

ITEM 10599.34 M - STANDBY POWER GENERATOR

DESCRIPTION

- (a) This work shall consist of furnishing, installing, and putting into permanent operating condition a standby natural gas-fueled, engine generating set of the latest commercial type and design rated for prime service at a minimum of 150 kW, 187 KVA, at 0.8-PF, 60-hertz, 480Y/277 volts, 3-phase, 4-wire. The system shall be a package of new equipment consisting of:
- (1) A natural gas-fueled, engine-driven electric generating set, complete with battery pack and charger.
 - (2) An engine start-stop control system mounted on the generating set.
 - (3) Mounted accessories as specified.
- (b) To ensure that there is one source of supply and one responsibility, the whole engine-generator system (engine, generator, engine control system, and all major items of auxiliary equipment) shall be built, tested, and shipped by the same manufacturer. This said manufacturer shall be completely responsible for furnishing, testing and placing in proper operating condition the engine-generator set. Independent vendors that buy the engine, generator, and auxiliary equipment from various manufacturers and then assemble the equipment together relying on the individual manufacturers for their supply of spare parts and engineering expertise, do not meet the criteria of this Specification and will not be acceptable. The Generator shall be manufactured by Caterpillar or approved equivalent as manufactured by Kohler or Onan.

The Contractor shall warrant the in-service performance of the standby generator in accordance with Section 2.00.

MATERIALS

Conformance

- (a) Electrical equipment and its installation shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials (AASHTO), except as may be otherwise provided herein.
- (b) Materials and construction shall conform to the requirements of the current National Electrical Code, Standards for the American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI) and to any applicable local rules and ordinances. In addition, electrical equipment shall conform to the standards of the National Electrical Manufacturers' Association (NEMA) and the Underwriters Laboratories, Inc.

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(UL), where applicable. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

Equipment and Material Provisions

All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be manufactured and erected to the satisfaction of the Engineer. The Contractor shall warrant the in-service working of the electrical installations for six (6) months or the manufacturer's warranty period, whichever is greater, following project acceptance. If the Contractor has any objection to any feature of the electrical equipment as designed and arranged, he must state his objection in writing to the Engineer prior to fabrication and/or installation, otherwise his objection will not be accepted if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus.

- (a) Each piece of electrical equipment and apparatus shall have a corrosion-resisting metal nameplate on which is stamped the name of the manufacturer and the rating or capacity of the equipment or apparatus.
- (b) All metal parts of the installation, except structural steel, shall be of corrosion-resisting material, such as aluminum, bronze, or stainless steel. Cast-iron, malleable iron, or steel with a hot-dip galvanized finish shall be used where specified herein. Structural steel shall conform to the requirements given under Section 715 – Castings, Forgings, and Metals of the NYSDOT Standard Specifications Construction and Materials.
- (c) All mounting hardware and all wire and cable terminals shall be vibration proof.
- (d) If any departures from the Plans or these Specifications are deemed necessary by the Contractor, details of such departures and the reasons therefor shall be submitted for approval as soon as practicable. No such departures shall be made nor work started without approval of the Engineer.

CONSTRUCTION

Working Drawings and Samples

- (a) The Contractor shall prepare and submit for review within 90 working days after the award of the Contract (except long lead items as specified elsewhere) the following working drawings executed in accordance with the provisions of the Contract:
 - (1) Detailed specifications describing the engine-generator set and its accessories.
 - (2) A complete outline drawing of the engine-generator set locating all accessories including conduit boxes, air intake, and connections for the fuel line, exhaust line and cooling system.

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- (3) A detail drawing showing the construction of the structural steel base.
 - (4) An outline drawing of the control panel showing all devices mounted thereon, and giving construction details of the enclosure.
 - (5) A wiring diagram of the control panel.
 - (6) An outline drawing and wiring diagram of the battery charger and its control.
 - (7) A wiring diagram of the engine and its associated devices including the starting system.
 - (8) An outline drawing of the generator-mounted battery rack.
 - (9) A layout drawing showing the installation of the engine-generator set together with details of the mounting of the vibration-damping material.
 - (10) An outline drawing of the exhaust silencer.
 - (11) Layout drawings showing the complete fuel supply accessories cooling and exhaust systems. The fuel piping layout covering all lines external to the engine, showing all piping, fittings, valves, strainers, regulators and other devices shall be included.
 - (12) A complete schematic conduit diagram showing the interconnection of the engine-generator, starting batteries and control panel.
 - (13) Any other drawings which may, in the opinion of the Engineer, be necessary to show the work completely.
- (b) All layout and installation drawings for the standby generator work shall be submitted for approval prior to the submission of pertinent shop drawings for the new generator house and support structure so that provision for mounting of conduits, cables, and other electrical equipment, where required, can be shown on the structural shop drawings.
- (c) Certified dimension prints of the apparatus shall state in the certification the name of the job, the application of the apparatus, device designation, number required, right-hand or left-hand assembly, electrical rating, number of poles or contacts, material, finish, and any other pertinent data to show that the apparatus meets the specified requirements.
- (d) The Contractor shall submit for inspection and test, if directed by the Engineer, samples of apparatus or devices which he proposes to use as a part of the electrical installation.

Operation and Maintenance Manuals

The Contractor shall furnish the Engineer with seven copies of a booklet containing complete instructions

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covering the operation and maintenance of the engine-generator unit and its associated equipment, together with an engine parts catalog, spare parts inventory and maintenance instructions for the unit. The booklet shall contain copies of wiring diagrams showing the connections of all major components, including the engine, generator, control panel, starting panel and starting batteries. One of the seven copies of the instruction book shall be for the Engineer's records.

Shop Tests

- (a) The components of the engine-generator set shall be factory assembled, and with all accessories connected and in place, shall be subjected to full-load test runs at the manufacturer's plant, as hereinafter specified. Prototype testing will not be accepted in lieu of testing the actual set to be supplied.
- (b) The engine shall be run continuously for not less than 4 hours without stoppage, and shall include at least 1 hour's operation at 50 and 75 percent and 2 hour's operation at 100 percent of rated load. A record shall be kept of the water temperature in the engine head until a stabilized temperature is reached. When the engine is stopped, the temperature of the water shall rise to not more than 200 degrees F.
- (c) The tests shall include complete performance tests of the entire generator set to show that the generator voltage regulator and the engine governor perform properly to meet all specified requirements.
- (d) The generator and exciter shall be subjected to a full load heat run, and the test results shall be reported on the Standard Performance Specification Forms of the National Electrical Manufacturer's Association.
- (e) The manufacturer of the generator set shall provide an insulation resistance test per NEMA Standard MG-1, Section Nos. 12.02 and 12.03. Test results shall be reported on the standard forms for generators of the National Electrical Manufacturers Association. All test reports and curve sheets shall be certified by the manufacturer and five copies of each shall be submitted and approved by the Engineer prior to shipment from the factory.
- (f) The Contractor shall test the insulation resistance of the generator prior to installation by dielectric absorption utilizing 500 volts DC. Tests shall follow recommendations of IEEE Standard No, 43. Approved test equipment shall be provided and used by the Contractor. Test instruments shall have been calibrated within the last six months by a calibration facility with traceability to NBS Standards (ISO 9002) approved by the manufacturer of the test instruments. Written certification of calibration shall be provided to and approved by the Engineer prior to executing the tests.
- (g) Seven certified copies of the results of the above tests shall be submitted for review. The units of the engine-generator set shall not be shipped from the plant of the manufacturer until the certified tests thereon have been accepted by the Engineer. A certified copy of the test results shall be included in the aforementioned instruction books.

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Field Tests

- (a) The Contractor shall arrange for and provide all the necessary field tests prescribed by the manufacturer, as directed by the Engineer, to demonstrate that the entire engine-generator installation is in proper working order and in accordance with the drawings and Special Provisions.
- (b) During the testing period, the Contractor shall arrange to have at the site a representative of the manufacturer of the engine-generator. This representative shall be a service engineer experienced in the installation of generator sets, and he shall be capable of making adjustments to the equipment; of locating faults or defects and correcting them, if possible; and of obtaining from the manufacturer, without delay, new parts or replacements for apparatus which does not perform satisfactorily.
- (c) Field testing shall also include complete operating tests to show that the engine-generator and all components operate satisfactorily to sustain the loads imposed during operation of the span and its auxiliaries. At least three complete bridge opening/closing sequences shall be performed with the generator supplying electric power to the span motors and auxiliary equipment.
- (d) Should the tests show that the engine-generator or any component piece of equipment or apparatus, in the judgment of the Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.

Assembly and Mounting

- a. The engine-generator set, complete with all set-mounted accessories and auxiliary equipment, shall be factory-assembled by the manufacturer. The Generator shall be a Caterpillar G3306 150 kW Natural Gas generator or equivalent as manufactured by Kohler or Onan.
- b. The engine and generator shall be coupled together through a non-backlash type, flexible coupling, and mounted on a self-supporting, structural steel base (skid) using coiled-spring type vibration isolators. The structural steel base shall be bolted to the structural support bolts of size and number as recommended by the manufacturer.

Engine

1. The engine shall be a gaseous-fueled, full-ignition type, four-cycle, V-8 cylinder, 1800-RPM, heavy-duty, turbo-charged, aftercooled unit. (Two-cycle engines will not be accepted.) The engine shall have a minimum displacement of 7538 cubic centimeters and a bore and stroke of 110.74 x 97.8 mm with a compression ratio of 8.0:1. The engine shall be equipped with replaceable wet cylinder liners and have pistons of one piece construction. The engine shall be operable under a natural gas service with a nominal pressure of 178-280 mm in H₂O.
2. The engine shall be furnished complete with all accessories such as radiator with duct

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flanges and duct, fan, water circulating pump, fuel supply system, pressure lubrication system with pump, close-regulating speed governor, intake air cleaner and silencer, electric starting motor and selector switch. The engine shall be furnished with an engine safety control switch which shall be arranged to give a visual and an audible alarm on shut down of the engine under the condition of low oil pressure, high water temperature, or over-speed.

3. The engine shall be provided with a thermostatically-controlled, immersion-type, jacket water heater capable of maintaining a minimum coolant temperature of approximately 32.2 degrees Celsius in an ambient temperature of 4.4 degrees Celsius. The heater shall be suitable for operation from a 277-volt, single-phase supply, and shall be automatically de-energized when the engine is started.
4. The engine shall be capable of starting and attaining rated KW output within 10 seconds.

Generator and Exciter

1. The generator, exciter, and voltage regulator shall be a package unit suitable for use with a natural gas engine prime mover and capable of supplying electric power to a motor load controlled by variable frequency motor controllers. The generator shall be of the brushless type, with a rotating A-C exciter and static voltage regulator. It shall conform to NEMA Standards for generators.

2.

The generator shall be a 3-phase, 4-wire, 60-Hertz, 4-pole, 1,800 RPM, open drip-proof, single-bearing, brushless generator. It shall be rated 187-kVA, on a continuous basis at 0.8 power factor load, with a temperature rise not exceeding 105 degrees C. Insulation shall be Class F. Tropicalization treatment shall be provided to increase the moisture resistance of the insulation. The generator shall be designed for good wave shape and shall have a deviation factor not greater than 5 percent. The radio interference suppression shall not be less than 50 and be in accordance with NEMA Standards.

3. The exciter and generator field rectifiers shall be mounted on a common shaft with the generator rotor, without brushes, commutator, or additional bearings. The exciter shall be of sufficient capacity to produce the required excitation. The rectifiers shall be of the low-loss, non-aging, hermetically-sealed silicon type and shall be capable of withstanding extreme vibration and centrifugal forces without serious effect.
4. The generator shall be provided with a unit-mounted, completely static, voltage regulator of the silicon-controlled-rectifier type. The voltage regulator shall be factory-tested with the generator to insure proper operation of the regulating system in accordance with the requirements hereinafter specified.
5. The generator, exciter and regulator package shall regulate the output voltage to within 2 percent of the rated voltage for any change in load from no load to rated load, at rated power factor. It shall be capable of sustaining a one-step application of full rated load with a maximum voltage dip of 20 percent. Following the initial voltage dip, the output voltage shall recover to not less than 95 percent of rated voltage within one second.

Governing System

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1. The engine governor shall be a close-regulating, solid-state, electronic governor, capable of holding the engine speed constant to within plus or minus 0.33 percent for any constant value of load between 1/4 load and full load. Speed regulation from no load to full load shall not exceed 3 percent.
 - 2.
3. The governing system shall re-establish stable engine operating conditions within three seconds, without excessive oscillation, following the sudden change in load imposed by the acceleration or deceleration of the span motors. The maximum change in engine speed during the three-second surging period shall not exceed 5 percent of rated speed.

Control Panel

1. An enclosed control panel shall be provided for mounting all control and indicating devices associated with the engine and generator. On the panel, for the engine there shall be mounted a water temperature gauge, lube oil pressure gauge, running time meter, tachometer, vernier throttle and battery charging ammeter. The instruments for the generator mounted on the controller shall be an ammeter, voltmeter and frequency meter. Other controller mounted equipment shall be a phase selector switch, cyclic cranking, overcranking and starter unmesh protection, fault reset switch, overspeed control, remote start/stop termination, voltage adjusting rheostat, DC circuit protection, engine start control selector switch, emergency stop switch and a molded case circuit breaker of sufficient frame size, conforming to the requirements of NEMA Pub. No. AB1-latest revision. The circuit breaker shall conform to the requirements specified for circuit breakers under the Specification for the Bridge Electrical System and shall have trip coil as shown on the Plans. All wiring shall be factory-installed in flexible, liquidtight, galvanized steel conduit.
2. The enclosed control panel (in conjunction with the automatic transfer switch specified under the "Bridge Electrical Work") shall provide automatic starting of the generator set in the event of failure of the regular power supply. The engine starting control shall operate from a single pole contact of the automatic transfer switch in the power cabinet to be installed in the operator's room. The control panel shall provide for repeated cranking, automatic disconnect when the engine begins to run, automatic disconnect and indication on failure to start, indication of generator running, automatic shutdown and indication for low oil pressure, high water temperature and engine overspeed, and oil pressure bypass during starting. Indicating lights for these conditions shall be mounted on the engine-starting panel. Alarm terminals for a remote annunciator shall be incorporated for the above mentioned shut-down features. The remote annunciator panel shall be as specified elsewhere under this Special Provision. The control panel shall also include a 4 position switch to select "Hand Crank", "Stop", "Automatic", or "Engine Test". The control panel shall be furnished in a hinged-door cabinet, and shall be of the type recommended by the engine manufacturer. It shall be integrally mounted on the generator set.
3. Each device on the generator control panel shall be suitably named or identified by means of engraved nameplates or dials.
4. In addition, a normally open dry contact rated 120-volts, 5-amps shall be provided and

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arranged to close when the generator is running and capable of providing bridge power.

Starting System

1. The starting system shall consist of a storage battery and an engine-starting panel wired in conjunction with the starting motor on the engine. A battery charger shall be furnished and installed to maintain the battery at full charge.
2. The storage battery shall comprise a block assembly of heavy-duty, pocket-type, nickel cadmium cells of the alkaline type connected in series to provide the required voltage. Each cell shall be designed specifically for spark-ignited engine starting service. The storage battery shall be installed on a battery rack. The battery rack shall be rigidly mounted on the non-vibrating generator set skid base. The battery rack shall not be installed on the vibrating engine-generator base.
3. The starting battery shall be maintained at full charge by a solid state battery charger with fully automatic charge control. The charger shall be a single-phase 120-volt AC unit capable of sufficiently charging the battery, and shall be of the silicon controlled rectifier type. It shall be provided with independently adjustable float and recharge voltages and shall include current limiting to 110 percent of rated current for all load conditions. The charger shall be equipped with a DC voltmeter, DC ammeter, AC and DC fuses and low voltage alarm relay. The charger shall be capable of sensing current discharges of the battery and of automatically recharging it without interruption of AC power to the rectifiers. The battery charger shall be approved for use with the batteries provided.

Remote Annunciator Panel

A remote alarm annunciator panel shall be furnished and installed in the operator's room in the Control House to give visual and audible indication of impending alarm conditions and engine failure condition. The alarms shall at least include the engine failure conditions hereinbefore specified plus indication of low battery voltage and low fuel supply pressure. The equipment shall conform to the requirements of NFPA 76A, L973.

Fuel Supply System

1. The Contractor shall furnish and install a new natural gas line to the new generator house under this item. Under this item, the Contractor shall make the necessary connections from the new gas distribution equipment in the new generator house to the new generator.
2. The gas line installation shall supply natural gas to the primary regulator of the generator at a minimum utilization pressure of 178 mm and a maximum of 280 mm in H₂O. If the generator furnished by the Contractor requires a different utilization pressure, the Contractor shall provide the required materials and services to coordinate the gas service with the engine requirements.
3. The Contractor shall furnish and install all gas regulating and safety equipment including pressure switch, solenoid valve, manual shut-off valve, differential regulator, digester gas carburetor, gas meter and any other required equipment necessary to extend gas service to the generator to render it operable as specified. The installation shall conform to the BOCA National Building Code, Keyspan Energy Delivery, NYSDOT requirements and any other local codes or ordinances.
4. Gas line piping shall be black iron pipe, sized per the generator manufacturer's

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recommendations. All pipe fittings shall be of similar construction as the pipe.

Exhaust System

1. The engine exhaust line shall be directed upward from the engine to a silencer mounted from the ceiling of the generator house. The engine exhaust outlet shall be connected to the silencer inlet with a section of flexible, stainless steel exhaust hose. The size of the exhaust line shall be as recommended by the engine manufacturer. From the silencer, exhaust piping shall extend horizontally penetrating the wall of the generator house. An insulated thimble shall be provide at the wall penetration of the exhaust line. Exhaust piping shall be schedule 40, carbon steel pipe per ASTM A53, Type S - Grade A and hot-dipped galvanized.
2. All connections in the exhaust system shall be made with standard weight, flat faced, slip-on welded flanges, welded back and front to the piping. All flanges shall be 150 PSIG, flat faced, slip-on, hot-dipped galvanized, carbon steel per ASTM A105 with dimensions per ANSI Standard B 16.5. All joints shall be provided with full face, 1.6mm thick, woven graphite, wire-inserted, 150 PSIG rated gaskets. Fasteners for flanged joints shall be bolts per ASTM A193, Grade B7 bolts with nuts per ASTM A194, Grade 2H. Flange bolt threads shall be coated with an anti-seize, copper-based, thread lubricant.
3. The Contractor shall provide and install a critical-grade silencer, constructed of Type 316 Stainless Steel. The silencer shall be sized (including all exhaust piping as installed) to minimize back-pressure on the engine to the minimum manufacturer's recommendation. The silencer shall reduce overall sound pressure levels from the engine exhaust, with the engine generator set operating at full load, to 60 dBA at a distance of 3.05m from the exhaust outlet.

Conduits and Wiring

1. The engine generator shall be furnished with all internal wiring for the engine, generator, and their accessories, complete in place.
2. The Contractor shall furnish and install all conduits and wiring required for interconnection of the engine, generator, starting panel, control panel, remote indicators and alarms, battery and charger console and other associated equipment. Conduits and wiring and their installation shall conform to the requirements given under the "Bridge Electrical Work".
3. Conduits and wiring required to extend a power feeder and grounding conductor from the line circuit breaker on the generator control panel to the bridge power cabinet, for the remote starting and stopping circuit, and for the battery charger and jacket heater, shall be furnished and installed under the "Bridge Electrical System". The connections of these circuits at the generator control panel shall be made under this item.

Louvers and Ducts

1. Ventilation louvers shall be provided in the generator house where shown on the Plans. One stainless steel combination fixed/motor-operated adjustable louver, complete with motor and controls, to provide an air outlet for cooling air from the engine generator shall be sized, furnished and installed in the wall of the generator house as shown on the Plans. The louver shall be the Motor Operated Louver model as manufactured by Airolite Co., Construction Specialties, Industrial Louvers or approved equal.

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2. The lower frame and blades shall be No. 16 gauge stainless steel. The frame shall be reinforced channel construction, welded at the corners and shall be equipped with an angle flange for fastening to the house steel frame opening with 6.35mm (M6) stainless steel bolts spaced approximately 150 mm on center.
3. The blades shall be neoprene-tipped and shall be mounted on stainless steel ball bearings in cadmium plated races. Blades shall be normally closed and shall open to an angle of about 70 degrees. Blades shall be completely weathertight when closed.
4. The louver motor, shall be two-directional, 277-volts AC, 60-Hertz with limit switches, wired for automatic operation whenever the generator is started. The motor shall be concealed in the louver frame. Controls and connections for the motor-operated louver shall be included under this item.
5. One stainless steel combination fixed, automatic counter-balanced adjustable air intake louver, shall be sized, furnished and installed in the north wall of the generator house as shown on the Plans. The louver shall be the Automatic Louver model as manufactured by Airlite Co., Construction Specialties, Industrial Louvers or approved equal.
6. The frames, blades and angle flange shall be as hereinbefore specified for the motor-operated adjustable louver.
7. The adjustable blades of these louvers shall be normally closed and shall open to a maximum of 70 degrees due to back pressure created when the generator is started and running. All louvers shall be provided with vandal-proof screws. The louvers shall be weathertight when closed.
8. The Contractor shall furnish and install a galvanized sheet metal cooling duct directing cooling air from the radiator fan to the motorized exhaust louver. The Contractor shall provide all equipment and labor necessary to properly erect the duct.

Grounding

1. All metallic conduits, equipment enclosures, frames, housing, and all other metal parts of electrical systems installed or connected under this item, in the proximity of current-carrying conductors or equipment shall be bonded to the bridge ground system. Grounding and bonding shall conform to the requirements given under the "Bridge Electrical Work".
2. The generator frame, generator disconnect enclosure and all associated conduits and boxes shall be bonded together and connected to a No. 2/0 AWG grounding conductor at the generator disconnect. From the disconnect, the grounding conductor shall extend to the grounding electrode conductor which shall be run to a ground rod network to be installed outside the generator house.
3. All grounding connections shall be as specified under the Special Provisions for Replacement of the "Bridge Electrical Work".

Painting

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1. The engine generator set and associated boxes and equipment shall be factory-finished using not less than three coats of paint.
2. Enclosures for separately-mounted devices and equipment which are normally given a factory paint finish suitable to the Engineer, need not be field-painted. If the factory finish is damaged or marred before acceptance of the work, the finish coat shall be "touched up" or the entire unit repainted at the discretion of the Engineer. All other equipment including structural steel supports for equipment specified herein, shall be galvanized and connections painted in accordance with the requirements of the NYSDOT Standard Specifications.

METHOD OF MEASUREMENT

Payment for the Item "Standby Power Generator" shall be made on a lump sum basis.

Basis of Payment

The lump sum bid for Standby Power Generator" shall include the cost of all labor, materials, and equipment necessary to complete the installation, ready for operation.

Progress payments for work satisfactorily completed will be made in accordance with the pre-established breakdown.