

**PORTSMOUTH-KITTERY
16189B**

April 22, 2021

SPECIAL PROVISION**SECTION 677 – INTELLIGENT TRANSPORTATION SYSTEMS (ITS) EQUIPMENT****Maine Communications Equipment Shelter Stand-By Generator Specification****Description**

1.1 This work shall consist of the furnishing, installing, and start-up testing of a new 60kW (minimum) diesel powered generator at the Maine Communications Equipment Shelter.

1.2 The work consists of furnishing and delivering an Automatic Transfer Switch (ATS) device at the Maine Communications Equipment Shelter. Installation of the new ATS will be done by others in the new Communications Equipment Shelter. The work does include the Contractor providing material and labor support and includes providing and installing wire and conduit from the new ATS to the power distribution system in the new Maine Communications Equipment Shelter.

Materials

2.1 The generator system shall be capable of providing a source of emergency power that complies with Article 700 of the National Electrical Code. All materials shall be new and comply with NEMA, UL and NEC standards, listings and requirements as applicable.

2.2 Materials associated with the ATS shall be new and comply with NEMA, UL and NEC standards listings and all requirements as applicable. The completed installation shall conform to NFPA 70 Article 700 requirements for emergency electrical systems. The ATS shall be listed under UL Standard 1008.

2.3 System Capacity.

2.3.1 The capacity of the installed generator system shall be rated at elevation to 300 feet above sea level and ambient temperature between -20 °F and +100 °F; continuous standby rating using engine-mounted radiator. The capacity includes the ten percent power factor and shall be the minimum capacity supplied for the unit.

2.4 Technical Submittal. The Contractor shall provide a complete technical submittal as outlined below and shall not proceed with procurement until the Engineer has approved the

submittals in accordance with Section 105.02. See additional Special Provisions for other ITS devices required as part of the Project Technical Submittal.

2.4.1 The Contractor shall provide drawings, manufacturer's specifications, electrical load calculations, and applicable catalog cuts for all materials and components for this work, submitted in accordance with Section 105.02.

2.4.2 Shop Drawings for the generator shall include plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements and electrical diagrams including schematic and interconnection diagrams.

2.4.3 Submittals are required for the following equipment items:

2.4.3.1 Standby Generator with Accessories

2.4.3.2 Exhaust Silencer, Exhaust Piping, and Flexible Exhaust

2.4.3.3 Batteries

2.4.3.4 Battery Charger

2.4.3.5 Vibration Isolators

2.4.3.6 Control Panel and Wiring Diagrams

2.4.3.7 Main Circuit Breaker

2.4.4 Shop drawings for the ATS shall be prepared by the Contractor shall include plan and elevation views with overall and point dimensions and electrical diagrams including schematic and interconnection diagrams. The manufacturer's product data for transfer switches shall show overall dimensions, electrical connections, electrical ratings and compliance with environmental constraints. The installation instructions prepared by the manufacturer shall be provided.

2.4.5 The following ATS operation and maintenance data prepared by the manufacturer shall be provided:

2.4.5.1 Instructions for operating equipment.

2.4.5.2 Identification of operating limits which may result in hazardous or unsafe conditions.

2.4.5.3 Document ratings of equipment and each major component.

2.4.5.4 Routine preventive maintenance and lubrication schedule.

2.4.5.5 List of special tools, maintenance materials and replacement parts.

2.5 Manufacturer Requirements.

2.5.1 It is the intent of these Specifications that a completely operable generator be furnished and delivered by the Contractor. All items shall be coordinated to provide an integrated system, insuring reliability of operation and convenience for maintenance and repair. The generator shall be composed of all items of new manufacture.

2.5.2 The supplier of the generator must have a local and nationwide sales and service organization. Units assembled by the Contractor from several manufacturers' components will not be acceptable.

2.5.3 Parts and service must be available locally on a 24-hour a day basis (this shall include engine, generator and control cabinet parts) so that the Authority shall not be penalized due to a breakdown.

2.5.4 Supervision of coordination of components must be given by the manufacturer of the unit.

2.5.5 Unit start-up service and load testing shall be performed by a factory trained representative.

2.5.6 Furnish service and maintenance of packaged engine generator system for one year from date of final acceptance of this Contract.

2.5.7 Acceptable Manufacturers for the Generator and ATS are the following:

2.5.7.1 Cummins Power Generation

2.5.7.2 Caterpillar Engine Division

2.5.7.3 Kohler Co. Generator Division

2.5.7.4 Automatic Switch Company (for ATS only)

2.6 Engine Characteristics.

2.6.1 Engine type shall be water-cooled inline or V-type, four stroke cycle, compression ignition, and internal combustion engine. The engine shall be EPA Tier IV compliant.

2.6.2 Engine shall be sufficient to operate at 10 percent overload for any two-hours of a 24-hour period at specified elevation and ambient limits.

2.6.3 Engine shall have a diesel fuel system.

2.6.4 Engine speed shall be rated at 1800 revolutions per minute (RPM).

2.6.5 Generator shall have an isochronous-type governor to maintain engine speed within 0.25 percent, steady state and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

2.6.6 Engine shall be equipped with safety devices capable of engine shutdown on high water temperature, low oil pressure, overspeed and engine over-crank NFPA Package.

2.6.7 Engine shall be equipped with a DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions.

2.6.8 Engine shall be equipped with an engine jacket/block heater with thermal circulation-type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F and suitable for operation on 120 volts AC.

2.6.9 Engine mounted radiator shall use a glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Air Flow Restriction: 0.5 inches of water maximum. Provide antifreeze to -32°F for generator engines.

2.6.10 Engine shall be equipped with and Exhaust Silencer.

2.6.10.1 Residential level exhaust silencer shall have side inlet and end outlet.

2.6.10.2 Flexible exhaust connections shall be stainless steel.

2.6.11 Engine shall be equipped with the following accessories: lube oil filter, intake air filter, lube oil cooler, and gear-driven water pump. The engine shall include water temperature gage and lube oil pressure gage on engine-generator control panel.

2.6.12 Engine shall be mounted with suitable vibration isolators to provide 95 percent vibration elimination and mounted on structural steel base.

2.6.13 Contractor shall supply a battery/batteries as recommended by the manufacturer.

2.7 Generator Characteristics.

2.7.1 Generator shall be 120V/208V, 60 Hz, Three Phase, 60 kW minimum Standby with a minimum 10 percent Surge rating.

2.7.2 Generator shall be completely brushless synchronous type, single bearing, directly connected to the engine flywheel and housing. Frame to be drip proof intake, open exhaust.

2.7.3 The generator shall be supplied with pole face (amortisseur) windings. The direct axis transient reactance shall not be greater than 20 percent based on rated KW, 0.8 P.F. when operating at 1800 RPM. Waveform deviation factor not to exceed 10 percent no load, line to line, or line to neutral.

2.7.4 Generator insulation shall be ANSI/NEMA MG 1, Class F.

2.7.5 Temperature Rise: 105°C continuous, 130°C standby

2.7.6 Generator shall be equipped with an enclosure that meets the following requirements:

2.7.6.1 ANSI/NEMA MG 1; open drip proof. Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and controls shall be mounted within enclosure.

2.7.6.2 Engine Colling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

- Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
- Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

2.7.6.3 The generator's finish shall be the Manufacturer's standard finish over corrosion resistant pretreatment with compatible primer.

2.8 Exciters.

2.8.1 The exciter field shall be of a single field construction with the exciter armature of the inboard rotating type, mounted on the alternator shaft, the output of which shall supply DC excitation for the main rotating field connected to a rotating rectifier bridge assembly. It must be possible to measure the DC voltage output of the rotating rectifier bridge to eliminate damage to this bridge due to excessive inverse voltages that occur when paralleling is attempted without regard to synchronization, short circuits and application of the generator across the line while the rotor is in a stationary position.

2.8.2 The rectifiers must be selected such that rated load conditions on the generator will not cause an average current per rectifier to exceed two-thirds the rated forward current of the rectifier, nor the peak inverse voltage of any one rectifier.

2.9 Regulator Characteristics.

2.9.1 The voltage regulator shall be of the static single field type capable of regulating the voltage output to within one percent of the adjusted voltage for any rated load conditions between no load and full load between 0.8 P.F. and 1.0 P.F. The regulator must be capable of adjustment

from ten percent below the lowest rated voltage and ten percent above the highest rated voltage at no load.

2.9.2 The voltage regulator shall have built-in EMI suppression and built-in under frequency protection.

2.10 Generator Control Cabinet Characteristics.

2.10.1 Generator Control Cabinet shall be NEMA Class 1 drip proof and shall include:

2.10.1.1 Main circuit breaker

2.10.1.2 Voltmeter (with light and audible alarm for over voltage)

2.10.1.3 Ammeter

2.10.1.4 Frequency meter

2.10.1.5 Elapsed time meter

2.10.1.6 Voltage adjusting Rheostat

2.10.1.7 Circuit breaker for DC fields

2.10.1.8 Automatic engine starting with lights, and audible alarm(s), for low oil pressure, high and low coolant temperature protection, low coolant level, over-speed and over-cranking limiter-cyclic, 1-4 cranks over 90 sec. with all time sequences adjustable.

2.10.1.9 All devices shall be marked with nameplates and all leads shall be fully marked for easy identification and connection.

2.10.1.10 On/Off-Automatic run switch.

2.11 Battery Charger.

2.11.1 The battery charger shall be a SCR design, internally fused, with control to automatically charge and maintain the starting battery. The charger shall have a maximum charge rate of 2A at 12V and automatically taper to trickle charge. There shall be a manually set timer to provide an equalize charge for periods up to 12-hours.

2.12 Fuel System.

2.12.1 Fuel Oil Storage shall comply with NFPA 30.

2.12.2 Generator shall be equipped with a base-mounted fuel oil tank. The tank shall be factory installed and piped, complying with UL 142 fuel oil tank. Features shall include the following:

2.12.2.1 Tank level indicator

2.12.2.2 Fuel capacity sufficient for 24 hours continuous operation at 100 percent rated power output. Minimum fuel capacity of 133 gallons

2.12.2.3 Vandal-resistant fuel cap,

2.12.2.4 Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.12.2.5 In line fuel oil solenoid valve shall be code compliant in accordance with NFPA 37.

2.13 Automatic Transfer Switch Characteristics.

2.13.1 Standard automatic transfer switch shall be rated for 120/208 volts, three phase, 200 amp minimum.

2.13.2 The complete automatic transfer switch shall be designed and tested by manufacturer. It shall include necessary relays and component parts, together with electrically and mechanically interlocked switch and shall provide the following functions:

2.13.2.1 Upon power line outage, automatically start generator and when generator comes up to voltage, disconnect load circuits from main line and transfer them to standby generator output.

2.13.2.2 Upon normal power line, return transfer load back to line and stop generator.

2.13.2.3 Rating of transfer switch shall be sufficient to handle capacity of loads being transferred and allow for short circuit currents of 20 times full load rating for one second.

2.13.2.4 Automatic transfer switch shall be mechanically held, electrically operated type rated for continuous duty in an unventilated sheet metal enclosure. The switch shall be double throw having electrically operated normal-emergency positions inherently interlocked mechanically and with main contacts mechanically attached to a common shaft. A manual operator shall be provided.

2.13.2.5 All main contacts shall be silver alloy wiping-action type. They shall be protected by arcing contacts. All switch and relay contacts, coils, springs and control elements shall be removable from the front of the transfer switch without removal of the switch panels from the enclosure and without disconnection of drive linkages or power conductors. Sensing

and control relays shall be continuous duty industrial control type with minimum contact rating of 10 amperes.

2.13.2.6 Under-voltage Protection: Solid state voltage sensitive devices shall be provided to monitor normal power source and signal emergency power to start and assume load, on a partial loss of power on any phase or where feedback voltages exist. These shall have calibrated dial adjustments and be temperature compensated for a maximum deviation of ± 2 volts, from -25° F to 175° F

2.13.2.7 Time Delay to Start Emergency Power: A time delay, adjustable from 0.5 to 6 seconds, shall be provided to prevent emergency power from needless starting and stopping during periods of momentary voltage fluctuations from normal power source. Preset default shall be set at three seconds.

2.13.2.8 Time Delay to Pick-up Load: A time delay, adjustable from zero seconds to 50 seconds, shall be provided to prevent emergency power from accepting load until emergency power operates unloaded for a predetermined period of time. Preset default shall be set at ten seconds.

2.13.2.9 Time Delay to Retransfer Load: After normal power has returned to service, a time delay adjustable from 1 minute to 30 minutes shall be provided to delay retransferring load to normal power for purpose of (a) overriding initial voltage fluctuations of returning normal power and (b) providing a predetermined minimum period of operating time for emergency power. If generator should fail during delay period, time delay shall be bypassed and load instantly retransferred to normal power. Preset at 15 minutes.

2.13.2.10 Time Delay to Stop Engine: After load has been retransferred to normal power, a time delay, adjustable from 1 minute to 30 minutes, shall be provided to allow engine to cool by permitting generator to operate unloaded for a predetermined period of time before shutdown. Preset at 15 minutes.

2.13.2.11 Automatic Exerciser: Means shall be provided to automatically start and run generator for a set period of time for purpose of testing or exercising complete engine, alternator and load transfer control. After completion of set period of time for testing and exercising, emergency source shall be automatically shutdown. Such periods for testing or exercising shall be adjustable in multiples of 15 minutes per period with period repeated on any combination of days over a cycle of seven days before recycling. Preset the transfer switch to test and exercise the generator system for every Wednesday at 8:00 AM.

During period of testing or exercising, emergency power shall assume load.

2.13.2.12 Test Switch: Provide to simulate a normal source failure.

2.13.2.13 Disconnect Device: Provide means to electrically disconnect control section from transfer switch to permit safe access for maintenance or service of control, during periods of normal operation.

2.13.2.14 Normal and Emergency Lamps: Colored indicating lights shall be provided on the enclosure door and labeled to indicate transfer switch position: Green - normal source; Red - emergency.

2.13.2.15 Provide two auxiliary contacts, one to close and the other to open when normal source fails in addition to any contacts needed to accomplish the requirements of this Contract.

Construction Requirements

3.1 Standby emergency generator shall be installed in compliance with the requirements of Article 700 of NFPA 70 - National Electrical Code. All fueling connections shall be in accordance with NFPA 37 Chapter 4-3. All connections and controls shall be complete to form a complete, operable system.

3.1.1 This project is subject to compliance with all requirements of the Occupational Safety and Health Administration (OSHA). All work on this project must meet the requirements of all applicable federal, state, and local codes, laws, and ordinances.

3.2 The Contractor shall engage the services of a qualified factory Engineer to confirm the compliant installation of standby electric generator.

3.2.1 The Contractor and the qualified factory Engineer shall provide training to instruct the Maine Turnpike Authority's personnel as to operation and maintenance of the complete system. A minimum of four hours on-site training shall be provided to demonstrate proper generator system operation, adjustments, and servicing, including operation and maintenance of the ATS.

3.3 The Contractor shall furnish the Engineer with manufacturer's certification and warranty assuring each item of equipment is complete and in good condition, free from damage, properly installed, connected, adjusted and tested as to full power rating, stability and voltage and frequency regulation.

3.4 The ATS shall be installed and connected by others in accordance with the manufacturer's recommendations and the NEC including NEC Article 700.

3.5 In the event the ATS is from a different manufacturer than the generator, the Contractor shall engage the services of a qualified factory Engineer from the manufacturer of the engine generator to personally supervise the compliant connections and integration of the ATS to the engine generator.

3.6 Operation and Maintenance Manuals. The Contractor shall provide three sets of manuals prepared by the generator manufacturer (and by the ATS manufacturer if different than the generator manufacturer) containing spare parts list, complete wiring diagrams, maintenance, operating and repair instructions for each piece of equipment furnished under this Contract. The

manuals shall also include instructions for normal operation, routine maintenance requirements; service manuals for engine, generator and all serviceable components; oil sampling and analysis for engine wear, and emergency maintenance procedures. All materials are to be submitted and approved by the Engineer prior to final payment.

3.7 Final System Inspection and Test

3.7.1 After the systems and equipment are completely installed and, at such time as the Engineer may direct, the Contractor shall conduct an operating test for approval and acceptance by the Authority. The test shall be performed in the presence of and witnessed by the Engineer. Advance approval of equipment or materials will not constitute a waiver of the requirements that the equipment or materials shall be demonstrated to operate in accordance with these Specifications.

3.7.2 The test shall be a resistant load bank test. The load bank shall be adjustable resistive loads and shall be provided by the Contractor for the testing. The engine generator is to be tested under the following loads and durations:

3.7.2.1 50 percent load for one-hour.

3.7.2.2 75 percent load for one-hour.

3.7.2.3 100 percent load for two-hours.

3.7.3 Within seven (7) days following completion of the testing, the Contractor shall provide written test data and results to the Engineer.

3.8 Final Cleaning. Prior to the start of the Maintenance and Warranty period and at the completion of the Maintenance and Warranty period, the Contractor shall provide cleaning service for the generator equipment.

3.8.1 Contractor shall clean engine and generator surfaces.

3.8.2 Contractor shall change the oil and replace oil filter(s).

3.8.3 Contractor shall clean the ATS and touch up any marred surfaces.

3.8.4 Contractor shall fill/top off the fuel tank(s).

3.9 Maintenance Service. The Contractor shall be responsible for a minimum of 2 years of warranty and maintenance service as part of the Project's Warranty and Maintenance requirements.

3.9.1 Initial Maintenance Service: Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide replacement parts and supplies same as those used in the manufacture and installation of original equipment.

3.10 Warranty.

The complete electrical power system (diesel engine powered generator, controls, and associated switches, switchgear, and accessories), as provided by the single source manufacturer shall be warranted by said manufacturer against defects in materials and workmanship for a period of five years, or 1500 operational hours, whichever occurs first from the date of Final System Acceptance. Said coverage shall include replacement parts for the entire coverage period, as well as labor to replace warrantable parts through the second year of coverage, per the manufacturer's standard published limited warranty. There shall be no deductibles applied to the warranty. A copy of written warranty shall be attached to the Technical Submittal.

3.11 Spare Materials.

3.11.1 Contractor shall furnish one set of specialty tools (any tool required for maintenance, but not typical to a mechanics toolbox) required for preventative maintenance of the engine generator system. Package tools in adequate size metal toolbox.

3.11.2 Provide two additional sets of each oil and air filter element required for the engine generator system.