

PART 1 - GENERAL

1.1 WORK INCLUDED

- .1 The Work of this Section includes the design, fabrication, warranty, supply and installation for a Package Diesel Generator as specified and includes furnishing all materials, labour, tools, equipment and performing all operations necessary including supervision of installation, field testing, fueling and commissioning.
- .2 Installation includes new double wall fuel tank, spill containment accessories, vent whistler and fuel piping.
- .3 Verification that the fuel tank and fuel installation has been completed by a certified petroleum tank installer recognized by the Province of Nova Scotia.
- .4 Instrumentation to tie into existing Veeder Root TLS-300C fuel monitor system.

1.2 REFERENCES

- .1 NEMA MG1-2011, Motors and Generators.
- .2 CSA C282-15, Emergency Electrical Power Supply for Buildings.
- .3 ISO 3046/1-2002, Reciprocating Internal Combustion Engines: Part I Performance.
- .4 CSA C22.1-2015, Canadian Electrical Code, Part 1.
- .5 CSA C22.2 No. 14-13, Industrial Control Equipment.
- .6 CSA C22.2 No. 5-13, Moulded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures.
- .7 API Standard 650-2014, Welded Steel Tanks for Oil Storage.
- .8 ASTM D975-15, Standard Specification for Diesel Fuel Oils.
- .9 ULC142.18-95, Rectangular Steel Aboveground Tanks for Flammable and Combustible Liquids.
- .10 CCME PN1326.

- .11 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Product Regulations
- .12 ULC S661-10, Standard for Overfill Protection Devices for Flammable and Combustible Liquid Storage Tanks

1.3 RELATED WORK

- .1 Metal Fabrications: Section 05 50 00.
- .2 Electrical General Requirements: Section 26 05 00
- .3 Automatic Load Transfer Equipment: Section 26 36 23
- .4 Moulded Case Circuit Breakers: Section 26 28 21
- .5 Building Automation System: Section 25 00 00.

1.4 DESCRIPTION OF SYSTEM

- .1 System will consist of: an exterior self-contained weatherproof generator set with aluminum enclosure, base mounted fuel tank and access platforms; exterior rated weatherproof electric load bank.
- .2 The generator set and load bank must be of proven standard design with a record of satisfactory performance; prototypes will not be accepted. Where any provision of this specification causes a deviation from the Manufacturer's normal practice such as to materially impair performance, price or delivery of the equipment, the Manufacturer must call attention to this in their quotation and must offer their normal standard equipment as an alternative.
- .3 Generating system consists of:
 - .1 Diesel engine.
 - .2 Alternator.
 - .3 Alternator control panel.
 - .4 Battery charger and batteries.
 - .5 Fuel supply system.
 - .6 Exhaust system.
 - .7 Steel mounting base.
 - .8 Block heater.
 - .9 Sub-base double walled fuel tank.
 - .10 Weather protective enclosure for exterior installation (non-walk in type).
 - .11 Fuel filters.
 - .12 Air filter.
 - .13 Environmental protection from fuel spills (drip pans).

- .14 Systems to be designed to operate as emergency standby, unattended in remote location.
 - .15 System to be completely self-contained in an aluminum, weather tight enclosure.
 - .16 Provide control system complete with BACNET connectivity.
 - .17 Remote control panel for monitoring and control from owner maintenance office.
 - .18 Controls for shut down from a contact closure. Auto load dump circuit.
 - .19 Instrumentation and control panel for fuel inventory and quality control to integrate into existing Veeder Root TLS-300C monitoring system.
 - .20 Necessary fuel oil to commission and test equipment plus full tank of fuel left after load bank test.
- .4 Outdoor resistive load bank consists of:
- .1 Exterior enclosure and controls rated for -40°C.
 - .2 Blower.
 - .3 Lug compartment for incoming cables.
 - .4 Automatic load remote controller mounted in owners maintenance office.
 - .5 Controls for shut down from a contact closure. Auto load dump circuit.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Engine: make and model, with performance curves.
 - .2 Alternator: make and model.
 - .3 Voltage regulator: make, model and type.
 - .4 Battery: make, type and capacity.
 - .5 Battery charger: make, type and model.
 - .6 Alternator control panel: make and type of meters and controls.
 - .7 Governor type and model.
 - .8 Cooling air requirements in m³/s.
 - .9 British standard or DIN rating of engine.
 - .10 Flow diagrams for:
 - .1 Fuel.
 - .2 Cooling air.
 - .11 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, radiator, drip trays, and total weight.
 - .12 Continuous full load output of set at 0.8 PF lagging.

- .13 Description of set operation including:
 - .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
 - .2 Manual starting.
 - .3 Automatic shut down and alarm on:
 - .1 Overcranking.
 - .2 Overspeed.
 - .3 High engine temp.
 - .4 Low lube oil pressure.
 - .5 Short circuit.
 - .6 Alternator overvoltage.
 - .7 Lube oil high temperature.
 - .8 Over temperature on alternator.
 - .4 Manual remote emergency stop.
- .14 Sub-base mounted fuel tank system including all associated instrumentation. Fill location, vent location and schematic of fuel system.
- .15 Sound attenuated weather proof enclosure.
- .16 Paint chips for approval. Custom paint color is to match new building cladding finish.
- .17 Remote control panel.
- .18 BACNET communication interface with remote control panel.
- .19 Detailed dimensions of exterior load bank showing:
 - .1 Anchor bolt locations.
 - .2 Venting air distribution and required clearance dimensions.
 - .3 Detailed internal wiring schematics showing internal overload and over temperature protection.
 - .4 Details of cold weather package.
 - .5 Detailed drawing of elevating stand.
 - .6 Wiring diagram of remote mounted control panel.
 - .7 Automatic load controller.
 - .8 Details of artic modification for ratings down to -40°C.
- .20 Veeder Root:
 - .1 Product float.
 - .2 Water float.
 - .3 Probe installation kits.
 - .4 Field termination unit.
 - .5 Cabling details.
 - .6 Contact: Henry Lopez from PetroMax,
hlopez@petromax.ca, cell: (902) 456-4551.
- .21 Detailed connection diagram for integration into existing Veeder Root fuel monitoring system.

- .22 Overfill Protection Valve:
 - .1 Tank inlet spout adaptor with crossbar complete with dust cap.

1.6 OPERATION AND MAINTENANCE DATA

- .1 Provide copies of operation and maintenance data for diesel generator as described in Section 01 78 00.
- .2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:
 - .1 Operation and maintenance instructions for engine, alternator, control panel, battery charger, batteries, fuel system, engine room ventilation system, block heater, exhaust system and accessories, to permit effective operation, maintenance and repair.
 - .2 Technical data:
 - .1 Illustrated parts lists with parts catalogue numbers.
 - .2 Schematic diagram of electrical controls.
 - .3 Flow diagrams for:
 - .1 Fuel system.
 - .2 Lubricating oil.
 - .3 Cooling system.
 - .4 Certified copy of factory test results.
 - .5 Maintenance and overhaul instructions and schedules.
 - .6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.7 MAINTENANCE SPARES

- .1 Include:
 - .1 Two (2) fuel filter replacement elements.
 - .2 Two (2) lube oil filter replacement elements.
 - .3 Two (2) air cleaner filter elements.
 - .4 Two (2) sets of fuses for control panel.
 - .5 Special tools for unit servicing as recommended by the manufacturer.
 - .6 Two (2) alternator belts.
 - .7 Two (2) fan belts, for generator radiator fans as well as electric load bank blower.

1.8 SOURCE QUALITY CONTROL

- .1 Factory test generator set including engine, alternator, control panels, transfer switch and accessories.
- .2 Provide four (4) copies of factory test results to the Departmental Representative for inclusion into the Operations and Maintenance Manual.
- .3 Test procedure:
 - .1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:
 - .1 Date.
 - .2 Generator set serial no.
 - .3 Engine, make, model, serial no.
 - .4 Alternator, make, model, serial no.
 - .5 Voltage regulator, make and model.
 - .6 Rating of generator set, kW, kVA, V, A, r/min, Hz.
 - .2 Mark check sheet and record data on forms in duplicate as test proceeds.
 - .3 Signature of manufacturer's Quality Control representative on completed forms to indicate concurrence in results of test.
- .4 Tests:
 - .1 Standard Factory Tests as recommended by manufacturer and as per CSA C282.
- .5 Demonstrate:
 - .1 Automatic shutdown of engine on resumption of normal power.
 - .2 That battery charger reverts to high rate charge after cranking.
 - .3 Automatic start-up of genset upon signal from automatic transfer switch.
- .6 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

1.9 EXTENDED WARRANTY

- .1 Diesel engine generator set to be warranty covered for 60 months or 1500 operating hours, whichever occurs first from the date of Substantial Performance.
- .2 Warranty to be comprehensive. No deductibles will be allowed for travel time, expenses, part and labour.
- .3 Contract will include a full one (1) year servicing 365 day after substantial completion. Servicing to include replacement of all fluids, filter (air and fluids) cleaning and a full inspection of rotating parts. Worn or faulty parts are to be replaced with no cost for labour or materials.

- .4 On the anniversary of the 1 year warranty the contractor is to preform spectrographic oil and coolant analysis, fuel cleaning, and clear and bright test on the fuel system. A complete CSA 282 inspection and report are to be completed at this time. Change all filters (air, fuel and oil), belts, block heater elements, and fuses.
- .5 Provide a complete set of spare parts for the generation system including: air filters, oil filters, fuses, block heater elements and belts. These spare are to remain on site and are not to be used at the one year maintenance service provided under this contract.

1.10 SERVICE AND SUPPORT

- .1 Manufacturer of the generator set to maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
- .2 Equipment vendor must demonstrate with shop assurance drawings submittals that local representative can service generator.
- .3 The generator set must be serviced by a local service organization that is trained and factory certified in generator set service that maintains an inventory of critical replacement parts at the local service organization and in service vehicles. The service organization must be on call 24 hours per day, 365 days per year. Service Company to be able to respond to maintenance request from CFIA within two (2) hours
- .4 Manufacturer to maintain model and serial number records of each generator set provided for at least 20 years.

PART 2 - PRODUCTS

2.1 GENERATOR SET

- .1 Ratings:
 - .1 Generator set to operate at 1800 rpm and at a voltage of 600 Volts AC, 3-phase, 4-wire, 60 Hertz.
 - .2 Generator set to be rated at the minimum kW/kVA rating at 0.8 PF as indicated on the drawings, based on site conditions of: Altitude 64 meters, ambient temperatures up to 40 degrees C.
 - .3 Base the generator set rating on emergency/standby service.

- .2 Performance:
 - .1 Voltage regulation must be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load must not exceed plus or minus 0.5 percent.
 - .2 Frequency regulation to be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
 - .3 The diesel engine-generator set must be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
 - .4 The generator set must be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
 - .5 The alternator must produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.
 - .6 Generator start up time to meet CSA C282 6.4.1 (15 Seconds).
- .3 Construction:
 - .1 Mount the engine-generator set on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails
 - .2 All switches, lamps, and meters in the control system must be oil-tight and dust-tight, and the enclosure door gasketed. There must be no exposed points in the control (with the door open) that operate in excess of 50 volts.
- .4 Connections:
 - .1 The generator set load connections must be composed of silver flashed or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Provide a sufficient lug space for use with cables of the number and size as shown on the drawings.
 - .2 Make power connections to auxiliary devices at the devices.
 - .3 Make generator set control interfaces to other system components on a common, permanently labelled terminal block assembly.

2.2 ACCESS PLATFORMS

- .1 Access platforms, stairs and handrails are to be supplied and installed to access three (3) sides of the generator. Access platforms are to be of equal height of base tank with a top surface constructed of open grating support legs fabricated of 51mm x51mm HSS (6.4mm wall). Handrails fabricated of 42.2 mm O.D. schedule 80 pipe. The concrete slab under the catwalk slopes. Verify the slab elevations prior to fabrication of the support legs.

- .2 Access platforms are to be free standing and not attached to the generator or base tank. Final dimensions of the access platform are to be determined after the generator is sitting in its final location. Provide detailed fabrications drawings for review.
- .3 Access platforms and all associated hardware are to be hot dipped galvanized steel.
- .4 Provide hot dipped galvanized steel filler between side walk and generator to allow a maximum gap of 25mm. Minimum material thickness to be 12mm.

2.3 ENGINE AND ENGINE EQUIPMENT

- .1 Diesel engine: to ISO 3046/1.
 - .1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.
- .2 Turbo charged synchronous speed 1800 r/min, radiator and fan cooled.
- .3 The horsepower rating of the engine at its minimum tolerance level must be sufficient to drive the alternator and all connected accessories.
- .4 Cooling System:
 - .1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side with ethylene glycol anti-freeze non-sludging above minus 46°C.
 - .2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 50°C.
 - .3 Coolant heater: thermostatically controlled liquid coolant heating system, sized in accordance with manufacturer's recommendations and complete with thermostat and single point AC power connection heater (208 VAC single-phase, powered from local distribution panel). Provide shut-off valve directly on engine block.
- .5 Fuel: Grade No. 2 diesel to ASTM D975 Ultra Low Sulphur Diesel.
- .6 Fuel system: engine driven solid injection, mechanical positive displacement fuel pump, replaceable fuel filters, fuel rack solenoid energized when engine running, flexible supply and return fuel lines.

- .7 Governor:
 - .1 Steady state speed band of plus or minus 0.5%.
 - .2 Speed regulation no load to full load 5% maximum.
 - .3 Electronic type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.
- .8 Lubrication system:
 - .1 Pressure lubricated by engine driven positive displacement mechanical oil lubrication pump.
 - .2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
 - .3 Lube oil cooler.
 - .4 Provide automatic oil top-up reservoir. Capacity large enough to run the generator at no load for a three day long weekend (72 hours).
 - .5 Engine sump drain valve.
 - .6 Oil level dip-stick.
- .9 Starting system:
 - .1 Positive shift, gear engaging starter 24 Vdc.
 - .2 Cranking limiter to provide three (3) cranking periods of 15 s duration, each separated by 15 s rest without overheating.
 - .3 24 Vdc starting batteries with sufficient capacity to crank engine for 1 min at 0°C without using more than 25% of ampere hour capacity. Provide a battery switch and a full set of redundant batteries to meet the above performance criteria. The battery switch will be used to isolate a set of batteries to perform maintenance activities. Batteries to be mounted in battery tray complete with battery cables and connectors.
 - .4 Independent battery charger for each set of batteries: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 2% output for plus or minus 10% input variation. Equipped with dc voltmeter, dc ammeter and on-off switch. Charger shall be suitable for connection to 15A, 120 V, 1-phase, 60 Hz supply (powered from local distribution panel). Charger shall be complete with "alarm" lights (loss of AC power, low battery voltage, high battery voltage), "power on" light and a dry form 'C' contact (rated 4A, 120V) for each alarm condition for remote monitoring.
- .10 Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer.
- .11 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.
- .12 Drip trays.

- .13 Replaceable dry element air cleaner with restriction indicator.

2.4 ALTERNATOR

- .1 Alternator: to NEMA MG1.
- .2 The alternator must be capable of delivering rated output (KVA) at rated frequency and power factor, at any voltage not more than 5% above or below rated voltage.
- .3 Output at 40°C ambient:
 - .1 100% full load continuously.
 - .2 110% full load for 1 h.
- .4 Four-pole, 2/3 pitch, revolving field, brushless, single pre-lubricated sealed bearing.
- .5 Amortisseur windings.
- .6 Synchronous type.
- .7 Exciter: permanent magnet.
- .8 All insulation system components shall meet NEMA MG-1 temperature limits for class H insulation.
- .9 Digital voltage regulator: microprocessor based, programmable operating characteristics, over excitation protection, fault detection logging, digital display, remote communication capability, adjustable overvoltage and under voltage protection, true RMS 3-phase voltage monitoring, rotating diode monitor, under frequency protection, and solid state voltage buildup.
 - .1 Regulation: $\pm 0.5\%$ no load steady state to full load steady state.
 - .2 Regulation temperature drift: less than 0.5% for any 33°C change over the operating temperature range.
 - .3 Programmable V/Hz characteristic: two (2) slope ranges adjustable from 1-10V/Hz.
 - .4 Regulator response time: maximum of 10ms.
 - .5 Regulating sensing: True RMS 3-phase with variable sense range from 90 to 600 Vac.
 - .6 Regulator stability: stable for total harmonic distortion of the generator output voltage waveform up to 20%.
 - .7 Voltage adjust range: -10% to 10% of regulator sensing voltage.
 - .8 Regulator voltage gain: 0-10%.
 - .9 Reactive droop adjustment: 0-10%.

- .10 Alternator: capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.
- .11 The sub transient reactance of the alternator must not exceed 12%, based on standby rating of the generator set.

2.5 GENERATOR SET CONTROL

- .1 Provide the generator set with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system must also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. Mount the control on the generator set. The control must be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. Generator set mounted control to include the following features and functions:
 - .1 Control switches:
 - .1 Mode Select Switch: The mode select switch will initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set will immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - .2 EMERGENCY STOP switch: Switch to be Red "mushroom-head" push-button. Depressing the emergency stop switch will cause the generator set to immediately shut down, and be locked out from automatic restarting.
 - .3 RESET switch: use the RESET switch to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 - .4 PANEL LAMP switch: Depressing the panel lamp switch will cause the entire panel to be lighted with DC control power. The panel lamps will automatically be switched off within a pre-set time delay after the switch is depressed, or after the switch is depressed a second time.
 - .2 Generator Set AC Output Metering:
 - .1 Provide the generator set with a metering set including the following features and functions as a minimum:
 - .1 Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage will be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

- .3 Generator set alarm and status display:
 - .1 Provide the generator set with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. Lamps to be high-intensity LED type. The lamp condition must be clearly apparent under bright room lighting conditions. The generator set control will indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
 - .1 Low oil pressure (alarm)
 - .2 Low oil pressure (shutdown)
 - .3 Oil pressure sender failure (alarm)
 - .4 Low coolant temperature (alarm)
 - .5 High coolant temperature (alarm)
 - .6 High coolant temperature (shutdown)
 - .7 Engine temperature sender failure (alarm)
 - .8 Low coolant level (alarm or shutdown--selectable)
 - .9 Fail to crank (shutdown)
 - .10 Fail to start/overcrank (shutdown)
 - .11 Overspeed (shutdown)
 - .12 Low DC voltage (alarm)
 - .13 High DC voltage (alarm)
 - .14 Weak battery (alarm)
 - .15 High AC voltage (shutdown)
 - .16 Low AC voltage (shutdown)
 - .17 Under frequency (shutdown)
 - .18 Over current (warning)
 - .19 Over current (shutdown)
 - .20 Short circuit (shutdown)
 - .21 Over load (alarm)
 - .22 Emergency stop (shutdown)
 - .23 Low fuel level
 - .2 Provide hardware required to connect generator control/monitoring system to Owners building automation system. Connectivity to use BACNET protocol Provide full alarm list in new DDC graphical interface.

- .4 Engine status monitoring:
 - .1 The following information must be available from a digital status panel on the generator set controls as well as remote control panel and through BACNET connectivity:
 - .1 Engine oil pressure (psi or kPA)
 - .2 Engine coolant temperature (degrees F or C)
 - .3 Engine oil temperature (degrees F or C)
 - .4 Engine speed (rpm)
 - .5 Number of hours of operation (hours)
 - .6 Number of start attempts
 - .7 Battery voltage (DC volts)
 - .2 Control system to also incorporate a data logging and display provision to allow logging of warning or shutdown indications (minimum of last 10) on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
- .5 Engine control functions:
 - .1 Control system provided to include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
 - .2 Control system to include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system will be disabled.
 - .3 Control system to include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. Governor control to include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control must be suitable for use in paralleling applications without component changes.
 - .4 Control system to include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
 - .5 Control system to include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

- .6 Alternator control functions:
 - .1 Generator set to include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It must be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. Equip the voltage regulation system with three-phase RMS sensing and control buildup of AC generator voltage to provide a linear rise and limit overshoot. System to include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 HZ. Voltage regulator to include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
 - .2 Provide controls to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. Controls to shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). Provide protective functions in compliance to the requirements of NFPA 70, article 445.
 - .3 Provide controls to individually monitor all three phases of the output current for short circuit conditions. The control/protection system will monitor the current level and voltage. The controls must shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). Provide protective functions in compliance to the requirements of NFPA70, article 445.
 - .4 Provide controls to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls to include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
 - .5 Provide an AC over/under voltage monitoring system that responds only to true RMS voltage conditions. The system must initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown will occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
 - .6 Provide a battery monitoring system which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit will be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

- .7 Control interfaces for remote monitoring: bring all control and interconnection points from the generator set to remote components to a separate connection box. Do not make field connections in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:
 - .1 Provide Form "C" dry contact set rated 15A @ 120V (minimum) to indicate each of the following: generator common alarm and generator not-in-auto.
 - .2 Provide four (4) N.O. generator run isolated contacts, rated 5A @ 120V (minimum) and wired to terminals for connection to ventilation systems and/or remote monitoring system.
- .8 Provide a remote generator control panel to duplicate the on-board controls. Fabricate a CSA certified control panel under a common cover including: generator remote control panel, load bank remote control panel and generator remote 'E'-stop.

2.6 STEEL MOUNTING BASE

- .1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.
- .2 Assembly fitted with vibration isolators and control console resiliently mounted.
 - .1 Spring type isolators with adjustable side snubbers and adjustable for levelling.
- .3 Sound insulation pads for installation between isolators and concrete base.
- .4 Provide a double wall, sub-base tank. The fuel tank base capacity must permit the unit to operate at 100% load for a period of 72 hours and provided as an integral part of the enclosure. Contain the fuel tank in a rupture basin with 110% capacity. The tank must be manufactured and certified to meet ULC142.18 standards. Provide a locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact and fuel tank rupture alarm contact. Connect the low fuel level and rupture basin contacts to the generator set control panel to give alarm on these two conditions independently, provide a second connection of these points to the existing Veeder Root fuel monitoring panel in maintenance office.
 - .1 Provide tank complete with a lockable fill/spill box complete with 100mm fill connection, drain valve, 50mm spout adapter for tight-fill operation and lockable dustcap. Fill/spill box to be of adequate size to fit overflow prevention valve and spout adapter.

- .2 Overfill protection system is to conform to the Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME), Part 3.4 item 1
- .3 Secondary containment to meet CCME part 3.9 item 1.
- .4 75mm vent cap complete with vent whistle extended to top of enclosure. Paint to match enclosure finish.
- .5 Provide instrumentation and remote Veeder Root termination box for fuel tank monitoring. New devices are to be connected back to the existing Veeder Root monitoring system in the maintenance office. Instruments are to monitor:
 - .1 Fuel volume
 - .2 Fuel used
 - .3 Water volume
 - .4 Water level
 - .5 Temperature
- .6 Provide OPW overfill prevention valve and tank inlet spout adapter with cross bar and dust cap. Overfill protection to conform to CAN/ULC S661.
- .7 Provide all necessary apertures for instruments, vent fuel lines and fill lines.
- .8 On completion of the tank installation provide the following information before the system is put in service:
 - .1 Letter indicating the name of the certified installer and confirmation of date the installation was completed.
 - .2 As build fuel system installation drawing sealed by a Professional engineer.
 - .3 Nominal capacity of the storage tank system.
 - .4 Type of storage tank system.
 - .5 Tank's ULC or API standard number.
 - .6 Material used in the construction of each tank.
 - .7 Type of corrosion protection of each tank.
 - .8 Type of secondary containment of each tank.
 - .9 Type of overfill protection of each tank.
 - .10 Material used in the construction of the piping.
 - .11 Diameter of the piping.
 - .12 Type of corrosion protection of the piping.
 - .13 Type of spill containment devices.
 - .14 Type of leak detection.

- .9 Provide an extra-large mobile spill response cart containing:
 - .1 Large yellow rectangular weatherproof cart with signage.
 - .2 Pads quantity: 150.
 - .3 75mm x 1.2m sock quantity: 36.
 - .4 75mm x 3.6m socks quantity: 12.
 - .5 525mm x 5.2m pillows quantity: 16.
 - .6 Goggles.
 - .7 Nitrile gloves quantity 6 large pairs.
 - .8 Disposal bags quantity: 30.
 - .9 Wipes.
 - .10 Emergency response handbook.
 - .11 Provide hasp with pad lock capabilities.
 - .12 Secure cart to catwalk using Stainless steel chain and pad lock.

2.7 EXHAUST SYSTEMS

- .1 Heavy duty critical type horizontally mounted exhaust silencer with condensate drain, plug and flanged couplings.
- .2 Heavy duty stainless steel exhaust piping, with flanged connections, size and material as per manufacturer's specifications.
- .3 Fittings and accessories as required.
- .4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.
- .5 Through wall stainless steel timbale of suitable length to pass through wall and to absorb both vertical and horizontal expansion.
- .6 Insulate all exhaust components with high temperature (calcium silicate) insulation to 50 mm thickness.
- .7 Support exhaust system as required using vibration isolating pipe hangers.

2.8 CIRCUIT BREAKER

- .1 Provide integral moulded case circuit breaker to Section 26 28 21. Circuit breaker shall be factory wired to the generator complete with enclosure mounted on the generator skid.
- .2 Provide circuit breaker complete with provision to padlock in the off position.
- .3 Provide LSIG electronic trip unit.

2.9 WEATHER ENCLOSURE

- .1 Standard Non Walk-in Weather Enclosure:
 - .1 Weather resistant, sound attenuated enclosure of aluminum with electrostatically applied powder coated baked polyester paint complete with integral fuel tank. Custom colour is required to match building cladding.
 - .2 Sound pressure level not to exceed 85 dBA at 1 meter, and 75 dBA at 7.0 meters from the enclosure at full load.
 - .3 Enclosure to consist of a roof, side walls and end walls.
 - .4 All fasteners must be stainless steel.
 - .5 Enclosure to have the number of doors required so that all normal maintenance operations may be accomplished without disassembly of any enclosure components.
 - .6 Access doors must be fabricated of the same material as the enclosure walls and shall be reinforced for rigidity. Handles to be key lockable, all doors keyed alike, and hinges shall be stainless steel. Doors are to be keyed to CFIA's Sargent Restricted Master key system.
 - .7 Air intake silencer.
 - .8 Exhaust air silencer.
 - .9 Extend lube oil and coolant drains to the exterior of the enclosure and terminate with drain valves and capped with pipe nipples on flanged connectors.
 - .10 Radiator access to be through a hinged, lockable cover on enclosure.
 - .11 Cooling fan and charging alternator to be fully guarded to prevent injury.
 - .12 Enclosure sound attenuation: provide acoustical foam between all supports and inside doors and sound baffles on air intake and air discharge.
 - .13 Furnish a critical type silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized. Enclosure manufacturer to internally mount the exhaust silencer(s) and maintain the weather resistant integrity and aesthetic appearance of the system. Externally mounted silencers will not be permitted.
 - .14 Lifting points on base frame suitable for lifting combined weight on base fuel tank, generator set and enclosure. A tested and certified single point lifting facility to aid in generator placement.
 - .15 Provide a 15A, 120V GFCI duplex service receptacle (CSA 5-15R configuration) in the enclosure.
 - .16 Wire the packaged generator for a single point 120/208VAC, three phase, 4 wire, 60 Hz power circuit (amperage as required by the manufacturer), minimum 18 kA interrupting rating. Generator package to provide all necessary wiring, receptacles fusing and circuit breakers to distribute power to the various auxiliary devices (i.e., battery charger, block heater, receptacle, etc.).

- .17 Provide fibreglass, weather tight, LED strip light fixtures in continuous row on both sides of generator. LED fixtures are to extend from one end of the enclosure to the opposite end of the enclosure. Provide 3 way light switch for the generator lights to be located at opposite ends of the enclosure.
- .18 All exterior drains and fluid fill ports are to be lockable (padlock) to prevent security tampering.

2.10 FINISHES

- .1 Alternator control cubicle: paint inside, exterior to match engine and alternator.
- .2 Provide custom paint colour for exterior of generator enclosure, steel support base, base fuel tank and load bank. Provide paint sample for approval. Paint color to match new building cladding color.
- .3 Supply 0.25 L of touch-up enamel for all colours.

2.11 EQUIPMENT IDENTIFICATION

- .1 Control panels: To be complete with Generator voltages, kW and kVA rating and breaker sizing.

2.12 FABRICATION

- .1 Shop assemble generating units including:
 - .1 Base.
 - .2 Engine and radiator.
 - .3 Alternator.
 - .4 Control panel.
 - .5 Battery and charger.
 - .6 Enclosure.
 - .7 Subbase Tank.

2.13 OUTDOOR RESISTIVE LOAD BANK

- .1 Rating: 600 volt, 3 phase, 60 hertz, 650 kW (minimum).
- .2 Tolerance: +/- 5% overall load tolerance at rated voltage.
- .3 Duty cycle: rated for continuous operation.
- .4 Load steps: 50 kW steps (total of 13 steps).

- .5 Cooling system: integral blower complete with 600 volts, 3 phase motor.
- .6 Control power 120VAC, 1 phase.
- .7 Remote control panel mounted in NEMA 3R enclosure. Combined with generator remote control panel and generator 'E' stop.
- .8 Auto load dump circuit tied to the automatic transfer switch. If generator is running on the load bank and the power is lost to the building the transfer switch will switch off the load bank and pick up building load.
- .9 Rated for installation in -40°C.
- .10 Provide unit designed such that it does not require a cool down period in the event of a power loss.
- .11 Safety features to include:
 - .1 Branch circuit internal fusing.
 - .2 Differential pressure switch to provide protection on loss of cooling air.
 - .3 Over temperature switch.
 - .4 Blower motor thermal overload protection.
- .12 Provide custom paint finish to match building cladding colour.
- .13 Provide lug compartment for connection of incoming conductors.
- .14 Exhaust hood designed to prevent ice and snow buildup.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Handle and install equipment in strict accordance with manufacturer's instructions. Confirm such instructions are issued at time of shop drawing issue and are available on site when required.
- .2 Provide cast-in-place concrete equipment attachments as required by the equipment and as shown on the Drawings.
- .3 Provide correct type and full number, size and length of anchor bolts and other connecting bolts as required by equipment manufacturer. Preset anchor bolts in concrete where convenient; otherwise leave suitable openings in concrete and set anchor bolts later using Red-Head Epoxy anchors or other approved fastening methods.

- .4 Coordinate location and provide items for embedding into cast-in-place concrete.

3.2 RESPONSIBILITY OF TEMPORARY TRIAL USAGE

- .1 Obtain written permission from the Departmental Representative to use and test permanent equipment and systems prior to acceptance.
- .2 The guarantee period must not be affected by temporary trial use of the equipment.
- .3 Clean and renew equipment and systems used before acceptance. Restore to original or new working condition.
- .4 Protect equipment and systems openings from dirt, dust and other foreign materials during temporary usage.

3.3 INSPECTION, TESTING AND START-UP

- .1 Provide the services of competent servicemen, mechanics or other trained personnel of the equipment supplier's or manufacturer's to check the complete installation and be present for start-up of the equipment. Submit a written report signed by the equipment manufacturer's representative to the Departmental Representative stating the following:
 - .1 That a satisfactory installation of equipment has been performed and outlining any modifications that have been made as a result of the commissioning or testing of the equipment at no additional cost to the Contract.
 - .2 That the equipment is now ready for permanent operation;
 - .3 Siemen's interface and graphics have been completed and ready for full functional testing.
- .2 The equipment manufacturer's representative shall fully instruct the permanent operator of the equipment in the proper operation and maintenance of all equipment at no additional cost to the Contract.
- .3 Replace defective material and equipment with new. Bear costs including re-testing and repairing.
- .4 Fueling the new system is to be completed under this contract:
 - .1 Provide full tank of fuel while conducting commissioning.
 - .2 Refuel for 8 hour onsite test.
 - .3 Refuel to 100% on successful conclusion of load test on temporary load bank test.
 - .4 Refuel to 100% on successful conclusion of load test on permanently installed load bank.

- .5 Provide all fuel required to run the existing generator during switch board change outs.
- .5 Commission and test new permanently installed load bank using new generator. Test each heating stage for 30 minutes for a total test time of 6.5 hours.
- .6 Test load transfer function. While running load bank under full load on the generator, simulate a building loss of power and have the load bank shut down and transfer switch pick up building load.
- .7 Test full functionality of the remote control panels for generator and load bank as well as DDC graphical interface.

3.4 FIELD QUALITY CONTROL

- .1 Demonstrate:
 - .1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.
 - .2 Unit start and shut down on "Manual" control
 - .3 Unit start and transfer on "Test" control.
 - .4 Unit start on "Engine start" control.
 - .5 Operation of automatic alarms and shut down devices.
- .2 Provide resistive load bank and temporary connecting cables sized for full rating of generator for testing.
- .3 The new electric load bank will not be installed at the time of the generator commissioning. Provide a temporary resistive load bank, rated for full load of generator, for 8 hour load test.
- .4 Run unit on 100% load for minimum period of eight (8) hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of heat exchanger system to provide adequate engine cooling.
- .5 During full load test, also measure sound levels and demonstrate conformance to specifications.
- .6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.
- .7 Submit start up report within five (5) days of successful commissioning of system.

END OF SECTION