The City of Troy is accepting bids for two (2) stand by generators to be located at an existing City owned waste water lift stations. (Meadowlark & Fair Oaks)

Complete specifications for each generator may be picked up at Troy City Hall, 116 E. Market St., Troy, IL 62294 by contacting the Administration office at 618-667-9924 Ext 1 or by visiting our website at www.troyil.us.

Bids must be returned to Troy City Hall, 116 E. Market St., Troy, IL 62294 on or before the bid opening date of Monday, July 24, 2017 @ 10:00 a.m.

116 East Market • Troy, IL 62294-1599
Mayor Allen P. Adomite, Administration: 618/667/6741 • Fax: 618/667/4009
Public Works Dept: 618/667/9924 • Building & Zoning Dept: 618/667/8734
Website: www.troyil.us

SECTION 26 32 13 – ENGINE GENERATOR

PART 1 - GENERAL

1.1 SUMMARY

A. **Section includes packaged engine-generator sets for emergency power supply that has been factory built, production-tested, and site-tested with all accessories necessary for a complete installation with the following features:**

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Performance requirements for sensitive loads.
5. Fuel system.
6. Outdoor enclosure.
7. Installation within 40' of the existing meter and control cabinet.

1.2 SYSTEM DESCRIPTION

A. Generator System:

1. Liquid cooled diesel engine directly coupled to an AC generator, complete with all connections, auxiliary equipment, and safety devices for an operating system.

2. When the normal electrical supply fails, the generator shall automatically start and accept load within 10 seconds.

   a. The Automatic Transfer Switch shall initiate a signal to the generator upon losss of utility power.
   b. When the generator system is running and providing specified voltage and frequency, the Transfer Switch shall transfer the load to the generator system.

3. Upon restoration of te Normal (Utility) electrical power supply, the Transfer Switch shall, after specified time delays:

   a. Transfer load back to the normal power supply.
   b. Signal the generator system to stop.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor and rated load. Testing shall be performed per ISO3046 standards. Provide drawings

showing requirements and limitations for location of air intake and exhausts.

7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, andshort-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, center of gravity of full assembly, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For, manufacturer.

1. Statement of quality from manufacturer detailing acceptance as an ISO9001 manufacturer.

B. Seismic Qualification Certificates: For engine-generator set, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails identify center of gravity and total weight, supplied enclosure, external silencer, and each piece of equipment not integral to the engine-generator set, 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.

C. Source quality-control reports, including, but not limited to the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control reports.

E. Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. List of tools and replacement items recommended to be stored at Project for ready access.
2. Include part and drawing numbers, current unit prices, and source of supply.
3. Operating instructions laminated and mounted adjacent to generator location.
4. Training plan.

1.6 MAINTENANCE MATERIAL

A. Furnish extra materials 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 no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer accepted as an ISO9001 manufacturer.

1. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as described in the field and shown in the specifications herein.

2. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

3. The equipment shall be supported by a local distributor who has had local facilities for at least 5 years and who maintains a local service organization available twenty-four hours a day 365 days of the year.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved by manufacturer.

C. Third-Party Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: 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: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide diesel generator set for emergency applications:

1. one 30kW 240/120V, 60 hz Installation at Meadowlark Lift Station
2. one 30kW 240/120V, 60 hz Installation at Fair Oaks Lift Station

B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer. Generator set shall be standard offering from manufacturer. No special ratings will be permitted. Preapproved manufacturers include:

1. Caterpillar
2. Cummins
3. Kohler

C. Engineering changes resulting from the substitution of another product will be the responsibility of the electrical contractor.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Engine-generator set housing, day fuel tank, engine-generator set, batteries, battery racks, silencers, and sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to IBC 2012 and ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst case normal levels.
3. Component Importance Factor: 1.5.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 110 Type 10 requirements for Level 1 emergency power supply system.

C. UL Compliance: Comply with UL 2200/CSA.

D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

E. Noise Emission: Comply with applicable state and local government requirements 72dBa at 7 meters for maximum noise level due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. 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 50 deg C for diesel-fired and bifuel.

2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.4 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 2 in accordance with NFPA 110.

D. Governor: Adjustable isochronous, with speed sensing.

E. Emissions: Comply with EPA Tier 3 and local requirements for standby generation.

F. 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.

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.

G. 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.
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. Nameplate shall be in accordance with NFPA70.

H. Generator-Set Performance:

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

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

2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. 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.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. 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.

6. Transient Frequency Performance: Less than 5-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, 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.
9. Block Load Performance: per NFPA110, the unit shall be able to fully recover from a 100% block load.
10. Excitation System: Performance shall be unaffected by 10% total voltage distortion (THD) caused by nonlinear load.

    a. Provide permanent magnet excitation (PMG) for power source to voltage regulator.

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

2.5 ENGINE

A. Fuel: Diesel Fuel oil, Grade DF-2, Ultra Low Sulfur.

1. ASTM D 975 or ASTM D 396 for Ultra Lower Sulfur Diesel.
2. Biodiesel fuel is not recommended.

B. Engine Rating: Prime mover shall have adequate horsepower to meet the specified kW at the specified site altitude and temperatures. Products that de-rate below specified kW for temperature or altitude shall not be accepted.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Per manufacturer recommendations.
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. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Cooling System Sizing: Sized to adequately cool the generator set, including aftercooler, without de-rate to an ambient temperature of 122 deg F (50 deg C) for diesel. Maximum external restriction shall be no greater than 0.5 inch (12.7 mm) of water column.
3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
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 engine manufacturer.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element.

H. Starting System:

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, certified to meet NFPA 110, with capacity within ambient temperature range specified in "Performance Requirements" 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 "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and continuous rating adequate for batteries provided.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 15 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 F (minus 40 deg C) to 140 deg F (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 with adequate

vibration isolation if mounted within the generator set.

g. Battery chargers mounted within the Automatic Transfer Switch are acceptable.

2.6 DIESEL FUEL-OIL SYSTEM

A. Base mounted fuel tank capable of 24-hours operation on full load.

B. Tank shall be double wall construction and provided with leak detection system in the interstitial space.

C. Tank shall be provided with a low fuel indication level within the tank.

D. Provide auxiliary set of contacts for supervision of leak detection system and low fuel indication.

E. Comply with NFPA 30.

F. Piping: Fuel-oil piping shall be Schedule 40 black steel.." Cast iron, aluminum, copper, and galvanizing shall not be used in the fuel-oil system.

G. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

H. Fuel Filtering: Primary fuel filter to remove water and contaminents lager than 10 micron. Secondary filter to remove contaminants larger than 2 micron.

I. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

1. Fuel Tank Capacity: Minimum 133 percent of total fuel required for low-fuel level sensor quantity or required for the indicated EPSS Class.

2.7 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: 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 generator set. When mode-selector switch is switched to the manual position, generator set starts. 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.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the manual 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.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages 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. Panel shall be powered from the engine-generator set battery.

1. Engine and generator control wiring shall be multi-stranded annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, diesel fuel, and antifreeze. Wiring shall be suitable for continuous use at 250 deg F (121 deg C) with insulation not brittle at minus 60 deg F (minus 51 deg C). Cables shall be enclosed in nylon flexible conduit, which is slotted to allow easy access and moisture to escape.

    a. Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator set controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements.
    b. For engines without ECM functionality or for any additional generator set controller monitoring, sensors are to be conditioned to a 4 to 20 ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.

2. Construction: All circuitry within the control panel shall be individually environmentally sealed to prevent corrosion. Encapsulated circuit boards with surface mounted components and sealed, automotive-style connectors for sensors and circuit board connectors. Enclosed circuit boards and terminal strips that are susceptible to corrosion are not acceptable.

3. Custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

F. Indicating Devices: As required by NFPA 110 for Level 1 system. All ECM fault codes shall be displayed at the generator set controller in standard language; fault code numbers are not acceptable. Utilizing a digital display, including the following:

1. AC voltage: True three-phase sensing.
2. AC current.
3. Frequency.
4. EPS supplying load indicator.
5. DC voltage (alternator battery charging).
6. Engine-coolant temperature.
7. Engine lubricating-oil pressure.
8. Running-time meter.
9. Current and Potential Transformers: Instrument accuracy class.

G. Protective Devices and Controls in Local Control Panel: All monitored alarms capable of 4-20MA dry contact for connection to monitoring/ alarm equipment (dialer or omni site). Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1system, including the following:

1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.
5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Overcrank alarm.
8. Overspeed alarm.
9. Coolant high-temperature alarm.
10. Coolant low-temperature alarm.
11. Coolant low-level alarm.

12. Low lube oil pressure alarm.
13. Lamp test.
14. Contacts for local and remote common alarm.
15. Coolant high-temperature prealarm.
16. Generator-voltage; digitally adjustable via controller, password protected.
17. Main fuel tank low-level alarm.

    a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.

18. Run-Off-Manual selector switch.
19. Control switch not in automatic position alarm.
20. Low cranking voltage alarm.
21. Battery-charger malfunction alarm.
22. Battery low-voltage alarm.
23. Battery high-voltage alarm.
24. Generator overcurrent protective device not closed alarm.

H. 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. Sensors are to be conditioned to a 4 to 20 mA signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosions.

I. Emergency-Stop Switch: Flush; mounted on the generator control panel within the generator hoursing, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

J. Maintenance:

1. All engine, voltage regulator, control panel, and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set controls:
   a. Engine running hours.
   b. Service maintenance interval (running hours, calendar days).
   c. Engine crank attempt counter.
   d. Engine successful starts counter.
   e. 20 events are stored in control panel memory.
   f. Control panel shall time and date stamp all alarms and warnings. A snap shot of key parameters shall be saved in the control panel for use in troubleshooting alarms.
   g. A predictive maintenance algorithm will determine the optimal time for maintenance service based on the generator loading and operation.

K. Programmable Cycle Timer: To start and run the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. The timer shall not require a software program. Each sequence shall have the following programmable set points:

1. Day of the week.
2. Time of the day start.
3. Duration of cycle.
4. Option to exercise at reduced speed for quiet test mode.

2.8 AUTOMATIC TRANSFER SWITCHES

A. Manufacturers:

1. Cummins
2. Caterpillar
3. Zenith

B. Description: NEMA ICS 2, automatic transfer switch.

C. Standard features:

1. Switch ampacity as indicated on one-line diagram, 4 pole switch, rated for 3 base, 4 wire, 60 Hertz.

   a. Service entrance rated
   b. Withstand rating of at least 32,000 amperes.
   c. Rated at 600 VAC for all classes of load.
   d. Bus bars: Silver-plated copper.
   e. Capable of closing on loads with inrush fault currents described in ANSI/ UL 1008.
   f. Switch shall not contain any integral overcurrent devices in the switching poles to avoid conflict with coordination scheme.
   g. Transfer Switch shall be open transfer.

D. Transfer switches shall also include:

1. Indicating Lights: Mount in cover of the enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSTION. Provide switch position indicating contacts.
2. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
3. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
4. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent of frequency varies more than 3 percent from rated nominal value.
5. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.
6. Transfer switch position shall be provided with one set of auxiliary contacts for supervision by the BAS.

E. Automatic Sequence of Operation.

1. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
2. Time Delay to Start Alternate Source Engine Generator 0 to 15 seconds, adjustable.
3. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
4. Time Delay Before Transfer to Alternate Power Source: 0 to 120 seconds, adjustable.
5. Before transfer to alternate power source initiate disconnect circuit to disconnect large motors for 15 seconds.
6. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
7. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.
8. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

9. Time Delay Before Engine Shut Down: 0 to 10 minutes, adjustable, of unloaded operation.
10. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.
11. Alternate System Exerciser: Transfer loads at each transfer switch to alternate source during engine exerciser period.

F. Enclosure

1. NEMA 3R Finish: Manufacturer's standard.

2.9 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel and each located in a separate box per NEC700 separation of circuits.

B. Generator Circuit Breaker: Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Each circuit breaker installed in separate box in accordance with NEC700 separation of circuits.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator 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 load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when 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. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, 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.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other generator-set alarm indications.
2. Trip generator protective device on ground fault.

2.10 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and UL2200, sized for 248 deg F (120 deg C) temperature rise above ambient at rated load.

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

C. Electrical Insulation: Class H.

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

E. Winding Coils: Skewed to improve sine wave shape and eliminate ripple effects caused by air gaps.

F. Range: Provide broad range of output voltage by adjusting the excitation level.

G. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rated speed, and heat during operation at 110 percent of rated capacity.

H. Enclosure: Dripproof.

I. Instrument Transformers: Mounted within generator enclosure.

J. Voltage Regulator: Solid-state type on a sealed circuit board, separate from exciter, providing performance as specified and as required by NFPA 110. Must be 3-phase sensing.

1. Voltage Adjustment on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Provide anti-hunt provision to stabilize voltage.

K. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

L. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

M. Subtransient Reactance: 15 percent, maximum.

N. Excitation: Permanent magnet (PMG) type providing 300 percent current output for up to 10 seconds to a downstream breaker selective coordination and improved motor starting.

2.11 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: OEM Factory manufactured, vandal-resistant, sound-attenuating, weatherproof aluminum housing, wind resistant up to 180 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panel shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

1. Structural Design and Anchorage: Comply with ASCE 7-10 for wind loads up to 180 mph (290 km/h).hghg
2. Seismic Design: Comply with seismic requirements accordomg to IBC 2012 and ASCE/SEI 7.
3. Hinged Doors:

a. Door Panels: With integral stiffeners, and capable of being removed by one person without tools.
b. Slip-pin hinges and latches stainless steel with nylon spacers.
c. Gasketed for weather and rodent protection.
d. Handles to have padlocking provisions.

4. 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.
5. Muffler Location: Within enclosure. All exhaust piping shall be wrapped for personnel protection and to eliminate excessive heat build up during generator operation.
6. Assembly Hardware (Nuts and Bolts): Use JS500 and nylon washers to prevent paint deterioration.

B. Sound Attenuation: Factory enclosure, designed to meet the following design criteria:

1. Sound Attenuated Level Two enclosure designed to meet 72 dB(A) @ 7m in a free field environment. Enclosure shall have intake and discharge hoods, as well as sound insulating foam panels within; designed to meet the acceptable sound level. Foam shall be UL listed for purpose and have a reflective coating allowing for better lighting within the enclosure.

C. 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.

D. Color. Green

2.12 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neopreneseparated by steel shims.
2. Minimum Deflection: 1 inch (25 mm).

2.13 FINISHES

A. Outdoor Enclosures and Components: Electrostatically applied finish over corrosion-resistant pretreatment and compatible primer.

B. Powdercoated paint surfaces, meeting the following applicable standards:

1. Paint Thickness: More than 2.5 mil per ASTM D 1186.87.
2. Material Hardness: ASTM D 3363-92a.
3. Resistance to Cracking: ASTM D 522-B.
4. Paint Adhesion: ASTM D 3359-B.
5. Resistance to Salt Water Corrosion: ASTM B 117 or ASTM D 1654.
6. Resistance to Humidity: ASTM D 1735 or ASTM D 1654.

7. Impact Resistance: ASTM 2784.
8. UV Protection: SAE J1690.
9. Color: Green.

2.14 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 and with IEEE 115.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

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

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Examine equipment for re-use to verify working order (meter, control cabinets, pumps)

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Concrete bases/ slab and conduit rough-in will be provide by Owner. Contractor to coordinate locations with Owner based on Contractor's design.
2. Layout and coordinate size and location of concrete bases for packaged engine generators to help facilitate Owners' work.. Provide and help cast anchor-bolt inserts into bases.
3. Trench conduits and provide stub-ups in concrete bases prior to Owners' work.

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

E. Fuel. Installer provide initial diesel fuel fill in new base tanks.

3.3 CONNECTIONS

A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.

B. Connect engine exhaust pipe to engine with flexible connector.

C. Connect fuel piping to engines with a gate valve and union and flexible connector.

D. Ground equipment

E. Connect wiring according to

F. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.4 IDENTIFICATION

A. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

A. Provide the services of a factory trained representative to perform all testing and preparation work. the generator system shall be fully tested to verify that it is operating within manufacturers tolerances and that it is operating as specified. The test shall be fully documented and submitted as specified in Section 1.4 informational submittals.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

   a. Visual and Mechanical Inspection

      1) Compare equipment nameplate data with drawings and specifications.
      2) Inspect physical and mechanical condition.
      3) Inspect anchorage, alignment, and grounding.
      4) Verify the unit is clean.

   b. Electrical and Mechanical Tests

      1) Verify phase rotation, phasing, and synchronized operation as required by the application.
      2) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
      3) Conduct performance test in accordance with NFPA 110.
      4) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. 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.

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.
6. Voltage and Frequency Transient Stability Tests: Use data capture from manufacturer control panel and software to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

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

H. Remove and replace malfunctioning units and retests specified above.

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

J. 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.

3.6 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

B. Prepare a training and operation manual specifically for the project. This manual shall contain an equipment outline, showing front and side plan views, electrical power one-line diagrams, conduit entrances, equipment ratings, schematic drawings, wiring diagrams, interconnection wiring diagrams (showing all field interconnections), remote devices, battery charger, fuel tank, material list, cross references to schematics for component identifications and a narrative sequence of operations, detailing all possible operating modes. The manual shall also contain a complete list of replacement parts for the Engine-Generator System and test data per factory and field testing. All equipment drawings shall specifically show the interface between the generator and transfer switch. Also included shall be all information for adjustment, operation and maintenance of the system. The manual shall be the basis for all training.

END OF SECTION 26 32 13