



## ADDENDUM TO THE CONTRACT

for the

### LAWSON CREEK LIFT STATION REPLACEMENT PROJECT

Contract No. E13-243

**ADDENDUM NO.:** ONE

**CURRENT BID OPENING DATE:**  
May 16, 2013

**PREVIOUS ADDENDA:** NONE

**ISSUED BY:** City and Borough of Juneau  
ENGINEERING DEPARTMENT  
155 South Seward Street  
Juneau, Alaska 99801

**DATE ADDENDUM ISSUED:** May 1, 2013

The following items of the Contract are modified as herein indicated. All other items remain the same. This is a faxed addendum. A confirming copy will not be mailed to you. If this fax is incomplete, please call (907) 586-0490, and we will re-send it. This addendum has been issued and is posted online. <http://www.juneau.org/engineering ftp/contract/Contracts.php>

#### **PROJECT MANUAL**

Item No. 1 Section 16231 PACKAGED ENGINE GENERATORS, **Replace** Section 16231 Packaged Engine Generators with the Section 16231 Package Engine Generators attached to this Addendum and dated May 1, 2013.

#### **PROJECT PLANS**

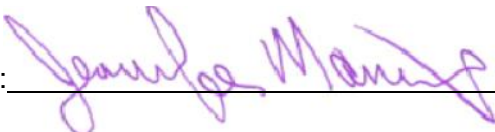
Item No. 2 Drawing E-2, DEMOLITION BUILDING FLOOR PLAN **Add** the following note. "DOUBLE DOOR IS TO BE REMOVED AND THE OPENING PATCHED".

Item No. 3 Drawing E-2, DEMOLITION BUILDING FLOOR PLAN **Add** the following note. "REPLACE SINGLE DOOR".

Item No. 4 Drawing E-2, DEMOLITION BUILDING FLOOR PLAN, **Add** the following. "NOTE 4. WHEN PATCHING OPENINGS AND HOLES IN WALLS, MATCH EXISTING WALL SECTION (BLOCK, INSULATION, VAPOR BARRIER, SHEET ROCK, ETC. REPAINT THE INTERIOR AND EXTERIOR OF THE BUILDING AFTER REMOVING EQUIPMENT, PATCHING THE WALLS, AND MAKING NEW OPENINGS BUT PRIOR TO INSTALLING NEW EQUIPMENT. PROVIDE TOUCH UP AS REQUIRED AFTER NEW EQUIPMENT IS INSTALLED. COLOR BY OWNER. PAINT SHALL BE BENJAMIN MOORE MOORGUARD LOW LUSTRE PRODUCT NO. W103 FOR THE EXTERIOR. WHEN PAINTING NEW BLOCK FIRST APPLY BENJAMIN MOORE MASONRY SEALER. PRODUCT NO. 066. FOR THE INTERIOR USE BENJAMIN MOORE

MOORCRAFT SUPER HIGH PRIMER PRODUCT NO. 284 OVER NEW SHEET ROCK,  
USE BENJAMIN BEN PRODUCT NO. W626 SEMIGLOSS FOR ALL WALLS.”

- Item No. 5 Drawing E-3, DEMOLITION BUILDING ELEVATIONS, **Add** the following note to GENERATOR BLDG-NORTH ELEVATION detail “REPLACE SINGLE DOOR.”
- Item No. 6 Drawing E-3, DEMOLITION BUILDING ELEVATIONS, **Add** the following note to GENERATOR BLDG-SOUTH ELEVATION detail “DOUBLE DOOR TO BE REMOVED AND THE OPENING PATCHED.”
- Item No. 7 Drawing E-5, NEW BUILDING FLOOR PLAN, **Change** the door swing for the new single door (ITEM 8) from swinging in to the left to swinging in to the right.

By:   
Jennifer Mannix, Contract Administrator

Total number of pages contained within this Addendum: 18

## SECTION 16231 PACKAGED ENGINE GENERATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and applicable sections of the Specifications apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes packaged diesel-engine generator sets with the following features and accessories:
  - 1. Air-intake silencer.
  - 2. Battery charger.
  - 3. Engine generator set.
  - 4. Muffler.
  - 5. Exhaust piping external to set.
  - 6. Starting battery.
  - 7. Automatic Load bank.
- B. Related Sections include the following:
  - 1. Division 16 Section 16415 "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generator sets.

#### 1.3 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

#### 1.4 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance. Include the following:

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1. Dimensioned outline plan and elevation Drawings of engine generator set and other components specified.
  2. Thermal damage curve for generator.
  3. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Design Calculations: Signed and sealed by a qualified professional engineer registered in Alaska. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  2. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
  3. Wiring Diagrams: Detail wiring for power and control connections and differentiate between factory-installed and field-installed wiring.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test and Observation Reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements.
- E. Certified summary of prototype-unit test report.
- F. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- G. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.
- H. Factory Test Reports: For units to be shipped for this Project, showing evidence of compliance with specified requirements.
- I. Exhaust Emissions Test Report: To show compliance with applicable regulations.
- J. Sound measurement test report.
- K. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.
- L. Field test report of tests specified in Part 3.
- M. Maintenance Data: For each packaged engine generator and accessories to include in maintenance manuals specified in Division 1. Include the following:
1. List of tools and replacement items recommended to be stored at the Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
  2. Detail operating instructions for both normal and abnormal conditions.

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### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.
- B. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- C. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NFPA 70.
- F. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

### 1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive OWNER of other rights OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### 1.8 MAINTENANCE SERVICE

- A. Maintenance: At Substantial Completion, begin 12 months' full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper, starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as

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required for proper operation. Maintenance agreements shall include parts and supplies as used in the manufacture and installation of original equipment.

### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every ten of each type and rating, but not less than one of each.
  - 2. Indicator Lamps: Two for every six of each type used, but not less than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the WORK include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar, Inc.; Engine Div.
  - 2. Kohler Co; Generator Division.
  - 3. Onan Corp; Industrial Business Group.

### 2.2 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: Three phase, four wire.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- E. Resistance to Seismic Forces: Supports for internal and external components, and fastenings for batteries, wiring, and piping are designed and constructed to withstand static or anticipated seismic forces, or both, in any direction. For each item, use a minimum force value equal to weight of item.

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- F. Limiting dimensions indicated for system components are not exceeded. The other equipment in the building may not fit if the generator is larger than shown on the drawings. The CONTRACTOR is responsible for all project costs associated with providing a generator with different dimensions.
- G. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- H. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.
- I. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.

### 2.3 GENERATOR-SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- H. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

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- I. Start Time: Comply with NFPA 110, Type 10, system requirements.

### 2.4 SERVICE CONDITIONS

- A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: 5 to 40 deg C.
  - 2. Relative Humidity: 0 to 95 percent.
  - 3. Altitude: Sea level to 1000 feet (300 m).

### 2.5 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF-2.
- C. Rated Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- E. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
  - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  - 2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
  - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
- F. Engine Fuel System: Comply with NFPA 37. System includes the following:
  - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  - 2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- G. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.

### 2.6 GOVERNOR

- A. Type: Electronic governor providing isochronous frequency regulation.



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### 2.7 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and petcock.
- E. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- F. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
  - 1. Rating: 50-psig (345-kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and noncollapsible under vacuum.
  - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- G. Provide a coolant heater.

### 2.8 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30 and NFPA 37.
- B. Base-Mounted Fuel Oil Tank: Factory-installed and -piped, listed and labeled fuel oil tank. Features include the following:
  - 1. Tank level indicator in tank.
  - 2. Capacity: Fuel for twenty four hours' continuous operation at 100 percent rated power output.
  - 3. Fill cap.
  - 4. Containment Provisions: Provide with dual wall.
  - 5. Tank shall be isolated from generator vibration.
  - 6. Provide vent piping of black iron pipe with rust inhibiting paint. Provide a vent for the fuel tank to the outside of the building under the roof. See Drawings.

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### 2.9 ENGINE EXHAUST SYSTEM

- A. Muffler: Industrial type, sized as recommended by engine manufacturer. Measured sound level in the 20- to 75-Hz frequency band at a distance of 25 feet (8 m) from exhaust discharge, is 87 dBA or less.
- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.
- E. Insulation for Mufflers and Indoor Exhaust Piping: Rigid Calcium Silicate with sheet metal covering. Cover both exhaust pipe and muffler.
- F. Supports for Muffler and Exhaust Piping: Spring hangers and all-thread rods and vibration hangers attached to building structure.
- G. Exhaust Piping External to Engine: ASTM A 53, Schedule 40, welded, black steel, with welded joints and fittings.
- H. Provide a welded steel thimble to isolate the exhaust pipe from the building wall. See drawings. Paint thimble with anti-rust paint.

### 2.10 COMBUSTION-AIR-INTAKE SYSTEM

- A. Air-Intake Silencer: Filter type provides filtration as recommended by engine manufacturer.
  - 1. Sound level emanating from air intake measured at a distance of 25 feet (8 m) is 54 dBA or less in 1200- to 4800-Hz frequency band and 56 dBA or less in 4800- to 10,000-Hz frequency band.
  - 2. Mounting: Factory installed on engine generator set at a location readily accessible for service.

### 2.11 STARTING SYSTEM

- A. Description: 12-V electric, with negative ground and including the following items:
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: 60 seconds.

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4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
  - a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
  - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
  - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

### 2.12 CONTROL AND MONITORING

- A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in the automatic-transfer switch initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set. In the automatic mode, the generator shall have an adjustable cooldown cycle that is initiated when the remote control contacts in the transfer switch open. The automatic load bank shall start and add load to the generator's load after the generator has been running an adjustable period of time initially set at three minutes. The automatic load bank shall remove it's load from the generator's load during the generator's cooldown cycle. Provide three customer configurable relays to

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connect and disconnect the automatic load bank's load from the generator. One of the relays shall be a spare for other functions.

- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: Include the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch(es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. H – O - A switch.
  - 11. Overspeed shutdown device.
  - 12. Coolant high-temperature shutdown device.
  - 13. Coolant low-level shutdown device.
  - 14. Oil low-pressure shutdown device.
  - 15. Fuel tank high-level shutdown of fuel supply alarm.
  - 16. Generator overload.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- E. Common Remote Strobe Light: Signal the occurrence of any events listed below without differentiating between event types. Locate weather proof strobe on the exterior wall of the building. Add an integral, audible alarm to the control panel of the generator.
  - 1. Engine high-temperature shutdown.
  - 2. Lube-oil low-pressure shutdown.
  - 3. Overspeed shutdown.
  - 4. Engine high-temperature prealarm.
  - 5. Lube-oil low-pressure prealarm.
  - 6. Fuel tank low level.
  - 7. Overcrank shutdown.
  - 8. Coolant low-temperature alarm.
  - 9. Control switch not in auto position.
  - 10. Battery-charger malfunction alarm.
  - 11. Battery low-voltage alarm.

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### 2.13 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator rating.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Adjacent to or integrated with control and monitoring panel.

### 2.14 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Drip-proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output- voltage operating band.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Subtransient Reactance: 12 percent, maximum.

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### 2.15 ELECTRIC MOTORS

- A. Comply with Division 15 Section "Motors."

### 2.16 LOAD BANK

- A. Description: Permanent, indoor, radiator mounted, forced-air-cooled, resistive unit capable of providing a balanced three-phase, delta-connected load to generator set at 35 KW, at unity power factor. Unit shall be capable of selective control of load in 5 KW percent steps.
- B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements are double insulated and designed for repetitive on-off cycling. Elements are mounted in removable aluminized-steel heater cases.
- C. Load-Bank Heat Dissipation: Airflow and coil operating current are such that, at maximum load, with ambient temperature at the upper end of the specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of the resistance wire. The unit shall be designed to operate using the exhaust generator cooling air from the radiator. The load bank shall be mounted on the radiator with double angle flanges and shall be mounted to the exhaust air cooling duct. Provide a fan only if the load bank will not have sufficient cooling air from the radiator. Coordinate with genset manufacturer as necessary.
- D. Load Element Switching: Contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors are located in a separate enclosures mounted on each side of load bank frame with other controls.
- E. Load-Bank Enclosures: NEMA 250, Type 1, complying with NEMA ICS 6.
- F. Protective Devices: Power input circuits to load banks are fused, and fuses are selected to coordinate with generator circuit breaker. Fuse blocks are located in contactor enclosure. Cooling airflow and overtemperature sensors automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors disconnect load power, control, and heater circuits. Fan motor is separately protected by overload and short-circuit devices. Short-circuit devices are noninterchangeable fuses with 60,000-A interrupting capacity.
- G. Control Panel: Mounted to side of load bank frame, the control panel shall house contactors, control switches, a programmable logic controller, pilot lights, and all other controls needed to operate the load bank in both automatic and manual modes. Includes a control power switch and pilot light, and switches controlling groups of load elements both manually and automatically. The load bank shall have remote current transformers and other hardware to allow the load bank to provide automatic load leveling. The current transformers shall be mounted on the load side of the automatic transfer switch (ATS) within the ATS enclosure. Provide all conduit, wiring, controls and other WORK as required to operate the load bank as described.

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### 2.17 FINISHES

- A. Indoor Enclosures and Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

### 2.18 SOURCE QUALITY CONTROL

- A. Factory Tests: Include prototype testing.
- B. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 1. Generator Tests: Comply with IEEE 115.
  - 2. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.
- C. Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Perform tests at rated load and power factor. Include the following tests.
  - 1. Full load run.
  - 2. Maximum power.
  - 3. Voltage regulation.
  - 4. Transient and steady-state governing.
  - 5. Single-step load pickup.
  - 6. Safety shutdown.
- D. Observation of Factory Tests: Provide 14 days' advance notice of tests and opportunity for observation of test by OWNER's representatives.
- E. Report factory test results within 10 days of completion of test.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

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- B. Examine roughing-in of cooling-system piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

### 3.2 INSTALLATION

- A. Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with codes for optional standby power systems.
- B. Set packaged engine generator set on concrete floor.
  - 1. Install generator-set on isolation mounting spring sets with rubber pads underneath the spring sets. Provide four minimum spring sets, two on each side. Size each spring set to carry the percentage of the dead load and live load as recommended by the genset and spring manufacturers.
- C. Install packaged engine generator to provide access for periodic maintenance, including removal of drivers and accessories.
- D. Install cooling-system piping, accessories, hangers and supports, and anchors for complete installation.
  - 1. Extend drain piping from heat exchangers to point of disposition outside of building.
- E. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Size piping according to manufacturer's written instructions.
- F. Install condensate drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system and from muffler to condensate traps and to point of disposition outside of building.
- G. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
  - 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 16 Sections. Proceed with equipment startup only after wiring installation is satisfactory.

### 3.3 CONNECTIONS

- A. Piping installation requirements are as required by the genset and equipment manufacturers and common trade practices. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
  - 1. Install piping adjacent to packaged engine generator to allow service and maintenance.



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- B. Electrical wiring and connections are specified in Division 16 Sections.
- C. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 IDENTIFICATION

- A. Identify system components according to Division 16 Section 16050 "Basic Electrical Materials and Methods."

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.
- B. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.
- C. Tests: Include the following:
  - 1. Tests recommended by manufacturer.
  - 2. Perform tests required by code for optional standby generators that are additional to those specified here including, but not limited to, the following:
    - a. Single-step full-load pickup test.
    - b. Simulated utility outage via opening service disconnect.
    - c. Varying the load and verifying proper operation of automatic load bank load leveling feature maintaining a 35 KW load on generator.
  - 3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's Specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  - 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

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8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- F. Coordinate tests with tests for transfer switches and run them concurrently.
- G. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- H. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- I. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

### 3.6 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

### 3.7 CLEANING

- A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
  1. Coordinate this training with that for transfer switches.
  2. Train OWNER's maintenance personnel on procedures and schedules for starting and stopping, using all features and functions of the equipment, and troubleshooting, servicing, and maintaining equipment.
  3. Review data in maintenance manuals.
  4. Schedule training with OWNER, through ENGINEER, with at least seven days' advance notice.
  5. Minimum Instruction Period: Eight hours.

**END OF SECTION**