TOWN OF HEBRON

EMERGENCY ELECTRIC GENERATOR UPGRADE PROJECT

Pre-Purchase

EMERGENCY ELECTRIC GENERATOR

ADDENDUM NO. 1

JUNE 25, 2025

Each Respondent must acknowledge receipt of this Addendum by inserting its number within the Bid Form submission. Failure to do so may result in the Respondent's disqualification.

<u>This Addendum consists of one (1) page</u>.

1. **Specifications:**

a. Addition of Section 006000-Statement of Manufacturer's Vendors Qualifications Dated June 25, 2025**. This document must be completed and submitted as part of your Bid submission**. 2 Pages

b. Revision to Section P263213-Pre-Purchase Engine Generators-Dated June 25, 2025 25 Pages

2. **Van Zelm Addendum**:

a. Addendum No. 1-Dated June 25, 2025 1 Page

END OF ADDENDUM NO. 1

Provide a list of all Emergency Electrical Generators installed in the State of Connecticut with a size of 750 kW or greater completed within a minimum in the past three (3) years but no more than five (5) years for the Town of Hebron's references:

Project (Name & Address)	Owner (Name & Address)	Contact Phone Number	Size of Generator

Confirm that your firm can meet the servicing requirements of the RHAM Middle and High School such as reasonable distance away from the campus, expeditious turnaround time for emergency service, etc.

Please indicate the exact location of your local service branch.

Please indicate the current lead time for the manufacturing of the Emergency Electric Generator after approval of shop drawings.

State of:)

) ss:

County of:)

being duly sworn deposes and says
that his/her of
and that answers to the foregoing questions and all statements therein contained are true and correct.

Sworn to before me this_____day of_____20 _____

Notary Public:

-

My Commission Expires:

END OF SECTION

VAN ZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
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Connecticut | Massachusetts | North Carolina

ADDENDUM #1

Issue Date: **June 25, 2025**

Project Name: EMERGENCY ELECTRICAL GENERATOR SYSTEM
RHAM MIDDLE & HIGH SCHOOLS
PRE PURCHASE EMERGENCY ELECTRIC GENERATOR

Project No.: 2023159.00

GENERAL:

Modifications described herein as Addendum items supersede specific parts of the Contract Documents for the above-named project. All bids and the construction contract shall be based on the inclusion of these modifications.

REVISIONS TO PROJECT MANUAL

ITEM 1: In Section #P263213, PRE PURCHASE ENGINE GENERATORS, **REPLACE** Section dated "*REVISED May 21, 2025*" in its entirety with attached Section #P263213, PRE PURCHASE ENGINE GENERATORS dated "***REVISED June 25, 2025***".

ITEM 2: Portions not related to the pre purchase have been deleted, replacements and/or clarifications are shown ***bold/italicized***

END OF ADDENDUM

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SECTION P263213 – PRE PURCHASE ENGINE GENERATORS

PART 1 - GENERAL

1.1 REFERENCES

A. This Section covers the specification of Packaged Engine Generators. Section – COMMON WORK RESULTS FOR ELECTRICAL WORK, GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, applicable Sections of DIVISION 1, and all other project instructions for other requirements.

1.2 SCOPE

A. Provide labor, materials, services, equipment and transportation necessary for complete and operational electrical generation systems as indicated on Contract Drawings and specified herein, including, but not limited to the following:

1. Engine generator set
2. Unit mounted cooling system
3. Unit-mounted and remote-mounted control and monitoring
4. Performance requirements for sensitive loads
5. Fuel system, including sub-base fuel tank.
6. Load Management System
7. Starting battery
8. Battery charger
9. Silencer/exhaust system
10. Remote annunciators
11. Remote stop switch
12. Outdoor Enclosure

B. The engine generator will be pre-purchased by the Owner and assigned to the contractor.

C. The prepurchase shall include:

1. Processing of submittals.
2. ***Coordination of*** all required work ***for start-up***.
3. Assist in field start-up and testing.

1.3 DEFINITIONS

A. 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.

B. 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 the following:

B. Specifications Compliance: A complete copy of this generator specification with each subparagraph noted with the comment, “compliance”, “deviation”, or “alternate”. In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

1. By noting the term “compliance”, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
2. By noting the term “deviation”, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
3. By noting the term “alternate”, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
4. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
5. Include thermal damage curve for generator.
6. Include time-current characteristic curves for generator protective device.
7. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
8. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
9. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
10. Include generator characteristics, including, but not limited to kw rating, efficiency, reactance, and short-circuit current capability.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Detailed, dimensioned plan, elevations and sections for outdoor enclosure. Include sound attenuation data.
3. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
4. 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.
5. Wiring Diagrams: Power, signal, and control wiring.

D. Welding certificates.

E. Manufacturer Seismic Qualification Certification: Submit certification that sub-base tank engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined as Seismic Design Category D. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Submit Qualification Data for testing agency; including a sample of a representative Field Quality Control Test Report.

G. Certified summary of prototype-unit test report.

H. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

I. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.

J. Test Reports:

1. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
2. Report of sound generation.
3. Report of exhaust emissions showing compliance with applicable regulations.

4. Field quality-control test reports.

K. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

L. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 and Division 26 , 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.

M. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

F. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX for welding exhaust system piping.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. Comply with NFPA 37.

I. Comply with NFPA 70.

J. Comply with NFPA 99.

K. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver engine generator set and system components to ***the off-site rigger's/storage facility*** 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. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

2. All warranty work shall include all parts and labor for the duration of warranty period and shall include provision of temporary generator for the duration of the repair at no additional cost to the Owner.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of 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 required for proper operation. Maintenance agreements shall include parts and supplies as used in 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 10 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. Generators:
   a. Caterpillar; Engine Div.
   b. Generac Power Systems, Inc.
   c. Kohler Co; Generator Division.
   d. Cummins Power Generation; Industrial Business Group.
   e. MTU.

2. The Basis of Design is Caterpillar C32-D1250-GC.

2.2 ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. EPSS Class: Engine-generator set shall be classified as a Class 48 in accordance with NFPA 110.

D. Induction Method: Turbocharged.

E. Governor: Adjustable isochronous, with speed sensing.

F. Emissions: Comply with EPA Tier requirements.

G. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

H. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

2.3 ENGINE-GENERATOR SET

A. Packaged engine-generator set shall be a coordinated assembly of compatible components.

B. Power Output Ratings: Nominal ratings of 1,250 kW with capacity as required to operate as a unit as evidenced by records of prototype testing.

C. Output Connections: Three-phase, four wire.

D. Safety Standard: Comply with ASME B15.1.

E. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

F. UL Compliance: Comply with UL 2200.

G. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of componant.

H. Fabricate engine-generator-set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.

I. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

2.4 GENERATOR-SET PERFORMANCE

A. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

1. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

B. Steady-State Voltage Operational Bandwidth: 2 percent of rated output voltage from no load to full load.

C. Steady-State Voltage Modulation Frequency: Less than 1 Hz.

D. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.

E. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.

F. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

G. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.

H. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

I. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.

J. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

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

2.5 SERVICE CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.6 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: 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: Control flow in system to maintain optimum oil temperature. Unit shall be 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, siphons, special tools, or appliances.

E. Engine Fuel System:

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.
3. Provide fuel cooler to maintain fuel temperature and viscosity during a long period (up to one week) of continuous operation at high load.
4. Provide fuel consumption meter to provide data on fuel consumed during any testing or actual power outage generator operation. The fuel data will be transmitted to the Facility Wide BMS system to aid in generator running data required by the State of Connecticut DEEP.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity: minimum 1500 Watt.

G. Pipe crankcase ventilation fumes directly into engine intake to burn them and reduce unwanted emissions.

H. Emissions: Engine must be certified to meet the EPA Emissions Limits Alternate Standard for Stationary Emergency Generator Sets.

2.7 ENGINE COOLING SYSTEM

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame 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 rated to withstand maximum closed-loop coolant system pressure for engine used. Equip 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 maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.

2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Coolant piping external to engine-generator set. Use ASTM B 88, Type L (ASTM B 88M, Type B) copper tubing with brazed joints, sized as recommended by engine manufacturer. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation and joint construction.

2.8 FUEL SUPPLY SYSTEM

A. Comply with NFPA 30.

B. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Fuel for 48 hours continuous operation at 100% rated power output of generator without refueling. Minimum 133 percent of total fuel required.
3. Leak detection in interstitial space, indicated on generator control panel and remote annunciator.
4. Vandal-resistant fill cap.
5. Containment Provisions: Minimum 110% of tank capacity, double wall EPA rupture basin.
6. Fuel tank can be up to 48" high and up to 376" long to provide required fuel amount.

2.9 ENGINE EXHAUST SYSTEM

A. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 7 meters from exhaust discharge after installation is complete shall be 78.8 dBA or less.

B. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe, minimum 18" length from exhaust outlet to muffler with flanged pipe connections.

C. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liner.

D. Exhaust Piping External to Engine: ASTM A 53/A 53M, Schedule 40, welded, black steel, with welded joints and fittings.

2.10 COMBUSTION-AIR INTAKE

A. Description: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

2.11 STARTING SYSTEM

A. Description: 24-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.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 60 seconds.
4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize 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: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either

condition shall close 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. Provide a fully solid-state, microprocessor based, generator set mounted control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.

B. The controller shall also include logic to automatically provide load management. If the load exceed a maximum preset level, the controller shall initiate load shed by closing a contact to signal the existing BMS to immediately shut down one of the existing chillers and its auxiliary equipment. The maximum preset level shall be 1250kW. Provide a total of two (2) load shed output contacts.

1. The controller shall provide Monitoring Software with the following functionality
   a. Provide access to all data and events on generator set communications network and transmit all, including sub-base fuel levels and fuel consumption to the High School BMS.
   b. Provide interface adapters to convert the generator's data protocol to be compatible with the High School BMS. The generator supplier shall also include software package(s) that will allow all available status points of the generator to be programmed, read, and recorded. The generator data interface shall be a read only interface.
   c. Ability to communicate via Modbus TCP, Modbus RTU or remote modem.
   d. The integrity of the generator remote start circuit(s) shall be continuously monitored for broken, disconnected, or shorted wires.
      1) Loss of integrity of the remote start circuit(s) shall initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and start the generator(s).

C. Functional Description: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of the generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of the same switch initiates generator-set shutdown. When 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.

D. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

E. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

F. Comply with UL 508A.

G. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

H. Indicating and protective devices and controls shall include those required by NFPA 110 for a Level 1 system, and the following:

I. Indicating and Protective Devices and Controls:

1. AC voltmeter: dual scale, 0-600V, 2% accuracy, 2-1/2" diameter.
2. AC ammeter: dual scale, 2% accuracy, 2-1/2" diameter.
3. AC frequency meter: dial type.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Engine lube oil temperature.
8. Running-time meter.
   a. Transmit running-time meter data to the system wide BMS system to aid in providing generator operating data required by the State DEEP.
9. Ammeter-voltmeter, phase-selector switch(es).
10. Generator-voltage adjusting rheostat.
11. Upper and lower meter scale indicator lights.
12. Auto/Off/Test switch. Test mode shall automatically start unit without interrupting normal electrical supply.
13. Overspeed shutdown device with LED status indicator which lights when overspeed condition has occurred as cause of shutdown.
14. Coolant high-temperature shutdown device with LED status indicator which lights when pre-alarm operating temperature has been reached and stays lit when shutdown occurs.
15. Coolant low-level shutdown device with LED status indicator which lights when low coolant level causes shutdown.
16. Oil low-pressure shutdown device with LED status indicator which lights when pre-alarm oil pressure condition has been reached and stays lit when shutdown occurs.
17. Overcrank shutdown device with LED status indicator which indicates engine has failed to start after 60 second cranking period.
18. Lamp test switch and audible alarm with silencer switch.
19. Low coolant temperature alarm with LED status indicator which indicates failure of block heater.
20. LED status indicator for "switch off", which indicates when control switch has been placed in "off" position.
21. LED status indicator for "system ready", indicating no malfunctions detected.
22. Fuel tank derangement alarm.
23. Fuel tank high-level shutdown of fuel supply alarm.

24. Generator overload.
25. Start-stop switch.
26. Overspeed shutdown device.
27. Coolant high-temperature shutdown device.
28. Coolant low-level shutdown device.
29. Oil low-pressure shutdown device.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

K. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered elsewhere in Division 26.

L. 12 Volt remote annunciator panel: Provide two remote annunciator panels. Install one in the High School Main Electrical Room and one in the Middle Schol Main Electrical Room. Panels shall include lights, audible alarm, alarm switch and lamp test switch, in accordance with NFPA 110, Level 1, to monitor the following conditions:

1. Line power.
2. Generator power.
3. System ready (in auto position).
4. Alarm switch off.
5. Generator switch off.
6. Emergency stop.
7. Engine high-temperature shutdown.
8. Lube-oil low-pressure shutdown.
9. Overspeed shutdown.
10. Remote emergency-stop shutdown.
11. Engine high-temperature prealarm.
12. Lube-oil low-pressure prealarm.
13. Fuel tank, low-fuel level.
14. Low coolant level.
15. Overcrank shutdown.
16. Coolant low-temperature alarm.
17. Control switch not in auto position.
18. Battery-charger malfunction alarm.
19. Battery low-voltage alarm.
20. Battery high voltage alarm.

M. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LED shall identify each alarm event. Common audible signal shall sound for alarm conditions. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

N. Enclosure Exterior Remote Emergency Stop Switch: Mounted on exterior of generator enclosure. Glass break type switch within weatherproof enclosure.

2.13 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. General

1. Acceptance of generator overcurrent protective devices will be contingent upon achievement of selective coordination of system including but not limited to elevators per NEC Article 620; Emergency Systems per NEC Article 700 and legally required Standby Systems and components per NEC Article 701.
2. Provide an energy-reducing maintenance switch with local status indicator for all breakers rated 1200 Amp or higher or that can be adjusted to 1200 Amp or higher.

    a. The maintenance switch shall override the coordinated trip settings that may cause a delay in breaker opening during a fault condition while service is being performed on the breaker or distribution sections of the switchboard. The resulting faster breaker opening time will lower the potential arc flash energy available.
    b. Provide alternate means to reduce clearing time and provide arc energy reduction.

        1) Zone selective interlocking.
        2) Differential delaying.
        3) Energy reducing active arc flash mitigation system.

B. The 800 Ampere and 125 Ampere Generator Circuit Breakers: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489; Sq. D. PowerPact family or equal by ABB or Eaton as a minimum. These breakers must be capable of providing WCR/closing rating of the existing ATS's of a minimum of 50,000 RMS symmetrical amperes; SQD Type MH or PJ.

1. Tripping Characteristics: Adjustable long-time pickup and delay, short-time pickup and delay, instantaneous and ground fault pickup INDICATION ONLY if 1,000 amperes or above at 480/277 volts. Instantaneous must have high setting (15 times LTPU) or the capability to be turned off.
2. Trip Settings: Matched to generator thermal damage curve.
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.

C. 2000 Ampere and 1200 Ampere Generator Circuit Breakers: Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time pickup and delay, short-time pickup and delay, instantaneous and ground fault pickup INDICATION ONLY if 1,000 amperes or above at 480/277 volts. Instantaneous must have high setting (15 times LTPU) or the capability to be turned off. Breakers shall include energy reduction.
2. Trip Settings: Matched to generator thermal damage curve as closely as possible.

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.

D. The 125A and 1200A circuit breakers shall be provided in Nema 3R enclosures for exterior mounting in the field.

E. Generator Protector: Microprocessor-based unit that continuously monitors current level in each phase of generator output, integrates generator heating effect over time, and predicts when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.
3. As the overcurrent heating effect on the generator approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

F. Ground-Fault Indication: Comply with NFPA 70, Article 700.7(D). Integrate ground-fault alarm indication with other generator-set alarm indications.

G. Provide generator OPD with one N.C. and one N.O. contact indicating breaker status. This status indication shall signal an alarm to the remote annunciator panel to indicate a “Generator Output Breaker Open” alarm. The remote annunciator panel shall be equipped with a single summary alarm wired to the building BMS system indicating a “Generator Trouble” alarm.

2.14 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and specified performance requirements.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent 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 shall use no slip or collector rings, or brushes, and shall be 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 shall provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Provide with under-frequency protection and moisture-resistive protection.
3. Regulation shall be within +/-2% of rated voltage from no load to full load.
4. On application of rated load at rated power factor, instantaneous voltage dip shall NOT exceed 20%, with recovery within one second.

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.

M. Provide Permanent Magnet Generator (PMG) system.

N. Alternator shall be self-ventilated, one-piece cast aluminum alloy, uni-directional internal fan shall provide high volume, low noise air delivery with broad range, 12-lead reconnectable, four pole rotating field unit.

O. Temperature rise shall be within NEMA MG1-22.40, IEEE and ANSI Standards for standby duty at rated output.

P. Provide front-end mounted junction box for load connections. Junction box shall have space to mount regulator and voltage adjust rheostat inside box and to relocate same to opposite side without unit modification.

2.15 OUTDOOR GENERATOR-SET ENCLOSURE – SKIN TIGHT TYPE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance including rear-hinged control panel door. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

1. Provide locking hasps (keyed alike) on engine side panels and control door.
2. Hinged Doors: With padlocking provisions.
3. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
4. Muffler Location: Within enclosure.
5. Enclosure Panelboard: NEMA 3R panel external to enclosure, serving lights, receptacles, heaters, controls, battery charger and devices within enclosure. All electrical components and devices served by the enclosure panelboard shall be factory prewired and field wired to this panelboard. Enclosure panelboard may only serve equipment that serves the EPSS within the generator enclosure.
6. Sound level of 79 dBA at 25 feet (minimum 25 DB attenuation) or level to comply with local requirements at the property line, whichever is more restrictive.
7. Enclosure can be up to 376” long x 122” wide x 198” high, including generator, silcer and fuel tank.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

C. Interior Lights with Switch: Factory-wired, vapor-proof type fixtures within housing; arranged to illuminate controls and accessible interior.

D. Generator Access Platform: Prefabricated Code compliant heavy duty working platform along both sides of generator. Platform to include:

1. 48” wide steel frames (or larger to accommodate door swing) with 1” aluminum bar grate platform with OSHA compliant railings minimum of 42” high with posts top and mid railing of 1-1/2” schedule 40 pipe.
2. Leg height to set platform at base of enclosure, above fuel tank.
3. Final dimensions of platform to be based on dimensions of approved generator and sub-base fuel tank.
4. Stair system shall be designed for installation outdoors, with 1” aluminum bar grate in accordance with U.S. OSHA Standard for Fixed Industrial Stairs, 29 CFR 1910.24.
5. Guard and handrails shall be painted safety yellow.

2.16 FINISHES

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

2.17 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 energy converters.
2. Generator Tests: Comply with IEEE 115.
3. Test Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.
4. Test generator, exciter and voltage regulator as a unit.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. 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.
7. Observation of Factory Tests: Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

C. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect**,** test and adjust field-assembled components and equipment installation, including connections, and to complete in field testing. Report results in writing.

B. The factory-authorized service representative shall perform the following field tests and inspections and prepare test reports: Furnish required materials, equipment and services to perform on-site tests, in presence of Architect and Owner, to demonstrate system operation. Correct defects and re-test system until proper operation is guaranteed. Materials and equipment shall include: temporary power and wiring; temporary cooling; 480 Volt, 1500 KW, infinitely variable, outdoor load bank and operator; monitoring devices; etc.

1. Perform each electrical test and visual and mechanical inspection according to current Edition of ANSI/NETA Standards for Acceptance Testing as outlined in Section 7 (except for vibration baseline test). Certify compliance with test parameters. Tests shall

be conducted by applying load (via load bank) to load side of automatic transfer switch or to other load point acceptable to Engineer. Test shall include a minimum of four hours operating at 100% rated load.

2. Perform tests recommended by manufacturer.
3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:

    a. Single-step full-load pickup test.

4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. 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.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
6. 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. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
8. Exhaust Emissions Test: Comply with applicable government test criteria.
9. 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.
10. 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.
11. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently. There are multiple transfer switches in the two buildings that must be individually tested to confirm any one of these transfer switches will start the generator and provide generator power to the load.

    1. Test each transfer switch operation by opening its normal power feeder breaker.

D. Load Management Operation: Demonstrate proper operation of the Load Management system.

1. Engage the 2000 Ampere Automatic Transfer switch to start the generator and transfer to generator power.
2. Increase the load via Loadbank to 1250kW and confirm the BMS signals one of the chillers to shutdown.
3. Lower the load via Loadbanks to less than 1250kW and confirm the BMS signals the chiller to restart.

E. 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.

F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and retest as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. 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.

L. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels, so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.2 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. Complete installation and startup checks according to manufacturer's written instructions.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 1.

1. Coordinate this training with that for transfer switches.

END OF SECTION 263213