temperature warning.
    f. High engine temperature warning.
    g. High engine temperature shutdown.
    h. Overspeed shutdown.
    i. High fuel level warning.
    j. Low fuel main tank.

        1) Low-fuel-level alarm to be initiated when the level falls below that required for operation for duration required
        2) Critically low-fuel-level warning.

    k. Coolant low-level shutdown device.
    l. Coolant high-temperature warning.
    m. Coolant high-temperature shutdown.
    n. ECM Digital Trouble Codes warnings.
    o. ECM Digital Trouble Codes shutdown.
    p. Loss of ECM Communications shutdown.
    q. ECM mismatch shutdown.
    r. Battery high-voltage warning.
    s. Battery-charger malfunction warning.
    t. Battery low-voltage warning.
    u. Remote manual stop shutdown.
    v. Local manual stop shutdown.
    w. Alternator protection shutdown.
    x. Overcurrent warning.

y. Overcurrent shutdown.
z. Under frequency warning.
aa. Under frequency shutdown.
bb. Over frequency warning.
cc. Over frequency shutdown.
dd. Over power warning.
ee. Over power shutdown.
ff. Under voltage warning.
gg. Under voltage shutdown.
hh. Over voltage warning.
ii. Over voltage shutdown.
jj. User-defined input warning.
kk. User-defined input shutdown.
ll. No oil pressure signal shutdown.
mm. No speed sensor signal shutdown.
nn. Fail-to-start shutdown.

H. Remote Annunciator Panels: Provide flush mounted 20-light LED type remote alarm annunciator panels with brushed stainless steel finish and alarm horn, located as shown on the Drawings. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 2 systems for the local generator control panel. Annunciator shall be labeled with the specified functions. Alarm silence and lamp test switches shall be provided. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. 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. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel. Provide alarm horn, and indicators and alarms as follows:

Condition	Lamp Color	Audible Alarm
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Overcrank	Red	Yes
Emergency Stop	Red	Yes
Low Coolant Level	Amber	Yes

Low Fuel Level	Amber	Yes
Loss of Generator Control Wiring	Red	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

I. Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

J. Heaters: Provide manufacturer's recommended heaters with thermostatic controls to keep engine oil pan, engine block, generator controls, and generator windings within manufacturer's recommended temperature at 30°F. Provide immersion type coolant heater in remote radiator to keep radiator within manufacturer's recommended temperature at -20°F.

K. Mounting: The complete engine/generator package shall be mounted on a common, self-supporting, low profile, structural steel skid base with rubber in shear vibration isolators between the engine and base and spring type vibration isolators with seismic snubbers between the base and the module. The base shall extend from the rear end of the generator to the most forward point of the engine and shall be predrilled to accept a #2 AWG - 250 kCMIL copper grounding conductor.

L. Resistive Load banks:

1. UL listed, free-standing, air-cooled, resistive load bank:
    a. The load bank shall be Simplex MARS 900 and supplied by the generator supplier.
    b. The load bank shall be designed for continuous duty have a total capacity at unity power factor or +/-5% of the value shown on the drawings.
    c. The load bank shall be constructed of heavy gauge aluminized steel per ASTM A463 or galvanized steel with marine grade, baked polyester powder coated finish and exterior stainless steel fasteners.
    d. Load elements shall be helically wound chromium alloy wire rated to operate at approximately ½ of maximum continuous rating of the wire. Elements shall be fully supported across the entire length of the air stream by segmented ceramic insulators on stainless steel rods. Element supports shall be designed to prevent a short circuit to adjacent elements or ground.
    e. The load bank shall have a unit mounted control panel
    f. The load bank shall have automatic load stepping capability with a step resolution nominally 20% of the load bank rating.
    g. Protective Devices:
        1) A differential pressure switch shall be provided to detect air loss. The switch shall be electrically interlocked with the load application controls to prevent load from being applied if cooling air is not present.
        2) An over-temperature switch shall be provided to sense the load bank exhaust. The switch shall be electrically interlocked with the load application controls to prevent load from being applied in the event of an over temperature condition.
        3) Branch fuses shall be provided on all three phases of switched load steps above 50KW. Branch fuses shall be current limiting type with an interrupting rating of 200K A.I.C

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings.

B. Verify that required utilities are available in proper location and ready for use.

C. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Ground and bond generator and other electrical system components in accordance with NEC requirements.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Generator system on-site testing shall be performed in accordance with NFPA 110 requirements for Level 1 Systems, namely Part 7.13. Coordinate scheduling of testing with Owner and Authority Having Jurisdiction a minimum of seven (7) days prior to testing.

C. Perform an initial 1.5 hour minimum on-site acceptance test utilizing all loads that are served by the EPSS, per NFPA 110 7.13.4.1. Simulate power failure by opening the normal source to all transfer switches. Observe, verify and record the following:

1. Time delay on start up.
2. Cranking time until the prime mover starts and runs.
3. Time to reach operating speed.
4. Verify engine start function by verifying operation of the initiating circuit on all transfer switches supplying EPSS loads.
5. Time to achieve a steady-state generator condition after all transfer switches have transferred to the emergency position.
6. Record real power, apparent power, voltage, frequency, amperage, oil pressure, and coolant temperature at 15 minute intervals throughout the test.
7. Time delay on retransfer to normal power for all transfer switches.
8. Time delay on generator cooldown and shutdown.

D. Upon completion of the initial acceptance test, allow the generator to cool for a minimum of 5 minutes before beginning the full load test below.

E. Provide a two (2) hour full-load test utilizing the integrated load bank,. Building loads may be utilized during this full load test if approved by the Owner prior to testing. Simulate power failure including operation of each transfer switch. Full-load testing shall be done as follows:

1. 30 minutes at 50% rated load.
2. 30 minutes at 75% rated load.
3. 1 hour at 100% rated load.
4. Record real power, apparent power, voltage, frequency, amperage, oil pressure, and coolant temperature at 15 minute intervals throughout the test.

F. Upon completion of the full-load test test alarm and shutdown circuits by simulating conditions. Demonstrate all automatic features as directed by the Owner’s Representative.

3.04 MANUFACTURER'S FIELD SERVICES

A. Prepare, start, test, and adjust systems under provisions of Division 01.

3.05 ADJUSTING

A. Adjust work under provisions of Division 01.

B. Adjust generator output voltage and engine speed.

3.06 CLEANING

A. Clean work under provisions of Division 01.

B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.07 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 01.

B. Describe loads connected to standby system and restrictions for future load additions.

C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide standby power.

END OF SECTION