263213S01 DIESEL-ENGINE-DRIVEN GENERATOR SETS: Standby Power

1. GENERAL REQUIREMENTS

It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code ®, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the generator and controls, transfer switch, and assembles the standby generator sets as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

2. SUBMITTAL

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.

3. TESTING

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

3.1 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 since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

- 3.1.1 Maximum power (kW).
- 3.1.2 Maximum motor starting (kVA) at 30% instantaneous voltage dip.
- 3.1.3 Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG 1-22.40 and 16.40.
- 3.1.4 Governor speed regulation under steady-state and transient conditions.
- 3.1.5 Voltage regulation and generator transient response.
- 3.1.6 Fuel consumption at 1/4, 1/2, 3/4, and full load.
- 3.1.7 Harmonic analysis, voltage waveform deviation, and telephone influence factor.
- 3.1.8 Three-phase short circuit tests.
- 3.1.9 Alternator cooling air flow.
- 3.1.10 Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
- 3.1.11 Endurance testing.

3.2 Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

3.2.1 Single-step load pickup.
3.2.2 Transient and steady-state governing.
3.2.3 Safety shutdown device testing.
3.2.4 Voltage regulation.
3.2.5 Rated Power.
3.2.6 Maximum Power.
3.2.7 Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

3.3 Site Tests: An installation check, start-up, and full load bank test for a period of 4 (four) hours. In addition, a building load test shall be performed by the manufacturer's local representative. Prior to the building load test a written test plan shall be submitted for approval by the University simulating a power outage sequencing the fire pump, building controls, supply / exhaust fans, fire alarm panel, communications, etc. as they power up on emergency power and the time durations of each. The engineer, regular operators, the maintenance staff, and the UK Project Manager shall be notified of the time and date of the site test. The tests shall include:

3.3. 1 Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
3.3.2 Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
3.3.3 Start-up 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 running, normal and emergency line-to-line voltage, and phase rotation.
3.3.4 Automatic start-up by means of 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 voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.

4. WARRANTY & MAINTENANCE

The emergency generator system shall be warranted by the manufacturer for one year or 2,000 hours, whichever occurs first, from the date of the site start-up. Optional two-year and five-year warranties shall be available upon request.

5. EQUIPMENT

_____ standby generator set(s) shall be rated continuous standby (defined as continuous for the duration of any power outage)_____ Volts, _____ phase, _____ wire, _____ power factor, kW, _____ kVA, _____ amperes at 3300 feet altitude, 104°F (40°C).

5.1 The generator set shall be capable of starting motor loads of _____ kVA inrush, with a maximum voltage dip of _____ %.

5.2 Vibration isolators shall be provided between the engine-generator and heavy duty steel base or between the base and the floor.

6. ENGINE

The _____ cubic-inch-displacement engine shall deliver a minimum of _____ hp at a governed speed of 1800 rpm. The engine shall be equipped with the following:

6.1 Engine-driven or electric fuel transfer pump capable of lifting fuel six feet, fuel filters, electric solenoid fuel shut-off valve, and a fuel distribution system with an isochronous governor on 180 kW and larger generators.
Generators smaller than 180 kW shall be equipped with isochronous governor capable of +/- 0.25% steady-state frequency regulation.

6.2 _____ -Volt positive engagement solenoid shift-starting motor.

6.3 35-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.

6.4 Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

6.5 Dry-type replaceable air cleaner elements for (normal/heavy) duty, application.

Note: Engines requiring glow plugs will not be acceptable When NFPA 99 ten-second transfer requirement must be met.

6.6 The naturally aspirated or turbocharged and/or aftercooled engine shall be fueled with No. 2 diesel, _____ cylinders, liquid-cooled by unit-mounted radiator, blower fan, water pump, thermostat, and radiator duct flange shall properly cool the engine in (105 °F/125 °F) ambient with up to 0.5 inches H_2O static pressure on the fan.

7. GENERATOR

7.1 The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operation; and be protected from the environment by conformal coating.

7.2 Upon one-step application of any load up to 100% of the rated load at 0.8 power factor, the voltage dip shall not exceed 20% and shall recover to +/- 2% of rated voltage within one second.

7.3 The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a three-phase symmetrical short by inherent design or by the addition of an optional current boost system.

7.4 A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability, This breaker shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not

automatically reset preventing restoration of voltage if maintenance is being performed. Field current-sensing breaker will not be acceptable.

7.5 The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

8. CONTROLLER

Set-mounted controller capable of facing right, left, or rear shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote-mounted. The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C. Relays will only be acceptable in high-current circuits.

Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:

8.1 Fused DC circuit.

8.2 Complete two-wire start/stop control which shall operate on closure of a remote contact.

8.3 Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.

8.4 The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.

8.5 Cranking cycler with 15-second ON and OFF cranking periods.

8.6 Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.

8.7 Circuitry to shut down the engine when signal for high coolant temperature, low coolant level, low oil pressure, or overspeed are received.

8.8 Engine cool down timer factory set at 5 minutes to permit unloaded running of the standby set after transfer of the load to normal.

8.9 Three-position (Automatic - OFF - TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.

8.10 Indicating lights to signal:

Standard Equipment		(Not-in-Auto (flashing red))
		(Overcrank (Red))
		(Emergency Stop (Red))
		(High Engine Temperature (Red))
		(Overspeed (Red))
		(Low Oil Pressure (Red))
		(Air Damper (Red))
	*	(Battery Charger Malfunction (Red))
	*	(Low Battery Voltage (Red))
	*	(Low Fuel (Red))
	*	(Auxiliary Prealarm (Yellow))
	*	(Auxiliary Fault (Red))
	*	(System Ready (Green))
Optional Anticipatory Group	*	(Prealarm High Engine Temp. (Yellow))
	*	(Prealarm Low Oil Pressure (Yellow))
	*	(Low Coolant Temp. (Red))

*Required To Meet NFPA 99 Regulations.

8.11 Test button for indicating lights.

8.12 Alarm horn with silencer switch per NFPA 110.

8.13 Terminals shall be provided for each signal in 8. 10 above, plus additional terminals for common fault and common prealarm.

8.14 Normally open and normally closed contacts for owner to remotely monitor battery charger operation status.

8.14 Normally open and normally closed contacts for owner to remotely monitor whether or not the generator is running.

9. INSTRUMENT PANEL

An instrument panel shall include:

9.1 Dual range voltmeter 3 1/2-inch, +/- 2% accuracy.

9.2 Dual range ammeter 3 1/2-inch, +/- 2% accuracy.

9.3 Voltmeter-ammeter phase selector switch.

9.4 Lights to indicate high or low meter scale.

9.5 Direct reading pointer-type frequency meter 3 1/2-inch, 0.5% accuracy, 45 to 65 Hz scale.

9.6 Panel illuminating lights.

9.7 Battery charging voltmeter.

9.8 Coolant temperature gauge.

9.9 Oil pressure gauge.

9.10 Running time meter.

9.11 Voltage adjust rheostat.

10. ACCESSORIES

The following accessories shall be installed: (Note: Add to or delete from this list.)

10.1 Block heater, _____ - Watt (select size as required), 120 or 208/240 Volt AC. Thermostatically controlled and sized to maintain engine coolant at proper temperature to meet the requirements of NFPA-110 Regulation.

10.2 Generator strip heater, 120-Volt, single-phase for high humidity applications.

10.3 Line circuit breaker of _____ - amperes _____ - poles.

11. ACCESSORIES

The following accessories shall be shipped loose: (Note: Add to or delete from this list.)

11.1 Battery rack, battery cables. 12-Volt lead - antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0° F, per SAE Standard J-537, shall be supplied.

11.2 6-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from - 40° C to + 60° C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.

11.3 Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection. The engine exhaust silencer shall be coated to be temperature and rust resistance with integral condensate drain, rated for critical application. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment.

11.4 Two flexible fuel lines rated 300 °F and 100 psi ending in pipe thread.

11.5 UL labeled double wall construction sub-base mounted steel fuel tank with a enough storage capacity to run the generator set at full load for 24 hours without refueling.