

SECTION 263213

ENGINE GENERATOR SET

PART 1 GENERAL

1.1 Scope of Work

- A. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.
- B. Any and all exceptions to the published specifications shall be subject to the approval of the engineer.
- C. 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 shown on the plans, drawings, and specifications herein.
- D. 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.
- E. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.

1.2 Project Conditions

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:
 - 1. Exposure to unusual transportation or storage conditions.

1.3 Coordination

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements shall be specified the equipment manufacturer for the Owner furnished contractor.

1.4 General Requirements

- A. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final jobsite. The generator set and automatic transfer switch will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
- B. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, transfer switches, and switchgear. There will be one-source responsibility for warranty, parts, and service through a local representative with certified factory-trained servicemen.

1.5 Submittal

- A. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications. Provide (1) set of submittals to the Engineer of Record and (1) set to the Owner's Representative.

1.6 Codes and Standards

- A. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
- B. The generator set shall conform to the requirements of the following codes and standards:
 - 1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 2. EPA Tier II certified.
 - 3. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
 - 4. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 5. IEC8528 part 4, Control Systems for Generator Sets.
 - 6. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
 - 7. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 8. NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700 and 702.

9. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

1.7 Testing

- A. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer's local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
- B. Design Prototype Tests. Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
 1. Maximum power (kW).
 2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
 4. Governor speed regulation under steady-state and transient conditions.
 5. Voltage regulation and generator transient response.
 6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 7. Three-phase short circuit tests.
 8. Alternator cooling air flow.
 9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
 10. Endurance testing.
- C. Final Production Tests. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 1. Single-step load pickup
 2. Transient and steady-state governing
 3. Safety shutdown device testing
 4. Voltage regulation

5. Rated Power @ 0.8 PF
 6. Maximum power
 7. A certified test record shall be sent at time of shipment.
- D. Site Tests. The manufacturer's local representative shall perform an installation check, startup service, building load test, two (2) hour resistive load bank test and provide customer training prior to acceptance of equipment. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test to assure that the system functions as specified. If generator set fails to fulfill the performance requirements of this specification, take corrective action and retest the system to assure full compliance. Include all expenses associated with the field tests, including any corrective action, and retesting as part of the scope of work of this section. Before conducting the site tests, submit a copy of the proposed test data log sheet and the operation and maintenance manuals for the engineer's approval. The site tests shall include:
1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
 3. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building or enclosure, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
 4. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
 5. Load bank testing shall be performed to the NFPA 110 7.13.4.3.3 standard for two (2) hours using a resistive load bank. The generator shall be loaded at not less than 30 percent of the nameplate kW for the first thirty minutes, not less than 50 percent of nameplate kW for the next thirty minutes, and 100 percent of the nameplate kW for the remaining 60 minutes. Engine coolant temperature, oil pressure, and battery charge level along with generator set phase-to-phase voltage, line-to-neutral voltage, per phase amperes, frequency, kW, ambient temperature, and sound level shall be monitored throughout the test. Reading shall be recorded in fifteen (15) minute intervals. Before conducting the load bank testing, submit a copy of the proposed test data log sheet for the engineer's approval.

6. Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

1.8 Warranty and Maintenance

- A. The generator set shall include a standard five year warranty to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of startup. Optional warranties shall be available upon request.
- B. The generator set manufacturer and its local distributor shall maintain a 24-hour parts and service organization. The local distributor shall have factory trained service technicians certified to work on the generator set specified.
- C. The local distributor shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and function testing performed on all systems.

PART 2 - PRODUCTS

2.1 Engine Generator

A. Equipment

1. The generator set shall Kohler model 200REOZJF with 4UA9 alternator and shall be rated a minimum of 200 kW / 250 kVA at 480 volts, 3 phase, 60 Hz, 0.8 PF using a Standby 130°C rating when operating in an ambient temperature condition of less than or equal to 77°F and a maximum elevation of 7218 feet above sea level. It is with the price of this equipment that the contractor of this section shall enter with his proposal. If the contractor wants to propose equivalent equipment as manufactured by Cummins or Caterpillar, it is to be submitted in a separate document. All additional costs associated with re-engineering and mechanical & electrical modifications to the installation will be at the contractor's expense. The contractor must also supply the details listed below with his equivalent proposal. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid date. Alternate bids shall include a line-by-line clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.
2. The generator shall be rated for an average power of 70% of the specified generator rating over a period of 200 hours per year. The

engine generator set power rating shall be applicable to variable loads with a load factor of 70% of the specified rating with 100% of the specified rating available during the duration of an outage.

3. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 690 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.
4. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

B. Engine

1. The engine shall have a minimum displacement of 415 cubic-inches and shall deliver a minimum of 315 HP at a governed speed of 1800 rpm. The engine shall be equipped with the following:
 - a. Electronic isochronous governor capable of 0.5% steady-state frequency regulation.
 - b. 12-volt positive-engagement solenoid shift-starting motor
 - c. 45 Ampere automatic battery charging alternator with solid-state voltage regulation.
 - d. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 - e. Dry-type replaceable air cleaner elements for normal applications.
 - f. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.
2. The turbocharged and charge air-cooled engine shall be fueled by diesel.
3. The engine shall have a minimum of 6 cylinders and be liquid-cooled by a unit mounted radiator for an ambient air temperature of 122°F/50°C.
4. The engine shall be EPA certified from the factory, and shall not require a site performance test.

C. Alternator

1. The alternator shall be salient-pole, brushless, 2/3-pitch, 12 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within $\pm 2.0\%$ at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
2. The alternator shall have a single maintenance-free bearing, designed for 4000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
3. The generator shall be inherently capable of sustaining at least 300%% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
4. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - a. Provide permanent magnet excitation for power source to voltage regulator.
5. Start Time: Comply with NFPA 110, Type 10, system requirements.

D. Controller

1. Engine-Generator Controller
 - a. The generator set controller must meet NFPA 110 Level 1 requirements (1996 version) and shall include an integral alarm horn as required by NFPA.
 - b. The controller shall meet NFPA 99 and NEC requirements.
 - c. The controller shall be UL 508 listed.
2. Applicability
 - a. The controller shall be standard on a generator 20kW and larger.
 - b. The controller shall support 12- or 24-volt starting systems.

- c. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
- d. The controller shall mount on the generator or remotely within 40 feet with viewable access.

3. Control Functional Requirements

- a. Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the auto mode when the generator shall be ready to accept a remote signal for starting, run mode when the generator shall start as directed by the operator, and off/reset mode when the generator shall stop or reset all faults.
- b. Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
- c. Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.
- d. Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 characters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running the display shall scroll all important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
- e. Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
- f. Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
- g. Alarm Silence/Lamp Test Button. When this button is depressed it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.

- h. USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
 - i. Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2 wire star for transfer switch and auxiliary shutdown.
 - j. The controller shall have auto resettable circuit protection integral on the circuit board.
4. System Controller Monitoring and Status Features. The generator shall display and monitor the following engine and alternator functions and allow adjustments of listed adjustable parameters at the controller.
- a. Overview Menu
 - 1) Active shutdowns and warnings shall be displayed if present and without the need of operator interface.
 - 2) Engine runtime with total hours
 - 3) Average line to line voltage
 - 4) Coolant temperature
 - 5) Fuel level or pressure
 - 6) Oil pressure
 - 7) Battery voltage
 - 8) Software version
 - 9) Frequency
 - 10) Average current
 - b. Engine Metering Menu
 - 1) Engine speed
 - 2) Oil pressure
 - 3) Coolant temperature
 - 4) Battery voltage
 - c. Generator Metering Menu
 - 1) Total power in VA
 - 2) Total power in W
 - 3) Rated power % used
 - 4) Voltage L-L and L-N for all phases
 - 5) Current L1, L2, L3
 - 6) Frequency
 - d. Generator Set Information
 - 1) Generator set model number

- 2) Generator set serial number
- 3) Controller set number
- e. Generator Set Run Time
 - 1) Engine run time total hours
 - 2) Engine loaded total hours
 - 3) Number of engine starts
 - 4) Total energy in kW
- f. Generator Set System
 - 1) System voltage
 - 2) System frequency 50/60Hz
 - 3) System phase, single/three phase
 - 4) Power rating kW
 - 5) Amperage rating
 - 6) Power type standby/prime
 - 7) Measurement units, metric/English units adjustable
 - 8) Alarm silence, always or auto only
- g. Generator Set Calibration
 - 1) Voltage L-L and L-N all phases
 - 2) Current L1, L2, L3
 - 3) Reset all calibrations
- h. Voltage Regulation, +/-0.5% regulation, the following is adjustable at the controller
 - 1) Voltage Adjustable +/- 10%
- i. Digital and Analog Inputs and outputs
 - 1) Displays settings and status
- j. Event Log
 - 1) Stores event history, up to 1000 events
5. Control Monitoring Requirements
 - a. Automatic restart - the controller has automatic restart feature which initiates the start routine and re-crank after a failed start attempt.
 - b. Cyclic cranking - the controller shall have programmable cyclic cranking
 - c. Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.
 - d. The control system shall include time delays for engine start

and cool down.

- e. The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.
- f. The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring.

6. Controller Alternator Control Features and Function

- a. Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of of nominal voltage.
- b. AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
- c. Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
- d. Power metering. The controller digitally displays power metering of kW and kVA.

7. Other Control Features and Functions

- a. Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
- b. Historical data logging. The controllers total number of generator set successful start shall be recorded and displayed.
- c. Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.

8. Generator Set Warning, Shutdown Alarm and Status. The generator set shall have alarms and status indication lamps that show non-

automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum.

a. Engine functions

- 1) Critical high fuel level (alarm)
- 2) ECM communication loss (shutdown)
- 3) ECM diagnostics (alarm & shutdown)
- 4) Engine overspeed (shutdown)
- 5) Engine start aid active
- 6) Engine under speed (shutdown)
- 7) Fuel tank leak (alarm & shutdown)
- 8) High DC battery voltage (alarm)
- 9) High coolant temperature (alarm & shutdown)
- 10) High fuel level (alarm)
- 11) Low DC battery voltage (alarm)
- 12) Low coolant level (shutdown)
- 13) Low coolant temperature (alarm)
- 14) Low cranking voltage (alarm)
- 15) Low engine oil level (alarm & shutdown)
- 16) Low fuel level (alarm & shutdown)
- 17) Low fuel pressure (alarm)
- 18) Low oil pressure (alarm & shutdown)
- 19) No coolant temperature signal (shutdown)
- 20) No oil pressure signal (shutdown)
- 21) Overcrank (shutdown)
- 22) Speed sensor fault (alarm)

b. Generator Functions

- 1) AC sensing loss over & under current (alarm & shutdown)
- 2) Alternator protection (shutdown)
- 3) Ground fault input (alarm)
- 4) kW overload (shutdown)
- 5) Locked rotor (shutdown)
- 6) Over-frequency (shutdown)
- 7) Over AC voltage (shutdown)
- 8) Under-frequency (shutdown)
- 9) Under AC voltage (shutdown)
- 10) Emergency stop (shutdown)

c. Other General Functions

- 1) Battery charger fault (alarm)
- 2) Common fault (shutdown)
- 3) Common warning (alarm)
- 4) Master switch not in auto (alarm)

- 5) Generator running
 - 6) Input/Output fault (alarm)
- d. The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements which include several of the above along with; EPS supplying load, Master switch no in auto and contacts for local and remote common alarm.
- E. Accessories
1. Failure Relay
 - a. The common failure relay shall remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
 - b. The relay contacts shall be gold flashed to allow use of low current draw devices (100ma @ 24VDC min.).
 - c. Once energized the relay shall remain latched until the system is reset by the main controller switch.
 2. Run Relay. The run relay shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The relay provides three sets of dry contacts for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)
 3. Air Restriction Indicator. The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.
 4. Standard Air Cleaner. The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions
 5. Battery Charger. 6-ampere automatic float to equalize battery chargers each having the following features:
 - a. 12 VDC output
 - b. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations.
 - c. LED lamps for change of state indication
 - d. Temperature compensated for ambient temperatures for -40°C to 60°C
 - e. Short circuit and reverse polarity protection
 - f. UL 1236 listed

6. Battery Rack and Cables. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
7. Block Heater. An engine block heater that can be connected to a power source that is energized when the generator set is not running. The block heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.
8. Circuit Breaker. The generator shall come with a primary, factory installed, 80% rated thermal magnetic line circuit breaker that is UL2200 listed rated for 400 amperes. Load side lugs shall be provided from the factory. Load side breaker connections made at the factory shall be separated from field connections.
9. Shunt Trip. A shunt trip shall provide a solenoid within the circuit breaker case that, when momentarily energized from a remote source, activates the trip mechanism of the line circuit breaker.
10. Remote Serial Annunciator Panel. An NFPA 110 remote serial annunciator panel shall be supplied with the following features.
 - a. Alarm Horn - Sounds if fault or Prealarm condition exist.
 - b. Alarm Silence Switch
 - c. Lamp Test Switch
 - d. The following LED Alarm Lights:
 - 1) High Engine Temperature Warning
 - 2) Low Oil Pressure Warning
 - 3) Low Water Temperature
 - 4) Low Fuel
 - 5) High Engine Temperature Shutdown
 - 6) Low Oil Pressure Shutdown
 - 7) Emergency Stop
 - 8) Overspeed
 - 9) Battery Charger Fault
 - 10) Low Battery Voltage
 - 11) Auxiliary Fault
 - 12) Overcrank
 - 13) Line Power
 - 14) Generator Power
 - 15) System Ready
 - 16) Generator Switch Not in Auto
11. Flexible Fuel Lines. The two fuel lines shall have fittings for the engine inlet/return and threaded pipe fittings for connection to the subbase fuel tank (or stationary piping).
12. Skid End Caps. The generator shall include skid end caps.

- F. Double Wall Secondary Containment Sub Base Fuel Tank
1. The sub base fuel tank used in conjunction with a diesel powered generator set shall contain at least 400 gallons of fuel to support the generator set for a period of at least 26 hours at 100% rated load.
 2. The sub base fuel system is listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
 3. The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
 4. Primary Tank. It will be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.
 5. Steel Channel Support System. Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.
 6. Exterior Finish. The exterior coating has been tested to withstand continuous salt spray testing at 100 percent exposure for 244 hours to a 5 percent salt solution at 92-97° F. The coating has been subjected to full exposure humidity testing to 100 percent humidity at 100° F for 24 hours. Tests are to be conducted in accordance with The American Standard Testing Methods Society.
 7. Venting. Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
 8. Emergency Venting. The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is sized to accommodate the total venting capacity of both normal and emergency vents.
 9. Fuel Fill. There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.
 10. Fuel Level. A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed vacuum tested dial shall be provided to

eliminate fogging.

11. Low Fuel Level Switch. Consists of a 30 watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

G. Weather Enclosure

1. All enclosures shall be constructed from high strength low alloy steel.
2. The enclosure shall be finish coated with powder baked paint for superior finish, durability, and appearance. Enclosures will be finished in the manufacturer's standard color.
3. The enclosures shall allow the generator set to operate at full load in an ambient temperature of 40 - 45°C with no additional de-rating of the electrical output.
4. Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker shall meet the requirements of the National Electric Code.
5. Doors shall be hinged with stainless steel hinges and hardware and be removable.
6. Doors shall be equipped with lockable latches. Locks shall be keyed alike.
7. The enclosure roof shall be pitched to prevent accumulation of water.
8. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.
9. The complete exhaust system shall be internal to the enclosure.
10. The critical silencer shall be insulated with a tailpipe and rain cap.

PART 3 - EXECUTION

3.1 Installation

- A. Provide the services of a qualified factory representative to check the installation of the generator and automatic transfer switch to ensure a proper installation, perform check-out and start-up services, conduct the field test specified herein, and instruct the Owner's personnel in the operation and maintenance of the equipment.
- B. Installation shall include furnishing all required coolants and lubricants.

3.2 Equipment Startup Services

- A. After installation and manufacturer's representative check of the installed equipment, operate each unit to demonstrate its ability to operate continuously without vibration, jamming, leakage or overheating and to perform specified functions.
- B. Comply with the manufacturer's operating and maintenance instructions during start-up and operation.
- C. Promptly correct improper installation or operation of the equipment.
- D. Cooperate with the supplier of the equipment, at the time of start-up, in making any final adjustments necessary to place the equipment in satisfactory working order. Start-up shall not commence without the presence of the manufacturer's representative.
- E. Perform the site testing as specified in section 1.5 D.

END OF SECTION