

**SPECIFICATION
FOR
GENERATOR SET
ELECTRIC, DIESEL DRIVEN**

(This specification is released for procurement purposes until revised OR rescinded.)

SCOPE

This specification defines the requirements for a standby electric generator set consisting of an engine directly connected to an electric generator, together with the necessary switch gear, controls and accessories.

I. CLASSIFICATION

This specification covers one type of an electric generator set. It shall have the electrical characteristics as specified in the Invitation for Bids.

II. APPLICABLE STANDARDS

The following documents of issue in effect on the date of the Invitation for Bids shall form a part of this specification to the extent described in REQUIREMENTS:

NEMA Standards

National Electrical Manufacturer's Assn. (NEMA)
155 East 44th Street
New York, NY 10017

NEC Standards

National Electric Code (NEC)
60 Batterymarch Street
Boston, MA 02210

Occupational Safety and Health Act Standards (Federal)

U.S. Department of Labor
200 Constitution Avenue, NW
Washington, DC 20210

Occupational Safety and Health Act Standards (State)

N.C. Department of Labor
OSHA Division
4 West Edenton Street
Raleigh, NC 27611

III. REQUIREMENTS

A. GENERAL

The generator set shall automatically provide continuous electric power for the duration of any failure of the normal utility power supply.

All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment.

The system shall be free of destructive torsional and bending vibrations within a speed range from 10% below to 10% above synchronous speed.

B. ENGINE

1. Type

The engine shall be liquid cooled, diesel fueled, and either two or four cycle. The engine-generator set shall be capable of producing the rated KW at 0.8 power factor continuously for standby power applications and at the ambient and altitude conditions as stated in the Invitation for Bids. The continuous standby rating shall not be more than 110% of its prime rating. The engine speed shall not exceed 1800 RPM at normal full load operation. Certified engine horsepower curves shall be furnished with the bidder's proposal, showing the engine manufacturer's approval of the engine rating for standby application.

2. Governor

The engine shall be equipped with either a mechanical, electronic or hydraulic governor, as specified in the Invitation for Bids, to maintain frequency within limits specified herein. The maximum frequency variation at any constant load from no load to full load shall remain within a steady state band width of $\pm 0.5\%$ of rated frequency. The governor shall not permit frequency modulation to exceed one cycle per second.

3. Starting

An electric starting motor with solenoid and either Bendix or over-running clutch drive shall be furnished on the engine. The batteries shall be of the required voltage and ampere rating and mounted on the unit or on a separate rack located beside the engine. Necessary battery cables and connections shall be furnished and installed.

A battery charger shall be furnished which shall maintain the starting batteries at full charge. The charging system will permit charging from either the normal or the emergency power source. It shall have a high rate and low rate charging system so that the batteries may be charged at a rate or a trickle charger. An ammeter shall indicate the charge rate and the circuit will be protected by either fuses or circuit breakers. The charge shall be so designed that it will not be damaged during the engine cranking.

4. Cooling

The engine shall be furnished with a cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full-rated load in the ambient temperature stated in the Invitation for Bids. The engine shall be equipped with a radiator, fan, water circulating pump and thermostatic valve to maintain the engine at recommended temperature level. The cooling system shall be protected to at least -10°F.

5. Air Cleaner

The engine shall be equipped with one or more dry type air cleaners.

6. Exhaust Silencer

A suitable silencer shall be furnished for either commercial, moderate or high degree silencing, as specified in the Invitation for Bids. A flexible exhaust pipe shall be furnished to connect the exhaust manifold of the engine to the muffler.

7. Instruments

The engine mounted instrument panel shall contain the following gauges for proper engine surveillance and maintenance: engine water temperature, engine lube oil pressure and hour meter.

8. Safety Controls

The engine shall be equipped with automatic safety controls which will shut down the engine in the event of low lube oil pressure, high jacket water temperature, and engine over-speed and make electrical contacts for alarm lights on the control panel.

C. GENERATOR

1. Rating

The generator rating for voltage, phase, wires, and KW at 0.8 power factor shall be as specified in the Invitation for Bids. The rating shall be applicable for continuous service in standby power application.

2. Construction

The generator shall be a revolving field type, coupled directly to the engine flywheel through a flexible driving disc for positive alignment.

The generator shall be of heavy duty, compact design, Insulation shall be Class A, B, F, or H as recognized by NEMA.

Generator field excitation shall be performed by either a rotating exciter mounted on the generator rotor shaft through a brushless rotating diode system or by a solid state static exciter system through slip rings.

The voltage regulator shall be of the static-magnetic amplifier type with silicon diode control, and shall maintain voltage within limits as below:

Regulation: The maximum voltage deviation between no-load steady state and full-load steady state to be as specified in the Invitation for Bids.

Transient: 20% dip maximum of rated voltage for any addition of load up to and including 90% of rated load.

Transient: 5 seconds maximum voltage recovery time with application or removal of 0.8 P.F. full load.

3. Frequency Regulation

The frequency regulation from no load to rated load shall be in accordance with that defined by the engine governor performance. For any addition of load up to 90% of rated load, the frequency shall recover to the steady state frequency band within five seconds.

4. Generator Line Circuit Breaker

A circuit breaker shall be supplied to protect the generator and controls from overloads and/or short circuits in the load.

D. AUTOMATIC START AND STOP CONTROLS

1. General Description

Automatic starting and stopping controls shall be furnished to start the engine automatically when the normal electric power fails or falls below specific limits and to stop the engine automatically after the normal power supply resumes. The signal for starting or stopping the engine shall be sensed through an auxiliary contact in the automatic load transfer switch.

2. Engine Cranking Control

Crank control and time delay relays shall provide at least two cranking periods. Each cranking period shall be for at least 20 seconds, and the cranking attempts shall be separated by appropriate rest periods. A sensing device shall automatically disconnect the starting circuit when the engine has started. If the engine has not started at completion of the starting program, the over-cranking signal shall so indicate. The engine starting controls shall be locked out and no further starting attempts shall take place until the over-cranking device has been manually reset.

3. Selector Switch

A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine; a "manual" or "hand-crank" position that permits the engine to be started manually by the push-button on the control cabinet and run unloaded; a "test" position that will cause the engine to start and run through the automatic start and stop controls but does not transfer the load; an "automatic" position which readies the system for automatic start or stop on demand of the automatic load transfer switch, or a programmed exerciser.

E. INSTRUMENT PANEL

The alternate instrument panel shall be wired, tested and shock mounted on the generating set by the manufacturer of the alternator. It shall contain panel lighting, manual reset circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter, AC ammeter, and terminals for connection to the automatic load transfer panel.

F. AUTOMATIC LOAD TRANSFER SWITCH

An automatic load transfer switch shall be provided. When the voltage and/or frequency of any phase drops below 70% normal, power failure relays shall actuate contacts that cause the automatic engine starting control to start the engine. The switch shall transfer the load to the standby generator after the generator stabilizes at rated voltage and frequency. The load shall be restored to the normal power source when all phase voltages of this source are 90% or more of rated voltage. The load transfer switch must meet UL 100 and be UL listed.

The following functions shall be provided:

1. Upon power line outage, automatically start the plant. Start time following outage shall be adjustable from 0 to 10 minutes. When the plant comes up to operating voltage, disconnect the load circuits from the main and connect them to the standby plant's output.
2. A time delay on re-transfer of load to line after normal power is restored shall be provided, adjustable from 0 to 30 minutes.
3. After load has been restored to normal power, a timer adjustable from 0 to 30 minutes shall be provided to permit engine to operate without load for a period of time before shutdown.
4. The control electrical characteristics shall be as specified in the Invitation for Bids, complete with standby plant start-stop circuit, transfer switch pilot circuit, operator selection switch and NEMA cabinet.
5. Each contact pole of the main transfer device shall be constructed to handle the output, at full capacity of the plant, with either inductive or non-inductive loads. The switch shall be electrically and mechanically interlocked, mechanically held in the normal and emergency positions.
6. An exerciser clock shall be provided for automatically starting the plant under load at regular intervals (up to 7 days), and frequency of running times shall be adjustable.
7. A simulated power failure switch shall be furnished to start the plant and assume the load. When the switch is returned to the normal position, the load is transferred back to the line and the plant stops.

G. ACCESSORIES

When specified in the Invitation for Bids, the following accessories shall be provided:

1. Flexible fuel lines of suitable construction and length to use for connection to the engine.
2. A fuel transfer pump and day tank (10 gallons minimum) with float switch. The transfer pump shall operate on 120 VAC power and wired to generator output circuit.
3. Water-jacket heater (Size to be specified in the Invitation for Bids).

4. Hot air duct adapters.
5. Enclosure (Owner to furnish description).
6. Vibration isolation.
7. Type of mounting.

H. GENERATOR INSTALLATION:

The contractor shall furnish a drawing of the generator anchor bolt settings to the owner prior to shipment of the generator.

IV. WARRANTY

The contractor warrants to the owner that all equipment furnished and installed under this specification will be new, of good materials and workmanship, and agrees to replace promptly any part or parts which by reason of defective material or workmanship shall fail under normal use, free of negligence or accident, for a minimum period of 12 months from the date of acceptance. Such replacement shall be free of any charge to the owner or his representative.

V. SERVICE, PARTS, AND MANUALS

The contractor shall furnish at least two copies each of complete operator's instruction manual, service manual, and a repair parts catalog for each electric generating plant.

Warranty service must be provided to the owner within 24 hours from notification.

The contractor must maintain a spare parts inventory of known high mortality parts and components. Availability of such parts and components must be assured for a minimum of three years after expiration of initial warranty.

VI. ACCEPTANCE EVALUATION AND QUALITY ASSURANCE

Upon receipt of each electric generating plant at the receiving point, or completion of the installation, the owner or his authorized representative shall arrange for an acceptance inspection for compliance with the provisions of this specification.

If so stated in the Invitation for Bids, the contractor will be required to furnish a pilot model for inspection, tests and possible modification and/or adjustments of attachments in accordance with this specification.

VII. DELIVERY AND PAYMENT

Delivery of and payment for electric generating plants purchased under this specification shall be in accordance with the terms and conditions of the Invitation for Bids. The contractor shall be responsible for any packing, packaging, or protection required to insure safe delivery in an undamaged condition.

VIII. ORDERING DATA

Purchasers should exercise any desired option offered herein and should specify the following in the Requisition and Invitation For Bids:

1. Title, number, and date of this specification.
2. Electrical characteristics required (KW, KVA @ PF, phase, 4-wire etc, voltage, and cycles).
3. Ambient temperatures (maximum and minimum) and evaluation at installation.
4. Type of governor.
5. Automatic load transfer switch electrical characteristics and functions (if different from those specified herein).
6. Maximum voltage deviation (See Item III.C.2. Construction).
7. Accessories required (See Item III.G. ACCESSORIES).
8. Type exhaust silencer desired (commercial, moderate or high degree).
9. If pilot model is to be furnished.